IN THE HIGH COURT OF SOUTH AFRICA

(WESTERN CAPE DIVISION, CAPE TOWN)

Case No ...24492.../2024

In the matter between:

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	First Applicant
THE GREEN CONNECTION NPC	Second Applicant
NATURAL JUSTICE	Third Applicant

and

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	First Respondent
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	Second Respondent
TGS GEOPHYSICAL COMPANY (UK) LIMITED	Third Respondent
MINISTER OF MINERAL AND PETROLEUM RESOURCES	Fourth Respondent

Bundle 1

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CHENNELLS ALBERTYN
REF: Fiona Bester – Tel: 021 883 3189
Email: fiona@chennellsalbertyn.co.za and
carol@chennellsalbertyn.co.za

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TGS GEOPHYSICAL COMPANY (UK) LIMITED	Third Respondent
MINISTER OF MINERAL AND PETROLEUM RESOURCES	Fourth Respondent

2024 -11- 14
WEC

NOTICE OF MOTION

BE PLEASED TO TAKE NOTICE that the above-named Applicants intend to make application to this Honourable Court in terms of Rule 53, on a date to be arranged with the Registrar, for an order in the following terms:

CHENNELLS ALBERTYN
Ref: Fiona Bester – Tel: 021 883 3189
Email: fiona@chennellsalbertyn.co.za and
carol@chennellsalbertyn.co.za

1. Reviewing and setting aside the following decisions:

1.1. The decision taken by the first respondent on 17 April 2023 ("the first decision") to grant an environmental authorisation in terms of regulation 24 of the Environmental Impact Assessment Regulations 2014 (GN R. 982 of 4 December 2014), read with section 24 of the National Environmental Management Act 107 of 1998 ("NEMA"), to the third respondent for Proposed 3D Seismic Survey activities off the West Coast of South Africa.

1.2. The decision taken by the second respondent on 22 May 2024 in terms of section 43(6) of NEMA to dismiss the appeals by the applicants against the first decision and to confirm and amend the environmental authorisation for the proposed activities ("the second decision").

2. Substituting the first decision and the second decision with an order refusing the environmental authorisation;

3. That the costs of this application be paid by the first and second respondent, alternatively by the first, second and third respondent jointly and severally, in the event of the third respondent opposing such relief;

4. Granting the Applicants such further and/or alternative relief as this Honourable Court deems fit.

TAKE NOTICE FURTHER that in terms of Rule 53(1)(b) the first respondent and the second respondent are required within 15 (fifteen) days of receipt of the notice of motion to dispatch to the Registrar of this Honourable Court the record of the proceedings sought to be reviewed and set aside, together with such reasons as they are required by law or desire to give, and to notify the applicants that it has done so;

TAKE NOTICE FURTHER that the applicants may, within 10 (ten) days of receipt of the record from the Registrar, by delivery of a notice and accompanying affidavit or affidavits, amend, add to or vary the terms of their notice of motion and supplement their founding papers in terms of Rule 53(4).

TAKE NOTICE FURTHER that any opposing respondent may, within 30 (thirty) days after the expiry of the time referred to in Rule 53(4), deliver any affidavits it may desire in answer to the allegations made by the Applicants.

TAKE NOTICE FURTHER that the Applicants have appointed **Chennells Albertyn** of 44 Alexander Street, Stellenbosch and care of 18A Greenwich Road, Rondebosch, Cape Town as the address at which it will accept notice and service of all process in these proceedings.

TAKE NOTICE FURTHER that such respondents as are intent on opposing the relief set out above: may within 15 (fifteen) days of receipt of the notice of motion notify the Applicants' attorneys in writing that they intend to oppose the application and in such notice to appoint an address referred to in Rule 6(5)(b) at which it/they will accept notice and service of all documents in these proceedings; and within 30 (thirty) days' of such date deliver any affidavits they may desire in answer to the allegations made by the Applicants.

BE PLEASED TO TAKE NOTICE FURTHER that the affidavits of **Johannes Walter Steenkamp, Michele E H Fournet, Gillian Kay Hamilton, Mark New, Jean Mary Harris**, and the confirmatory affidavits of **Carmelita Mosterd, John Adams, Jacqueline Sunde** and **Chief Regan James** and will be used in support hereof.

TAKE NOTICE FURTHER that if any of the respondents intend opposing the relief sought in this notice of motion, they are required:

(i) To notify the applicants' attorney in writing within five (5) days of service of this application; and

(ii) Within 15 (fifteen) days after they have so given notice of their intention to oppose the application, to file their answering affidavits, if any.

If no such notice of intention be given, the application will be made on a date to be allocated by the Registrar of the above Honourable Court at 10h00.

DATED AT CAPE TOWN THIS 13th DAY OF NOVEMBER 2024.

CHENNELLS ALBERTYN
Attorneys for Applicants
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Stellenbosch, 7600
Tel: 021 883 3189
Email: fiona@chennellsalbertyn.co.za and
Carol@chennellsalbertyn.co.za
(Ref: F Bester/cvdv/12252FB
C/O CHENNELLS ALBERTYN
18A Greenwich Grove
Station Road
RONDEBOSCH

TO: **THE REGISTRAR**
HIGH COURT
CAPE TOWN

AND TO: **DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES**
First Respondent
Environmental House
Corner Steve Biko and Soutpansberg Street
Arcadia, Pretoria

AND CARE OF:
The State Attorney Pretoria
316 Thabo Sehume Street
Pretoria Central
Pretoria, 0001
AND CARE OF:
The State Attorney Cape Town
4th Floor
Liberty Life Centre
22 Long Street
Cape Town, 8001

AND TO: **MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT**
Second Respondent
Environmental House
Corner Steve Biko and Soutpansberg Street
Arcadia
Pretoria
AND CARE OF:
The State Attorney Pretoria
316 Thabo Sehume Street
Pretoria Central
Pretoria, 0001
AND CARE OF:
The State Attorney Cape Town
4th Floor
Liberty Life Centre
22 Long Street
Cape Town, 8001

AND TO: **TGS GEOPHYSICAL COMPANY (UK) LIMITED**
Third Respondent
8 Dalmeny Road
Pine Park
Randburg

AND TO: **MINISTER OF MINERAL AND PETROLEUM RESOURCES**
Fourth Respondent
Trevenna Campus
Building 2C
Corner of Meintjes & Francis Baard Streets
Pretoria
and

7th Floor,
120 Plein Street
Cape Town
AND CARE OF:
The State Attorney Pretoria
316 Thabo Sehume Street
Pretoria Central
Pretoria, 0001
AND CARE OF:
The State Attorney Cape Town
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MINISTER OF MINERAL AND PETROLEUM RESOURCES	Fourth Respondent

OFFICE OF THE CHIEF JUSTICE
2024 -11- 14
WESTERN CAPE HIGH COURT

FOUNDING AFFIDAVIT

I, the undersigned,

JOHANNES WALTER STEENKAMP

do hereby make oath and say:

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1. I am an adult small-scale fisherman and the Chairperson of the AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED ("Aukotowa"), Registration Number: 2018/005127/24) with registered address at DAFF Building, Beach Road, Port Nolloth, 8280 and doing business from Joos Engelbrecht Street, Port Nolloth, 8280. I am duly authorised to bring this application and to depose to this founding affidavit on behalf of the applicant. A resolution to this effect is attached to this affidavit marked "A1.1".

2. The facts contained in this affidavit are within my personal knowledge unless it appears otherwise and are, to the best of my belief, true and correct.

3. I attach confirmatory affidavits deposed to by Priyanka Naidoo, on behalf of the second applicant, and Delme Cupido, on behalf of the third applicant confirming the content of my affidavit as "A1.2" and "A1.3".

4. Where I make legal submissions in this affidavit, I do so on the advice of my legal representatives, whose advice I believe to be correct.

INTRODUCTION

5. Aukotowa is a co-operative of 64 small-scale fishers, established in 2018. All of our members are generational fishers residing in Port Nolloth, a coastal town in the Northen Cape.

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6. Port Nolloth, like many small towns in South Africa, is stricken by poverty. The town started as a railway junction for the copper-mining industry, along with off-shore diamond mining. However, traditional fishing has always existed in the area.

7. Our heritage of fishing is a definitive part of our culture and the culture of this region. Despite the long association between the local community and fishing to sustain our communities, I do not remember a time when we were able to partake in this activity free of exclusionary regulation or environmental encroachments from successive governments and multi-national mining companies.

8. Under apartheid, fishing quotas were available only to white people. This changed after the transition to democracy, however, it was almost impossible to obtain fishing rights as a person without means. Subsequently, most of the fishing rights were available only to commercial fishers and people who could afford to pay the application fees.

9. We were eventually able to obtain some recognition of traditional fishing rights following the adoption of the "Policy for the Small-Scale Fisheries Sector in South Africa" in Feburary 2012 This was the product of decades of activism and a long, litigious struggle with the Government.

10. The background to the policy is described in its introduction as follows:

"This policy aims to provide redress and recognition to the rights of Small Scale fisher communities in South Africa previously marginalised and discriminated against in terms of racially exclusionary laws and policies, individualised permit-based systems of resource allocation and insensitive impositions of conservation-driven regulation."

11. This policy took many years to develop and resulted in amendments to the Marine Living Resources Act, 18 of 1998 in 2014. Despite the progressive policy and official legal recognition of small-scale fishing rights, this has not stopped the steady marginalisation of West Coast fishers by commercial fishing and the development of other industries along our coastline.

12. Each of our 64 members now depends on their catch as their livelihood. Because of this, we have a deep appreciation for the ocean as a source of life.

13. In recent years we have seen a decline in our fish stocks and changes in their migration patterns. We need to go further out to sea in our small roeiboete (row boats) which is a safety risk for us. We believe that these changes are due to climate change. We have seen the behaviour of large marine mammals such as whales become more aggressive. There has also been a change in the fishing seasons and migration of fish. When I fished with my father almost 36 years ago, we would return home with a huge catch, today this is rare.

14. The fishers of the West Coast have always travelled extensively up and down the coast to 'chase the fish' and enable our livelihoods, which provides food

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security for our communities. In general, we travel between 20-30 kilometres offshore to catch snoek during the season which usually runs from March-September. Due to changes in the climate and ocean, which we have seen as fishers, sometimes the season is longer and can stretch from the end of February to December.

15. I relay these facts as the background to our interest in this case. Aukotowa is extremely concerned about the degradation of the oceans and our local coastline, which is at the heart of so much of our history and culture and is also now the source of our livelihoods.

THE APPLICATION

16. This is an application to:

16.1 review and set aside the confirmation on appeal on 22 May 2024 ("the Appeal Decision") by the second respondent in terms of section 43(6) of the National Environmental Management Act 107 of 1998 ("NEMA") of an environmental authorisation ("the EA") granted on by the first respondent, as the competent authority in terms of section 24O of NEMA, to the third respondent 17 April 2023 in terms of section 24 of NEMA allowing for a 3D seismic survey off the West Coast of South Africa ("the Project") in the area of jurisdiction of the Local Municipality in the Western Cape Province, and the Local Municipality in the Northern Cape Province, in the area

described in the EA ("the Project area");

16.2 review and set aside the first respondent's decision to grant the EA;

16.3 substitute the first and second respondent's decisions with an order refusing the environmental authorisation; and

16.4 further relief as set out in the Notice of Motion which will be filed with this affidavit.

17. When dealing generally with both decisions, I will refer to them as "the decisions". I will refer to the DG and the Minister collectively as "the decision-makers".

18. This founding affidavit is structured as follows:

18.1. In Part A, I describe the parties to the application.

18.2. In Part B, I outline the applicant's involvement with the Project.

18.3. In Part C, I describe the authorised activities and the relief sought in this application.

18.4. In Part D, I set out the relevant factual background.

18.5. In Part E, I set out relevant statutory and regulatory provisions.

18.6. In Part F, I discuss the review grounds in light of the relevant facts and the legislative provisions; and

18.7. In Part G, I summarise the applicant's grounds of review.

19. The following is a list of acronyms used in this affidavit:

BAR	basic assessment report
CA	competent authority
CO_2	carbon dioxide
CO_2eq	carbon dioxide equivalent
dB	decibels
EA	environmental authorisation
EAP	environmental assessment practitioner
EIA	environment impact assessment
EMPr	environmental management programme
GHGs	Greenhouse gases
HIA	heritage impact assessment
IAP	interested and affected party
ICMA	National Environmental Management: Integrated Coastal Management Act 24 of 2008
IEA	International Energy Agency
IISD	International Institute for Sustainable Development
IRENA	International Renewable Energy Agency

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IPCC	Intergovernmental Panel on Climate Change
LEDS	Low Emissions Development Strategy 2050
Mt	Megatons
MMO	Marine Mammal Observers
µPa	micropascals
NDC	nationally determined contribution
NEMA	National Environmental Management Act 107 of 1998
NEMPAA	National Environmental Management: Protected Areas Act 57 of 2003
PAJA	Promotion of Administrative Justice Act 3 of 2000
PAM	Passive Acoustic Monitoring
PASA	Petroleum Agency of South Africa
SCC	species of conservation concern
SEA	strategic environmental assessment
SIA	social impact assessment
Tcf	trillion cubic feet
TTS	Temporary Threshold Shifts
UNFCC	United Nations Framework Convention on Climate Change
UPRDA	Upstream Petroleum Resources and Development Bill, 2021

20. In all the quotations in this affidavit in which underlining or emphasis appears, it is my emphasis unless I specify otherwise.

PART A: THE PARTIES

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21. **The first applicant is the AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED, a company duly incorporated in accordance with the company laws of South Africa with registration number 2018/005127/24 and having its principal place of business at DAFF Building, Beach Road, Port Nolloth, 8280.**

22. The second applicant is THE GREEN CONNECTION NPC, a non-profit company incorporated in terms of the laws of South Africa with registration no. 2021/773490/08 and having its registered address at Unit B1 Clareview Business Park, 236 Imam Haron Road, Claremont, Cape Town ("Green Connection").

23. The third applicant is NATURAL JUSTICE, a voluntary association established with the object of providing legal support to indigenous and local communities. Natural Justice is a duly registered Nonprofit Organisation in terms of the laws of South Africa under registration no. 057-611-NPO and having its principal place of business at 6th Floor, Mercantile Buildings, 63 Hout Street, Cape Town ("Natural Justice").

24. **The Green Connection and Natural Justice are both organisations whose object is to promote sustainable development by empowering people to participate in decision-making about their environment.**

25. The first respondent is the DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES ("the DG" and "the Department") with an address at Environmental House, Corner of Steve Biko and Soutpansberg Street, Arcadia, Pretoria. This application will be served on the

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DG's physical address and on the State Attorney, Pretoria, at 316 Thabo Sehume Street, Pretoria Central, Pretoria, 0001, and the State Attorney, Cape Town, at Floor 4, Liberty Life Centre, 22 Long Street, Cape Town, 8001.

26. The second respondent is the MINISTER OF FORESTRY, FISHERIES, AND THE ENVIRONMENT ("the Minister") in his official capacity. This application will be served on the Minister at Environmental House, corner Steve Biko and Soutpansberg Street, Arcadia, Pretoria, and care of the State Attorney, Pretoria, 316 Thabo Sehume Street, Pretoria Central, Pretoria, 0001, and the State Attorney, Cape Town, at Floor 4, Liberty Life Centre, 22 Long Street, Cape Town, 8001.

27. The third respondent is TGS Geophysical Company (UK) Ltd ("TGS"), a corporation registered in terms of the corporate laws of the United Kingdom, registration number , whose main place of business is at Dukes Court Street, Woking, GU21 5BH, United Kingdom with its South African place of business at 8 Dalmeny Road, Pine Park, Randburg, Gauteng Province.

28. The fourth respondent is the MINISTER OF MINERAL AND PETROLEUM RESOURCES with an address at Trevenna Campus, Building 2C, C/o Meintjes & Francis Baard Street, PRETORIA, and at 120 Plein Street, Floor 7, CAPE TOWN. This application will be served on the fourth respondent's physical address and care of the State Attorney, Pretoria, 316 Thabo Sehume Street, Pretoria Central, Pretoria, 0001, and the State Attorney, Cape Town, at Floor 4, Liberty Life Centre, 22 Long Street, Cape Town, 8001.

PART B: THE APPLICANTS' INVOLVEMENT WITH THE PROJECT

29. The EA granted to TGS, which lies at the core of these proceedings, is a prerequisite for the exercise of rights pertaining to any reconnaissance permit granted to TGS in terms of section 75 of the Mineral and Petroleum Resources Development Act No. 28 of 2002 ("the MPRDA").

30. According to TGS it has applied for a reconnaissance permit and its application has been received by the Department, but I do not know whether a permit has been granted.

31. The applicants bring this application (i) in the interest of, or on behalf of, the members of the first applicant, and of persons who, for practical reasons, are unable to institute such proceedings, including members of coastal communities who do not have the capacity or resources to do so; (ii) in the interests of coastal communities who are affected by the proposed seismic activities; (iii) in the public interest with regard to both present and future generations; and (iv) in the interest of protecting the environment, to further the objectives of section 24 of the Constitution of the Republic of South Africa, 1996 ("the Constitution") in terms of section 38 of the Constitution and section 32 of NEMA.

32. The applicants registered as interested and affected parties ("IAPs") and commented on the application for the EA underlying the Project when it was

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advertised for public participation during 2022, and were among four other appellants, who appealed against the EA in May 2023. All the appeals were dismissed.

PART C: THE AUTHORISED ACTIVITIES AND THE RELIEF SOUGHT IN THIS APPLICATION

33. The relief sought in this application is for judicial review in terms of the Promotion of Administrative Justice Act 3 of 2000 ('PAJA'), alternatively, the principle of legality, and the setting aside of the EA and the appeal decision.

34. The Project area for the proposed 3D seismic survey is approximately 57 400 km² in extent, located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay. A single survey vessel equipped with seismic sources and streamers is to be used for the seismic survey, supported by two escort vessels. It is estimated that the 3D survey will take up to 70 days (including downtime) during the approved operating window between January and May, and is currently due to start in 2025 provided TSG receives its reconnaissance permit in time.

35. The Project area is adjacent to the Namaqualand and West Coast District Municipalities, the City of Cape Town metropolitan municipality, and the following local municipalities: Cederberg Local Municipality, Saldanha Bay

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Local Municipality, Bergrivier Local Municipality, Swartland Local Municipality, Nama Khoi Local Municipality, Kamiesberg Local Municipality, Ritchersveld Local Municipality and Matzikama Local Municipality.

36. The authorised activities of the Project relate to the seismic survey and are set out in the EA granted in respect thereof, which is attached marked "A2". The technical details of the Project are described on pages 7 and 8 of the EA.

37. The Minister's decision dismissing the applicant's appeal against the grant of the EA is attached marked "A3". The EA was confirmed and a further condition added by the Minister: "I am including a new condition in the EA, requiring the Applicant to appoint a community / fisheries liaison officer, who must be available to the affected communities. The communities must have access to the liaison officer who, in turn, must keep them informed of the activities at regular intervals and be available to answer any questions that they may have." (Para 2.22.10.)

38. The bases for the relief sought by the applicant are the following:

38.1. The basis of the first ground of review is that the BAR omitted relevant information and considerations in respect of impacts on marine life, particularly from underwater acoustic impacts and cumulative impacts, and that the decisions of the DG and the Minister were not rationally connected to the information before them, were irrational and/or

unreasonable, and failed to give adequate consideration to the precautionary principle.

38.2. The basis of the second ground of review is that the public participation process followed by the EAP in the EIA process did not ensure that persons in vulnerable and disadvantaged communities were given sufficient opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, or ensure that community well-being and empowerment was adequately promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.

38.3. The basis of the third ground of review is that the Minister failed to consider the reduced need for the seismic survey due to part of the Project area already having been surveyed, and the BAR failed to conduct a rational assessment of need and desirability in that the BAR:

38.3.1. considered only the potential positive impacts of the production of oil and gas for the purposes of determining need and desirability and not the potential negative impacts thereof, which was inconsistent and irrational;

38.3.2. failed to conduct a proper assessment of the option of not implementing the activity; and;

38.3.3. failed to conduct an assessment of the potential social, economic and environmental impacts of the exploration and production of oil and gas.

38.4 The basis of the fourth ground of review is that conditions of authorisation in the EA required the submission of further plans by the developer to the competent authority for approval without any public participation in regard thereto.

38.5 The basis of the fifth ground of review is that the BAR failed, with respect to the ICMA, to determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context, or to contain the information that is necessary for the competent authority to consider and come to a decision on the application.

38.6 The basis of the sixth ground of review is that the EMPr is materially deficient and fails adequately to set out the impacts and risks that need to be avoided, managed and mitigated, or to provide an identification of the manner in which the impact management outcomes will be achieved, the method of monitoring the implementation of the impact management actions, and the mechanism for monitoring compliance with the impact management actions.

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38.7 The basis of the seventh ground of review is that the EA failed to contain a plan which locates the proposed activity or activities authorised at an appropriate scale.

38.8 The basis of the eighth ground of review is that the BAR failed adequately to assess the cumulative impacts and risks of seismic blasting.

PART D: THE RELEVANT FACTUAL BACKGROUND

39. In this part I address the relevant factual background, under the following headings:

D.1: Seismic blasting

D.2 The Basic Assessment Report

D.3 The Social Impact of the Project

D.4 A History of Marginalisation and Discrimination

D.1 Seismic Blasting

40. The ocean is an acoustic world. This is because water is a dense medium, and sound travels faster and farther underwater. Marine species have evolved to depend on sound for essential biological functions, including feeding, breeding, communicating, navigating, and socialising. Sound is therefore also a fundamental component of marine habitats. The full impacts of seismic blasting

on marine life are not known. However, what is known is that airguns produce some of the loudest known underwater sounds on the planet, and in some cases, can be detected 4,000 kilometres from the source. These impacts are described in the expert report of Dr. Michelle Fournet, an acoustic ecologist at the University of New Hampshire. Dr Fournet specialises in the interactions between marine organisms and human activities, and her report will be filed together with this affidavit.

41. The BAR and associated specialist reports in this matter explain that during seismic surveys, high-level, low frequency sound pulses are generated by an acoustic instrument towed behind a survey vessel, 5 to 25 metres below the sea surface. The sounds are directed towards the seabed and the seismic signal is reflected by the geological interfaces below the seafloor. The reflected signals are received by an array of receivers or sets of hydrophones towed behind the vessel in a single streamer (2D) or in multiple streamers (3D) and are fed back to the recording instruments on board. The expert report of Dr. Fournet describes the process in detail. The survey will utilize a single 100 metre seismic ship equipped with seismic sources and streamers, supported by up to two escort vessels of unknown size, and is expected to last around 70 days. The towed hydrophone streamers would be 8,000 meters in length and 2,000 meters, approximately 87 football fields long and 30 football fields wide. The seismic pulse would be discharged every 2-6 seconds continuously during exploration operations at source levels (loudness at the source) between 200-255 dB re 1 µPa; for reference this is among the loudest produced anthropogenic sounds on the planet and is in the range of military weapons or

explosions.

42. According to Dr. Fournet and the BAR and its associated specialist reports, it is well established that marine seismic surveys can cause serious and irreparable harms to marine life extending well beyond the project site, ranging from death to long-term and debilitating behavioural impacts. For example, Dr. Fournet explains that anthropogenic noise within critical biodiversity areas ("CBAs") and marine protected areas ("MPAs") may harm, alter, or lead to death or population decline across a wide range of organisms and life stages that make up both ends of the trophic web (food web). Because noise cannot be contained to the project site, the impacts of noise are farther reaching than the directing region of interest and must include coastal and adjacent pelagic areas as well. The Marine specialist study and the Background Assessment Report ("BAR") which it supported acknowledge a wide range of impacts on numerous species:

42.1. physiological injury and/or mortality;

42.2. behavioural avoidance;

42.3. reduced reproductive success/spawning;

42.4. masking of environmental sounds and communication;

42.5. collision of turtles/marine mammals with the survey and support vessels or entanglement in towed acoustic apparatus; and

42.6. indirect impacts on piscivorous predators due to seismic effects on prey species.

43. According to the Marine study, the following species are present in the Project area and face the highest risk of harm from the proposed survey:

43.1. humpback whales, which migrate through the area between June and November (inclusive);

43.2. sperm whales, beaked whales and other odontocetes that frequent offshore waters;

43.3. large migratory pelagic fish and shark species that show seasonal association with Child's Bank and Tripp Seamount;

43.4. leatherback turtles which frequent offshore waters in low numbers and aggregate around seamounts to feed on jellyfish; and

43.5. various pelagic Albatross, Petrel, Storm Petrel and Shearwater species (the Pisces report indicates that pelagic seabirds are likely to be relatively frequently encountered in the offshore waters of the Reconnaissance Permit area).

D.2 The Basic Assessment Report

44. On 22 September 2022, TGS applied to the Department in terms of section 24 of NEMA for the EA by following environment impact assessment ("EIA") process and submitting a BAR.

45. Public participation was invited by advertising and making available a Draft BAR on the website of the environment assessment practitioner ("EAP"), Environment Impact Management Services (Pty) Ltd, who was appointed to submit the application and the BAR. IAPs and the public were notified of the availability of the Draft BAR on 24 October 2022, and were invited to submit their comments by 25 November 2022. Thereafter, the EAP finalised the BAR (referred to hereafter as "the BAR" or "the Final BAR") and submitted it to the Department for approval on 6 December 2022.

46. I attach, marked "A4" a copy of the Final BAR. There were six appendices thereto, which I shall list, but I shall only attach the parts thereof that appear to be relevant:

46.1. Appendix 1: the CV of the EAP (not attached).

46.2. Appendix 2: Public Participation, which has thirteen appendices thereto:

46.2.0. Appendix 1. IAP Database (not attached).

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46.2.1. Appendix 2, Advertisements (not attached).

46.2.2. Appendix 3, Initial Notification(not attached).

46.2.3. Appendix 4, Site Notice proof (not attached).

46.2.4. Appendix 5, Radio Advertisements (not attached).

46.2.5. Appendix 6, Initial Public Meeting Minutes, a copy of which is attached marked "A5.1".

46.2.6. Appendix 7, Public Meeting Reminder Notice (not attached).

46.2.7. Appendix 8, Draft BAR notification (not attached).

46.2.8. Appendix 9, Draft BAR Review Public Meeting Documentation, a copy of which is attached marked "A5.2".

46.2.9. Appendix 10, Draft BAR Review Reminder Notifications (not attached).

46.2.10. Appendix 11, Data-free SMS Notification (not attached).

46.2.11. Appendix 12, Table of Correspondence (not attached).

46.2.12. Appendix 13, Correspondence Document, portions of which will be attached below, which I shall describe, marked A6.1 to A6.2.

46.3. Appendix 3, Specialist Reports, of which there were five:

46.3.1. Appendix 3.1, a Marine Ecological Assessment, by Pisces Environmental Services (Pty) Ltd, dated September 2022, a copy of which I attach marked "A7.1". I refer to this as "the Marine Study".

46.3.2. Appendix 3.2, a Fisheries Assessment, by CapMarine (Pty) Ltd, dated September 2022, a copy of which I attach marked "A7.2".

46.3.3. Appendix 3.3, a Heritage Impact Assessment ("HIA"), by PGS Heritage (Pty) Ltd dated 28 September 2022, a copy of which is attached marked "A7.3", and a Heritage Declaration, a copy of which is attached marked "A7.3.1". I shall refer to this as "the HIA".

46.3.4. Appendix 3.4, a Social Impact Assessment ("SIA"), by Equiperspectives Research & Consulting Services (Pty) Ltd, dated September 2022, a copy of which I attach marked "A7.4". I refer to this as "the SIA".

46.3.5. Appendix 3.5, Acoustic Technical Report, by SLR Consulting, Australia (Pty) Ltd dated 10 October 2022, a copy of which is attached marked "A7.5", which I refer to as "the Acoustic study", and two Acoustics Declarations, copies of which are attached marked "A7.5.1" and "A7.5.2" respectively.

46.4. Appendix 4, an Impact Assessment Matrix, a copy of which is attached marked "A8".

46.5. Appendix 5, an Environmental Management Programme by the EAP, dated 6 October 2022, a copy of which is attached marked "A9". I refer to this as "the EMPr".

46.6. Appendix 6, a Rehabilitation and Closure Plan by the EAP, dated 6 October 2022 (not attached).

47. The applicants duly appealed against the EA to the Minister. A copy of the first applicant's appeal is attached marked A10, and a copy of the second and third applicants' appeal is in the appeal table together with TGS' responses thereto attached marked A.11, with five annexures to their appeal marked A11.1 to A11.5.

D.3 The Social Impacts of the Project

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48. The Social Impact Assessment ("SIA") (Annexure A7.4, referred to above) includes the following statements in its executive summary:

> *"Seismic reconnaissance projects are controversial in South Africa and have been in the news frequently in the last year. For many stakeholders it is an emotional matter, for others the potential of impacting their livelihoods is the biggest fear"*

> *"From a social perspective it is clear that the communities and majority of local people are opposed to the project."*

> *"If the social risks and potential damage to cultural and indigenous rights are considered the impact on the social fabric of already vulnerable communities may be significant. At this stage communities feel that they cannot make informed decisions."*

49. The following social risks were identified in the SIA: uncertainty; further marginalisation of vulnerable groups; concerns about cumulative impacts; perceived impact on livelihoods; impacts on sense and spirit of place; impacts on the social licence to operate; stakeholder fatigue and disillusionment; community expectations; and social unrest. These led to various recommendations, which I discuss further below.

50. The SIA finds that TGS lacks a social license to operate, which it defines as

"...the acceptance and belief by society, and specifically local communities, in the value creation of activities". The SIA states, with reference to the judgement in Sustaining the Wild Coast NPC and Others v Minister of Mineral Resources and Energy and Others 2022 (6) SA 589 (ECMk) ("Sustaining the Wild Coast"):

> *"Given the media attention surrounding the Shell ruling in September 2022 and the court interdict against Searcher in March 2022* [both related to seismic blasting] *there is a general mistrust against any company that want* (sic) *to conduct seismic surveys. Communities demand meaningful consultation, which go beyond the requirements of an EIA process. They want to feel that they can make informed decisions and have sufficient time to digest the technical information. Community members expressed misgivings about the government and its abillty to protect their interest. They feel that the decision to support the application has already been made."* (SIA table 6 on page 82.)

51. The decisions in this matter were taken in the context of a climate crisis. In August 2021, the Intergovernmental Panel on Climate Change (IPCC) (an international body for assessing the science related to climate change) released its 6th Assessment Report, known as "AR6". In its summary for policymakers, the IPCC indicates (among other things) that it is unequivocal that human influence has warmed the atmosphere, ocean and land, and that widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred; human-induced climate change is already affecting many weather

and climate extremes in every region across the globe; and, from a physical science perspective, limiting human-induced global warming to a specific level requires limiting cumulative CO_2 emissions. I attach a copy of the said report marked A6.1 to 6.2. I shall elaborate further on this in the grounds of review below.

D.4 A History of Marginalisation and Discrimination

52. The HIA, Annexure A7.3, states (in para 7 on page 34): *"It must be noted that, first and foremost, a large section of the effected communities not only view them* (sic) *as small-scale fishers but also as indigenous people and, as such, are intrinsically linked to the ocean and the land they have lived on for centuries."*

53. **This accurately reflects our cultural heritage. The HIA details a history of land appropriation and forced relocation, collapse of the fishing industry, poverty, marginalisation and discrimination.**

54. The HIA includes the following in its impact statement (in para 9.1 on p 41.), highlighting the social issues in the community:

> *"The public meetings and focused discussions with interlocutors have shown that these communities and groupings are struggling economically due to decades of turmoil in the fishing industry. An*

industry plagued by the closing of fish processing plants, fishing licence and quota issues, and diminishing catches due to environmental and industrial impacts, to name a few. This economic downturn led to social issues within the communities. Foremost are poverty, loss of social fabric, substance abuse, teenage pregnancies, and violence. In all the interviews, the above issues were raised as central to their social existence and community experience."

55. The overall impacts of the Project are assessed in the BAR as being low after taking mitigating measures into account. The impacts are summarised in the impact assessment matrix in Appendix 4 to the BAR (Annexure A8), which lists 33 impacts and the results of their assessment. Fifteen impacts relate to marine ecology, six relate to fisheries, one relates to heritage, and eleven relate to social impacts.

56. Four of the social impacts were given a high impact rating before mitigation: uncertainty, concerns about cumulative impacts, further marginalisation of vulnerable groups, and impacts on social licence to operate. These were all rated as medium impact after mitigation, along with another five social impacts that remained medium after mitigation: stakeholder engagement and fatigue, perceived impact on livelihoods, impacts on sense of spirit and place, community expectations and social unrest. All the other 24 impacts were rated low after mitigation. I say more about the effectiveness of the social mitigation measures in the grounds of review below.

57. The environment impact statement in the BAR recommends authorisation of the Project. It states:

> *"The findings of the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the reconnaissance activities, the findings of the specialist studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team and the EAP that the significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures and the project should be authorized. ..."* (BAR, Annexure A4, para 13.1 on p 248.)

58. The mitigation measures in the BAR are generally carried through to the EMPr (Annexure A9). However, in certain respects the EMPr fails to achieve its purpose of addressing the recommended mitigations. I deal with this in the seventh ground of review.

PART E: RELEVANT STATUTORY AND REGULATORY PROVISIONS

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59. It is necessary at this juncture to describe relevant statutory provisions and regulatory requirements underpinning the EA and the Appeal Decision.

E.1 The Constitution

60. Section 24 of the Constitution states:

> *"**Environment.**—Everyone has the right—*
>
> *a) to an environment that is not harmful to their health or well-being; and*
>
> *b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that—*
>
> *(i) prevent pollution and ecological degradation,*
>
> *(ii) promote conservation; and*
>
> *(ii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*

E.2 NEMA

61. NEMA is one of the suite of laws giving effect to section 24(b) of the Constitution and provides the framework for environmental management in South Africa.

62. Section 1 of NEMA defines sustainable development as "*the integration of*

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social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations."

63. Section 2 of NEMA sets out binding principles. Section 2(3) provides that development must be socially, environmentally and economically sustainable, and section 2(4) includes factors relevant to sustainable development.

64. In accordance with the power in section 24(2) of NEMA whereby the Minister may identify activities that may not commence without environmental approval, the Minister has listed and published the following activity relevant to this review application:

> *"Any activity including the operation of that activity which requires a reconnaissance permit in terms of section 74 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice or in Listing Notice 3 of 2014, required to exercise the reconnaissance permit, excluding-*
>
> *(i) any desktop study; and*
>
> *(ii) any aerial survey."*

65. Accordingly, a listed activity may not be commenced with unless environmental approval from the Competent Authority had been sought and obtained. In the case of mineral and petroleum activities, the Competent Authority is the Minister

responsible for mineral resources.

66. The procedure for applications for environmental authorisations is governed by the Environmental Impact Assessment Regulations, 2014 ("the EIA Regulations").

67. An application for environmental approval is made to the Competent Authority as contemplated in chapter 5 of NEMA and chapter 4 of the EIA Regulations.

68. The substantive matters to be considered by the Competent Authority involve a careful exercise of discretion.

69. NEMA and the EIA Regulations list multiple principles and factors which must be taken into account by the Competent Authority when deciding the EIA application. These include the principles of environmental management in section 2 of NEMA.

70. While section 2 of NEMA enumerates several principles of environmental management, a key principle is that environmental management is to "place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interest equitably" (section 2(2)).

71. When development is pursued, which serves the needs of people, it must take place in a manner that is "socially, environmentally and economically

sustainable" (section 2(3)). In other words, it must be sustainable development.

72. Section 2(4)(a) of NEMA provides that sustainable development requires the consideration of all relevant factors including, amongst others, the following:

> "*(i) that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;*
>
> *(ii) that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;*
>
> *(iii) that the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;*
>
> ...
>
> *(v) that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;*
>
> ...
>
> *(vii) that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and*
>
> *(viii) that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied."*

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73. **Section 2(4) of NEMA includes the following:**

> *"(b) Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option.*
>
> *(c) Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons.*
>
> ...
>
> *(i) The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment;*
>
> ...
>
> *(n) Global and international responsibilities relating to the environment must be discharged in the national interest.*
>
> ...
>
> *(o) The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common*

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heritage.

...

(r) Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure. ..."

74. Section 23(2) of NEMA establishes the general objectives of integrated environmental management, which include that it must:

"(a) promote the integration of the principles of environmental management set out in section 2 into the making of all decisions which may have a significant effect on the environment;

(b) identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with the principles of environmental management set out in section 2;

(c) ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them;

(d) ensure adequate and appropriate opportunity for public participation

in decisions that may affect the environment;

(e) ensure the consideration of environmental attributes in management and decision-making which may have a significant effect on the environment; and

(f) identify and employ the modes of environmental management best suited to ensuring that a particular activity is pursued in accordance with the principles of environmental management set out in section 2."

75. Section 24(1) of NEMA provides that:

"In order to give effect to the general objectives of integrated environmental management laid down in this Chapter, the potential consequences for or impacts on the environment of listed activities or specified activities must be considered, investigated, assessed and reported on to the competent authority or the Minister responsible for mineral resources, as the case may be, except in respect of those activities that may commence without having to obtain an environmental authorisation in terms of this Act."

76. Section 24(4) of NEMA elaborates on the nature of the investigation, assessment and reporting required:

"Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment -

(a) must ensure, with respect to every application for an environmental authorisation - ...

(ii) that the findings and recommendations flowing from an investigation, the general objectives of integrated environmental management laid down in this Act and the principles of environmental management set out in section 2 are taken into account in any decision made by an organ of state in relation to any proposed policy, programme, process, plan or project;

(iii) that a description of the environment likely to be significantly affected by the proposed activity is contained in such application;

(iv) investigation of the potential consequences for or impacts on the environment of the activity and assessment of the significance of those potential consequences or impacts;

(v) public information and participation procedures which provide all interested and affected parties, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures; and

(b) must include, with respect to every application for an environmental authorisation and where applicable –

(i) investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity;

(ii) investigation of mitigation measures to keep adverse

consequences or impacts to a minimum;

(iii) investigation, assessment and evaluation of the impact of any proposed listed or specified activity on any national estate referred to in section 3 (2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999);

(iv) reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information;

(v) investigation and formulation of arrangements for the monitoring and management of consequences for or impacts on the environment, and the assessment of the effectiveness of such arrangements after their implementation; [and]

(vi) consideration of environmental attributes identified in the compilation of information and maps contemplated in subsection (3);

(vii) provision for the adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question."

77. It is in this context that regulation 18 of the EIA Regulations requires that the Competent Authority must have regard to the "need and desirability" of the activity, together with the considerations in sections 24O and 24(4) of NEMA when deciding upon an application for environmental approval.

78. The Department of Environmental Affairs has published a *Guideline on Need*

and Desirability ("the Need and Desirability Guideline") to guide this evaluation in applications for environmental authorisation. This is an "implementation guideline" contemplated in section 24J of NEMA and accordingly its contents were a relevant factor in the decision-making process in terms of section 24O(1)(b)(viii).

79. The Need and Desirability guideline states that, in considering the questions related to sustainable development, when deciding upon an application for environmental approval, "it must be decided which alternatives represent the 'most practicable environmental option'". NEMA defines the "best practicable environmental option" as that which "provides the most benefit and causes the least damage to the environment as a whole, at a cost acceptable to society, in the long-term as well as in the short-term."

80. Section 24N(1) provides that the Competent Authority may require the submission of an environmental management programme ("EMPr") before considering an application for an EA. Section 24N(1A) requires this for EIAs. Section 24N(2) contains a list of information which an EMPr must contain.

81. Section 24O sets out the criteria to be taken into account by competent authorities when considering applications. Section 24O(1) requires the Minister, when considering an application for an EA, to:

> *"(b) take into account all relevant factors, which may include - ...*
>
> *(i) any pollution, environmental impacts or environmental*

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degradation likely to be caused if the application is approved or refused;

(ii) measures that may be taken—

(aa) to protect the environment from harm as a result of the activity which is the subject of the application; and

(bb) to prevent, control, abate or mitigate any pollution, environmental impacts or environmental degradation; ..

(i) where appropriate, any feasible and reasonable alternatives to the activity which is the subject of the application and any feasible and reasonable modifications or changes to the activity that may minimise harm to the environment;

(vi) information contained in the application form, reports, comments, representations and other documents submitted in terms of this Act to the Minister, Minister responsible for mineral resources, MEC or competent authority in connection with the application;

(viii)any guidelines, departmental policies, and environmental management instruments that have been adopted in the prescribed manner by the Minister or MEC, with the concurrence of the Minister, and any other information in the possession of the competent authority that are relevant to the application; ..."

E.3 The EIA Regulations

82. Regulation 1 of the EIA Regulations includes the following definitions:

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*"**alternatives**", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity which may include alternatives to the-*

(a) property on which or location where the activity is proposed to be undertaken;

(b) type of activity to be undertaken;

(c) design or layout of the activity;

(d) technology to be used in the activity; or

(e) operational aspects of the activity;

and includes the option of not implementing the activity.

*"**basic assessment report**" means a report contemplated in regulation 19;*

*"**cumulative impact**", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.*

83. Regulation 2 sets out the purpose of the EIA Regulations;

"The purpose of these Regulations is to regulate the procedure and criteria as contemplated in Chapter 5 of the Act relating to the preparation, evaluation, submission, processing and consideration of,

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and decision on, applications for environmental authorisations for the commencement of activities, subjected to environmental impact assessment, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto."

84. Regulation 18 provides:

"Criteria to be taken into account by competent authorities when considering applications.- *When considering an application the competent authority must have regard to section 24O and 24(4) of the Act, the need for and desirability of the undertaking of the proposed activity, the requirements of these Regulations, any protocol or minimum information requirements relevant to the application as identified and gazetted by the Minister in a government notice or any relevant guideline published in terms of section 24J of the Act."*

85. Regulation 19 sets out the requirements for the submission of a BAR and supporting documents to the Competent Authority, the relevant parts of which provide:

"(3) A basic assessment report must contain the information set out in Appendix 1 to these Regulations ....

(4) An EMPr must contain the information set out in Appendix 4 to

these Regulations. . . .

(6) A specialist report must contain all information set out in Appendix 6 to these Regulations . . . ."

86. Regulation 25 provides for the issue of an EA. Regulation 26 stipulates what an EA must contain, and includes the following:

"An environmental authorisation must specify - ...

(c) a description of the location of the activity, including-

(iv) a plan which locates the proposed activity or activities authorised at an appropriate scale, or, if it is -

(aa) a linear activity, a description and coordinates of the approved corridor of the activity or activities, ...

(d) the conditions subject to which the activity may be undertaken, including conditions determining- ...

(iv) requirements for the avoidance, management, mitigation, monitoring and reporting of the impacts of the activity on the environment throughout the life of the activity additional to those contained in the approved EMPr, and where applicable the closure plan; ...

and

(i) any relevant conditions which the competent authority deems

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appropriate."

87. Regulation 40(2) provides:

> *"The public participation process contemplated in this regulation must provide access to all information that reasonably has or may have the potential to influence any decision with regard to an application unless access to that information is protected by law . ."*

88. Regulation 41(6) provides:

> *"When complying with this regulation, the person conducting the public participation process must ensure that-*
>
> *(a) information containing all relevant facts in respect of the application or proposed application is made available to potential interested and affected parties; ..."*

89. Appendix 1 to the EIA Regulations sets out the requirements of a BAR. Paragraph 1 thereof provides:

> *"The environmental outcomes, impacts and residual risks of the proposed activity must be set out in the basic assessment report."*

90. Section 2 of Appendix 1 to the EIA Regulations provides:

"The objective of the basic assessment process is to, through a consultative process -

(a) determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;

(b) identify the alternatives considered, including the activity, location, and technology alternatives; . .

(d) through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine -

(i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and

(ii) the degree to which these impacts -

(aa) can be reversed;

(bb) may cause irreplaceable loss of resources; and

(cc) can be avoided, managed or mitigated; . . ."

91. Section 3(1) of Appendix 1 to the EIA Regulations, which sets out the required information that is necessary for the competent authority to consider and come to a decision on the application, includes: ...

"(i) a full description of the process undertaken to identify, assess and

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rank the impacts the activity will impose on the preferred location through the life of the activity, including -

(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and

(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.

(j) an assessment of each identified potentially significant impact and risk, including -

(i) cumulative impacts;

(ii) the nature, significance and consequences of the impact and risk;

(iii) the extent and duration of the impact and risk;

(iv) the probability of the impact and risk occurring;

(v) the degree to which the impact and risk can be reversed;

(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and

(vii) the degree to which the impact and risk can be avoided, managed or mitigated; ...

(m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr; ..."

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92. Appendix 6 of the EIA Regulations sets out what must be contained in specialist reports.

E.4 Listing Notices identifying listed activities in terms of NEMA

93. Three listing notices were issued along with the EIA Regulations, identifying activities in respect of which applications for EA must be submitted, the form of application, and the Competent Authority to whom it must be submitted.

94. The activity applied for in this matter is listed activity 19B in Listing Notice 1, GN 983 of 4 December 2014. Listing Notice 1 requires the basic assessment process to be followed.

PART F: THE REVIEW GROUNDS IN LIGHT OF THE RELEVANT FACTS AND LEGISLATIVE PROVISIONS

First Ground of Review – Marine Impacts

95. The first ground of review is that the BAR omitted relevant information and considerations in respect of impacts on marine life, and that the decisions of the DG and the Minister were not rationally connected to the information before them, were irrational and/or unreasonable, and failed to give adequate consideration to the precautionary principle.

96. As I have said above, the serious and irreparable harms to marine life caused by seismic surveys are well established, and these are listed in the BAR, and

numerous species are present in the Project area and face the risk of harm from the seismic survey.

97. In essence, the BAR finds that the Project area is far from the coastal area where the risk to marine life is the highest, with the result that the residual risks of the Project, after mitigation, are low.

98. In this regard the BAR relies on the Marine study, which itself relies on the modelling of the Acoustic study. Both these studies were desktop studies.

99. This ground of review is based chiefly on the gaps in knowledge and consequent fatally flawed assessments arising from a misconceived scope of the Acoustic study and flawed assumptions on which the studies are based.

100. In the circumstances, a cautious and risk-averse approach (the precautionary principle) should have been adopted, which would have resulted in the application for EA being refused, or the appeal being upheld.

Information before the decision-makers

101. Section 24O(1)(b) (vi) of NEMA requires the Competent Authority ("CA") to take into account all relevant factors, which may include, *"information contained in the application form, reports, comments, representations and other documents submitted in terms of this Act to the Minister, Minister responsible for mineral*

resources, MEC or competent authority in connection with the application".

102. The DG, who was the CA in this matter, was required to take into consideration the second and third applicants' representations regarding the Draft BAR, a copy of which is attached marked **A13.1**, including two specialist studies attached thereto related to impacts on marine life:

102.1. Annexure A, *"Report on Scientific Basis for Concerns of Significant Harm Inflicted to Marine Wildlife by 2D and 3D Seismic Surveys on the South and West Coasts of South Africa"* by Harris JM, Olbers JM, Wright K, dated 14 January 2022, a copy of which is attached marked **A13.2**, which I shall refer to as "Harris (January 2022)".

102.2. Annexure B, "*Comments on Tosaco Energy Block 1 Exploration Right issued to Tosaco Energy (Pty) Ltd (PASA Reference: 12/3/362)*" by Harris JM, Olbers JM, Wright K, dated 6 April 2022, a copy of which is attached marked **A13.3**, which I shall refer to as "Harris (April 2022)".

103. The DG's reasons for his decision made no specific reference to marine impacts, and failed to engage with the issues raised in regard thereto by the second and third applicants.

104. The DG's reasons contained only generalised statements in regard to impacts and mitigation measures, based on what he alleged were a "careful consideration of information submitted to the Department". (A2 para 3 on pg 15,

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"Key Findings".)

105. The second and third applicants' appeal included as a ground of appeal impacts on marine life (Annexure A12 hereto, paragraphs 62 to 125), and attached thereto three expert affidavits:

105.1. Annexure B1, affidavit of Aaron B Rice, PhD, dated 28 February 2022, which formed part of the court papers in the *Sustaining the Wild Coast* case, confirming the accuracy of a paper he wrote, titled *"Scientific Evaluation of the Transkei and Algoa Exploration Areas: Environmental Management Programme (EMPr) Final Report"*. (Annexure A11.1 hereto), which I shall refer to as "Rice (February 2022)".

105.2. Annexure B2, affidavit of Douglas Nowacek, which formed part of the court papers in the Sustaining the Wild Coast case in 2021, referred to above, describing how seismic airgun noise travels in the ocean and discussing harms from seismic surveys to marine mammals, based on an expert declaration he had made that was filed in a United States court and which provided the court with a summary of scientific evidence about the impacts of seismic airguns on marine life, and in particular on North Atlantic right whales. (Annexure A11.2 hereto, which I shall refer to as "Nowacek (2021)". It was deposed to on 9 December 2021, as per the signature page attached marked A11.2.1.)

105.3. Annexure B3, affidavit of Jean Mary Harris, dated 19 January 2022,

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which formed part of the court papers in the case of Adams and Others v Minister of Mineral Resources and Energy and Others (1306/22) [2022] ZAWCHC 24 (1 March 2022)("the Adams case"), confirming the accuracy of her article Harris (January 2022) referred to above. (Annexure A11.3 hereto.)

106. The Minister was required to consider all the aforementioned material, which formed part of the record before her.

Unjustified attack on the credibility of the second and third applicants' experts by the EAP and TGS

107. I am astonished by the approach taken by the EAP (in response to the second and third applicant's comments on the Draft BAR) and by TGS (in its response to the second and third applicants' appeal submissions) regarding marine impacts, which amounts to an attack on the credibility of their experts without engaging meaningfully with the content thereof, but instead reiterating what is contained in the BAR. The EAP's responses are attached marked **A13.4.**

108. In response to the second and third Applicant's comments on the Draft BAR and the two expert reports attached thereto, (Harris (January 2022) and Harris (April 2022)), the EAP attacked the credibility of the reports by implying they were biased, making the following unsubstantiated claim:

"The studies undertaken internationally over the past ~70 years on the impacts of noise on marine fauna (of which some 400 peer-reviewed publications have been summarised and cited in the marine faunal specialist study) have concluded that the effects of underwater sounds vary substantially and depend on a wide variety of physical and biological factors. When writing articles on the effects of seismic acquisition on marine fauna it is therefore not difficult to bias the literature cited to either demonstrate detrimental and irreversible impacts or only very limited impacts, depending on the personal view of the author(s) and/or the targeted readership."

109. One must bear in mind that Harris, the author of both those reports, was also an author of the National Coastal and Marine Spatial Biodiversity Plan, relied on in the BAR, and was the author of two other articles cited favourably in the BAR and by the marine specialist.

110. The expert evidence of Harris was accepted by the court as credible in the Sustaining the Wild Coast case and in the Adams case.

111. In fact, Harris (January 2022) cited 88 peer reviewed studies in support of the views expressed, 38 of which are cited favourably in the Marine study. The other 50 are not cited at all in the Marine Study.

112. The Fishery Impact Assessment cited three of Harris' articles with approval.

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113. The aspersions cast upon the credibility of Harris, who is a well-renowned expert, are completely unjustified, and this undermines the credibility of the BAR.

114. The EAP also used the same response quoted above, identically worded, in responding to comments on the Draft BAR submitted by Dr Jacqueline Sunde, who has published extensively since 1990 with over 30 peer-reviewed articles dealing with Ocean Governance, marine spatial planning, women's rights and small-scale fishing. Two of her articles are cited favourably in the Fisheries Impact Assessment.

115. It appears that the EAP's response quoted above is a stock response of the EAP to considered views that differ from those in the EAP's reports.

116. Despite the second and third applicants submitting the three affidavits I have mentioned with their appeal, TGS made use of the identically worded credibility attack quoted above in its response to the second and third applicants' appeal, without engaging with the points specifically raised in the affidavit other than by referring to the BAR and reiterating what it says. TGS's response is attached marked **A13.5**, being an extract of the relevant part of the response to their appeals.

117. Neither the DG nor the Minister had anything to say about this, or the basis on which they rejected the expert opinions before them.

118. Dr Rice (February 2022) cites 98 peer reviewed articles, and the record and experience of Dr Rice speaks for itself. Many of those articles are cited in the Pisces report as well.

119. The expert evidence of Dr Rice was accepted by the court as credible in the Sustaining the Wild Coast case and in the Adams case.

120. Likewise, the record and experience of Professor Nowacek in Nowacek (2021) speaks for itself, and the credibility of his evidence was also accepted in the Sustaining the Wild Coast case, where the court described him as "the Repass-Rodgers Chair of Marine Conservation Technology in the Nicolas School of the Environment and the Edmund T Pratt School of Engineering at Duke University in Durham, North Carolina, United States of America".

121. In his affidavit Nowacek refers to a more detailed declaration he made that was filed in a United States court that was attached to his affidavit in the Adams case, and in its judgment, the court did not question his credibility.

122. As I shall show, the rejection of the expert views of the second and third applicants' was irrational.

Critical Gaps in information related to the Acoustic and Marine Studies

123. In her affidavit Dr Fournet expresses her opinion on the BAR, the Marine study

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and the Acoustics study attached to the BAR.

124. Dr Fournet identifies several pertinent gaps in information and deficiencies in the assessment of marine impacts in the BAR, which she describes in some detail in her report. I attach hereto, as Annexure A14, Dr Fournet's report.

125. Most of the issues Dr Fournet raises were previously raised in the EIA process by the second and third applicants in their comments on the Draft BAR and appeal and in the expert reports attached thereto. The appeal, for example, raised a plethora of issues under the following headings:

125.1. Acoustic Modelling

125.2. Heightened Legislative Requirements are Not Considered for Critical Biodiversity Areas (CBAs), Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs)

125.3. Cape fur seals.

125.4. Whales and dolphins.

125.5. Fish.

125.6. Zooplankton.

125.7. The proposed mitigation measures are inadequate to prevent unacceptable harm to marine life.

125.8. Lack of baseline noise assessment.

126. I preface my summary of Dr Fournet's opinion by pointing out that the learned author expresses the following opinion:

> *"The Acoustics Specialist Report and the associated Marine Ecology Report solicited by TGS fail to adequately demonstrate that anthropogenic noise generated by the proposed seismic campaign will not have significant ecological consequences for marine organisms and habitats at the permit location."*

I pause to point out that this is an appropriate application of the precautionary principle.

127. This failure, says Fournet, is primarily due to the following five factors:

127.1 the failure to recognize the anthropogenic noise from the project as chronic;

127.2 the failure to consider the full spatial extent of the noise generated by the project,

127.3 the omission of an assessment of underwater ambient sound conditions at the site prior to the proposed activities;

127.4 the failure to evaluate potential impacts on the broader marine community, including population-level effects; and

127.5 the failure to incorporate the most up-to-date and relevant scientific recommendations for assessing industrial noise impacts on marine ecosystems.

128. Notably, Dr Fournet credits the science in the Acoustics study, but criticizes its premise and scope, determined by TGS, as being inadequate in that the soundscape beyond the Project area is not assessed, and both the temporal and acoustic characteristics of the noise are too limited since they are focused on the impact of discrete, 24-hour, pulsive noise on low-frequency sound levels in an otherwise pristine marine environment.

Summary of Fournet's Comments on the Acoustic study

129. Dr Fournet's summary of her comments on the Acoustic study raises the following nine points, each highlighting critical gaps in information, the full details of which appear in her report:

129.1. **Inaccurate Assumptions in Acoustic study:** The Acoustic study is

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based on incorrect assumptions, primarily focusing on short-term impacts from 24-hour airgun pulses. However, the actual project will involve 70 days of chronic, high-intensity noise, including both airguns and continuous vessel noise, leading to significantly higher impacts than modeled.

129.2. **Underestimated Noise Sources:** The Acoustic study overlooks the noise contributions from multiple sources, including support vessels and generator noise, which affect both low and mid-frequency ranges critical to marine fauna and elicit behavioral responses. These omitted noise sources exacerbate the overall impact of seismic operations on the marine soundscape.

129.3. **Lack of Baseline Soundscape Assessment:** No baseline data on natural ambient noise levels or soundscape characteristics in the project area were collected, making it impossible to accurately assess how much the proposed activities would increase ambient noise levels.

129.4. **Broader Spatial Impact Unaccounted For:** The Acoustic study fails to quantify how far noise will travel beyond the project area, particularly into Critical Biodiversity Areas (CBAs) and Marine Protected Areas (MPAs), where noise could have far-reaching ecological consequences.

129.5. **Insufficient Consideration of Ecosystem-Level Consequences:**

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The Acoustic study focuses primarily on direct physical injuries (such as hearing loss) but does not adequately address the indirect effects on behavior, communication, and predator-prey dynamics, which could disrupt entire ecosystems.

129.6. **Failure to Address Behavioral and Population-Level Impacts:** Noise-induced behavioral changes, such as altered communication or abandonment of critical habitats, are not properly assessed. These changes could lead to population-level consequences, affecting reproduction, survival, and overall ecosystem stability.

129.7. **Outdated Noise Thresholds and Methodologies:** The Acoustic study relies on outdated sound exposure thresholds that fail to account for the chronic nature of the project's noise impacts. In her report Fournet points out that the Acoustics study heavily relies on Southall (2019) to justify using certain thresholds to determine varying levels of risk, while omitting the caveats included in the 2019 publication. Southall (2019) states that *"The approaches in Southall (2019) are not applicable in evaluating potential auditory effects of chronic noise exposure over periods of weeks, months, or years."*

129.8. **Missing Quantification of Impacted Marine Animals:** The report does not estimate the number of marine animals likely to be affected by the noise, nor does it consider the heightened vulnerability of specific demographics, such as breeding males or nursing females, to noise

exposure.

129.9. **Need for Scaled Sound Propagation Modeling:** The report requires a broader-scale sound propagation model and an assessment of the full spatial and temporal extent ensonification.

Summary of Fournet's comments on the Marine study

130. Dr Fournet's summary of her comments on the Marine study raises the following five points, each highlighting critical gaps in information, the full details of which appear in her report.

130.1. **Inadequate Consideration of Temporary Threshold Shifts** (TTS): Based on mitigation suggestions the Marine study considers TTS an acceptable post-mitigation outcome and fails to address the long-term consequences of temporary hearing loss to individuals of specific species or populations. There is also no consideration for the cumulative effects of multiple days of noise exposure. It overlooks more detailed approaches, such as assessing impacts based on species' sex and behavioral states, and neglects to estimate how much of the marine population will be affected by the 70-day project.

130.2. **Chronic Noise Exposure Risks**: The Marine study downplays the significant risks of prolonged noise exposure for vulnerable cetacean

species (e.g., humpback whales, sperm whales, beaked whales). It fails to assess how chronic noise might cause stress, injuries, altered migration patterns, and permanent hearing loss. There is also no quantitative estimation of how habitat alteration might affect these species.

130.3. **Insufficient Mitigation for Acute Noise Impacts**: The mitigation strategies proposed, including a 500 m buffer zone, are insufficient to minimize acoustic impacts to marine species (e.g, beaked whales and cephalopods). This highlights a failure to align mitigation efforts with the real world risks.

130.4. **Failure to Address Population-Level Impacts**: The Marine study does not estimate how many individuals will be affected or assess the broader population-level consequences of direct or indirect harm, which downplays the long-term impacts of seismic exploration to this marine ecosystem.

130.5. **Omission of Soundscape Analysis**: The report neglects to assess the soundscape in relation to key oceanographic features (e.g., bathymetry, currents), despite sound being critical for marine organisms' interactions with their environment.

Critical failures of the BAR

131. Dr Fournet provides thirteen telling criticisms of the BAR, again highlighting critical gaps in knowledge. I summarize eleven of them here, and the other two, which relate to cumulative impacts, further below:

131.1. **Failure to Address Habitat Variability**: Since the Project area displays significant bathymetric variability due to significant variations in depth, with habitat use and biodiversity differing greatly throughout the area, mitigation measures should consider different operational behaviours based on habitats expected to harbour higher biodiversity or be home to species of concern. Ignoring habitat-specific sensitivities increases the risk of disrupting critical ecological processes.

131.2. **Inconsistencies within the BAR**: The BAR proposes a long-term soundscape analysis for acoustics mitigation but fails to specifically include this measure in mitigation plans or to indicate spatial and temporal extent as part of the preventive strategies. The BAR also specifically acknowledges the need to minimize ambient sound levels associated with seismic operations, yet requires no concrete mitigation measures regarding implementing technological or operational adjustments.

131.3. **Overly Optimistic Reliance on Marine Mammal Observers (MMOs) and Passive Acoustic Monitoring (PAM)**: The BAR fails to provide a clear scientifically driven, adaptive plan for real-time responses based

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on monitoring during the seismic survey. MMOs are limited in the scope and scale of their observations, and PAM only captures loudly vocalizing animals (essentially omitting invertebrates and fish). Thus, while MMOs and PAM operators are crucial for reducing seismic operation impacts, they are not a panacea to address all potential risks.

131.4. **Incorrect Temporal Scale:** The BAR focuses on short-term acoustic impacts (seconds to hours), despite the project involving approximately 70 days of seismic operation. This narrow focus disregards the long-term implications of chronic noise exposure. Prolonged anthropogenic noise can lead to chronic cumulative effects and these impacts, especially over the course of two months, are more likely to disrupt population dynamics, such as habitat avoidance or disrupted breeding patterns, which were overlooked in the assessment. Noise from the seismic survey is both chronic and spatially far-reaching, making the BAR's temporal scope inaccurate.

131.5. **Unknowns Are Disregarded:** The BAR does not sufficiently account for unknown variables, including species-specific responses, role of behavioural states, and lack of biodiversity data and ecosystem sensitivities, thereby underestimating the potential impacts of the seismic activity on species and habitats. Uncertainty is inherent in ecological impact assessments, particularly when dealing with complex, dynamic marine ecosystems, making it essential to adopt the precautionary principle. The failure to collect baseline data significantly

increases uncertainty; despite this, the BAR does not recommend commissioning ecological studies to address biological unknowns.

131.6. **Disregard for Far-Field Sound**: The BAR does not adequately consider the effects of far-field sound, which can propagate over long distances and affect distant marine life. Seismic noise can travel thousands of kilometers, disrupting long-range communication among marine species such as cetaceans. Far-field sound from seismic airguns will extend well beyond the immediate operational area, including into Critical Biodiversity Areas (CBAs) and Marine Protected Areas (MPAs),yet the EIA does not quantify the extent or ecological consequences or far field sound, nor does the EIA recommend broader scale acoustic modelling.

131.7. **Generalized Masking Effects:** The BAR. acknowledges the importance of acoustic masking to marine organisms but overgeneralizes the effects of noise masking, failing to account for species-specific auditory ranges and behavioural needs. Different marine species rely on unique frequency ranges for communication, predator detection, and prey location. A generalized approach that does not differentiate between species' auditory sensitivities can result in inadequate mitigation. Masking effects should be assessed separately for each species, given their varying hearing thresholds and reliance on the sonic environment.

131.8. **Disregard for Chronic Impacts:** The BAR does not sufficiently consider the long-term effects of temporary injuries, such as hearing loss, resulting from seismic exposure, which can have severe long-term consequences if it impairs an animal's ability to communicate, forage, or avoid predators. Chronic exposure to noise may also lead to habitat abandonment or reduced reproductive success, ultimately affecting population resilience. Seismic operations, particularly over 70 days, will result in chronic, not just temporary, impacts, leading to long-term harm to individuals and populations that depend on the proposed permit region.

131.9. **Flawed Scoring System:** The BAR employs a scoring system that does not allow for population-level impacts or the meaningful incorporation of uncertainty. In data-deficient situations, this scoring system biases the assessment toward assuming minimal impact, leading to underestimation of real risks. There is a need to factor in uncertainty and variability in population responses to ensure a precautionary approach is taken.

131.10. **Inadequate Mitigation Zone:** The BAR's reliance on a 500 m mitigation zone is insufficient to protect marine life from the harmful impacts of seismic noise, especially given the repetitive use of airguns over 70 days. The Acoustics Specialist Report explicitly indicates that behavioural impacts are expected for marine mammals at distances up to 3.8 km from the array source and for fish at 1.3 km. Similarly, a zone

of 2-5 km is necessary to avoid significant impacts on squid and other cephalopod.

131.11. **Failure to Use Best Science:** The BAR fails to incorporate the best available scientific practices in its mitigation strategies. For example, in the absence of comprehensive biological surveys, best practice recommends assuming the presence of sensitive species and applying conservative mitigation measures to avoid harm. The reliance on outdated scientific recommendations from the Acoustics study results in insufficient mitigation strategies.

132. Dr Fournet's report, read with the information that was before the decision-makers, reliably identifies critical gaps in knowledge in the information before the decision-makers.

133. An affidavit of Dr Harris will be filed together with this affidavit, confirming the contents of a report by her, Dr JM Olbers and Dr K Wright dated 10 November 2024, in which they express their opinion in regard to the BAR. The opinion of the learned authors is summarized as follows:

133.1. The proposed seismic surveys for reconnaissance pose an unacceptable acoustic and ecological risk to the marine ecosystems and species in South African waters.

JWS

133.2. With reference to point 3.2 of the EA, where seismic surveys are described as:

> "generally regarded as non-intrusive in nature", and although states that "the technology poses potential impacts on fisheries and marine fauna,.....the majority of the impacts were assessed to range between low to very low significance with mitigation"

they express the opinion that the acute anthropogenic noise over a prolonged period of time, and the extensive survey gear in the water is an ecological risk to threatened and protected marine fauna that primarily use sound to survive and/or are unable to avoid the area of impact.

133.3. They disagree with the finding of the BAR and Reasons for Decision in the EA, that seismic surveys are regarded as 'non-intrusive', especially when the report clearly acknowledges the presence of impacts, before assessing their significance as low despite the impacts being largely unknown.

133.4. To understand the risk of seismic surveys on cetaceans, the population status of species of concern needs to be established.

134. The opinion of Dr Harris is consistent with the opinion expressed by Dr Fournet.

JCS

Gaps in knowledge reported in the BAR

135. The BAR (in para 12.2 on pg 260) identifies certain information gaps as follows:

"Information gaps include:

- *details of the benthic macrofaunal communities beyond the shelf break;*
- *details on demersal fish communities beyond the shelf break;*
- *information specific to the marine communities of seamounts (Tripp Seamount, Child's Bank) and submarine canyons (Cape Canyon and Cape Point Canyon); and*
- *current information on the distribution, population sizes and trends of most cetacean species occurring in South African waters and the project area in particular.*

Keeping these information gaps in mind, the assessment of impacts has adopted a strongly precautionary approach."

136. How the precautionary approach was allegedly adopted in the BAR is indicated in Table 6 of the BAR, which is the 'Need and Desirability' analysis. In para 1.8.3 on p 24 of the BAR, in describing how a risk-averse and cautious approach was purportedly applied in terms of ecological impacts, the BAR states:

"As a result of the fact that this project entails only survey activities, it is

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anticipated that this project will not lead to a significant impact on the receiving environment. Refer to the impact assessment in Section 9 of this report. There is a deficiency in terms of local research in SA waters, but that international research is, in the view of the specialists, adequate for predicting risk-result and risk has been identified as low. Recommendations have been included to take the opportunity presented by this project to enhance/encourage site-specific local research."

137. **Furthermore, para 2.6.3 in Fig 6 on p 28 of the BAR, in describing how a risk-averse and cautious approach was applied in terms of socio-economic impacts, states:**

"The level of risk is low as the project is not expected to have far reaching highly negative impacts on socio-economic conditions. The survey area is located 120 km offshore, outside of the fisheries ringfence area. Since the survey activities will not include any drilling at this stage, a risk averse and cautious approach has been implemented to limit the impact on the surrounding environment."

138. **The BAR does record the following gaps in knowledge, reinforcing how widespread these gaps are in the context of this EIA:**

138.1. on pg 58 of the BAR: *"To date very few areas on the continental slope off the West Coast have been biologically surveyed (Sink et al. 2019;*

Harris et al. 2022)."

138.2. in para 8.4.1.1 on pg 61 of the BAR, relating to the impacts on benthic invertebrate macrofauna: *"The 2018 National Biodiversity Assessment for the marine environment (Sink et al. 2019) points out that very few national IUCN Red List assessments have been conducted for marine invertebrate species to date owing to inadequate taxonomic knowledge, limited distribution data, a lack of systematic surveys and limited capacity to advance species red listing for these groups. ...*

138.2.1. *"Information on the benthic fauna of the lower continental slope and abyss (beyond 1 800 m depth) is largely lacking due to limited opportunities for sampling. ...*

138.2.2. *"The 2018 National Biodiversity Assessment for the marine environment (Sink et al. 2019) points out that very few national IUCN Red List assessments have been conducted for marine invertebrate species to date owing to inadequate taxonomic knowledge, limited distribution data, a lack of systematic surveys and limited capacity to advance species red listing for these groups."*

138.3. in para 8.4.3.4 on pg 80 of the BAR, relating to the impacts on leatherback turtles (whose conservation status is endangered or vulnerable – Fig 10): *"Their abundance in the study area is unknown but expected to be low."*

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138.4. in para 9.3.3.2 on pg 215 of the BAR, relating to the impact of sound on catch rates: *"Existing experimental data regarding recoverable injury for fish eggs and larvae is sparse and no guideline recommendations have been provided. However, based on a subjective approach, noise impacts for fish eggs and larvae are expected to be moderate at the near field (i.e. in the distance of tens of meters) from the source location, low at intermediate (i.e. in the distance of hundreds of meters) and far field (i.e. in the distance of thousands of meters) from the source location."*

138.5. in para 11.1.1 on pg 238 of the BAR, relating to noise and acoustics: *"Existing experimental data regarding recoverable injury and TTS impacts for fish eggs and larvae is sparse and no guideline recommendations have been provided. However, based on a subjective approach, noise impacts are expected to be moderate for fish eggs and larvae. Impact is expected to be low for all of them at intermediate and far field from the source location."*

138.6. in para 9.3.2.4 on pg 221 of the BAR, relating to cumulative impacts: *"Due to the dearth of information on the impacts of seismic noise on truly pelagic species links between changes in migration patterns and subsequent catches thus remains speculative."*

138.7. in para 6.2 on pg 33 of the BAR, relating to layout alternatives: *"Most of*

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the ecosystem types in the Reconnaissance Permit Area are either poorly protected or not protected. CBAs within the Application Areas include both CBA1: natural and CBA2: natural areas (see Figure 91)."

138.8. in para 8.4.1.1 on pg 56 of the BAR, relating to impacts on benthic invertebrate macrofauna: *"The benthic biota of unconsolidated marine sediments constitutes invertebrates that live on (epifaune) or burrow within (infauna) the sediments and are generally divided into macrofauna (animals >1 mm) and meiofauna (<1 mm). Numerous studies have been conducted on southern African West Coast continental shelf benthos, mostly focused on mining, pollution or demersal trawling impacts [citing the studies]. These studies, however, concentrated on the continental shelf and nearshore regions, and consequently the benthic fauna of the outer shelf and continental slope (beyond ~450 m depth) are very poorly known. This is primarily due to limited opportunities for sampling as well as the lack of access to Remote Operated Vehicles (ROVs) for visual sampling of hard substrata."*

138.9. in para 8.4.1.1 on pg 58 of the BAR, relating to impacts on benthic invertebrate macrofauna: *"To date there have been no studies examining connectivity between slope, plateau or abyssal ecosystems in South Africa and there is thus limited knowledge on the benthic biodiversity of all three of these broad ecosystem groups in South African waters (Sink et al. 2019). There is no quantitative data*

describing bethyal ecosystems in South Africa and hence limited understanding of ecosystem functioning and sensitivity (Anderson & Hulley 2000; Harris et al 2022) Due to the lack of information on benthic macrofaunal communities beyond the shelf break, no description can be provided for the offshore portions of the Reconnaissance Permit Area. However, as these communities would receive the sound in the far field only, no detrimental effects to the communities or to individual benthic species are expected."

138.10. **in para 4.4.3.6 on pg 68 of the BAR, also relating to the impacts on marine mammals at:** *"Altogether 17 species are listed as 'data deficient' underlining how little is known about cetaceans, their distributions and population trends. The offshore areas have been particularly poorly studied with most available information from deeper waters (>200 m) arising from historic whaling records prior to 1970. In the past ten years, passive acoustic monitoring and satellite telemetry have begun to shed light on current patterns of seasonality and movement for some large whale species (Best et al. 2009; Elwen et al. 2011; Rosenbaum et al. 2014; Shabangu et al. 2019; Thomisch et al. 2019) but information on smaller cetaceans in deeper waters remains poor. Records from marine mammal observers on seismic survey vessels have provided valuable data into cetacean presence although these are predominantly during summer months (Purdon et al. 2020). Information on general distribution and seasonality is improving but data population sizes and trends for most cetacean species occurring on the west coast of*

TOS

southern Africa is lacking."

138.11. in para 8.6.2.3 on pg 159 of the BAR, relating to sensitive areas: *"Most of the ecosystem types in the Application Area are either poorly protected or not protected."* [See map Fig 90 p 160]

138.12. in para 12.3 on pg 261 of the BAR, relating to the assumptions and limitations relating to fisheries: *"The effects of seismic sound on the CPUE of fish and invertebrates have been drawn from the findings of international studies. To date there have been no studies focused directly on the species found locally. Although the results from international studies are likely also to be representative for local species, current gaps in knowledge on the topic lead to uncertainty when attempting to accurately quantify the potential loss of catch for each type of fishery. Research into the effects of seismic sound on marine fauna is ongoing."*

138.13. And in the executive summary on noise/ acoustics on pg xviv of the BAR: *"The Application Area falls into the Southeast Atlantic Deep Ocean Ecoregions. Although there is a lack of knowledge of the community structure and diversity of benthic macrofauna off the shelf edge, the South Atlantic bathyal and abyssal unconsolidated habitat types have been rated as 'Least Threatened', reflecting the great extent of these habitats in the South African Exclusive Economic Zone (EEZ)."*

ACOS

139. In the light of the reported gaps in knowledge, a more stringent application of the precautionary approach was called for. This is reinforced by the unreported gaps in knowledge that I have set out above.

140. Despite the assurances by the decision-makers that they considered all the material before them, lacking as it was crucial information, it is evident from the reasons for their decisions that they failed to give it due consideration.

Mitigation measure of a shorter window period was not considered

141. An example of the irrationality of the EA and the Minister's decision relates to the critical mitigation measure of approving the appropriate window within which to conduct the 70-day survey.

142. The EMPr, which was approved in the EA, requires the survey to take place in the period from January to May. That is a period of 151 days to conduct a survey that only requires a maximum of 70 days.

143. The reasons why the January to May window was selected are not explained in the BAR or the EMPr.

144. The BAR states that the feeding peak in the Benguela current off the west coast is "spring and early summer (October - February)" (BAR pg 95), and that Humpback whales are likely to be the most frequently encountered baleen

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whale in the project area, ranging from the coast out beyond the shelf, with year round presence but numbers 'peaking during the northward migration in June – February" (BAR pg 96).

145. This would indicate that the months of January and February are less favourable months within which to conduct the seismic survey.

146. It is not explained in the BAR, the EMPr or the EA or the Minister's decision why a window from March to May (92 days) would not be sufficient.

147. TGS, in its response to the second and third applicants' appeal, stated that a four month window is proposed for the survey, to coincide with the period of lowest activities for the fisheries that operate in the potentially affected sectors. (The first bullet point on pg 47 in the extract from TGS's comments marked A13.1.)

148. No consideration was given to the alternative of a four-month window in the BAR or by the decision-makers.

149. The first ground of review is that the BAR omitted relevant information and considerations in respect of impacts on marine life, and that the decisions of the DG and the Minister were not rationally connected to the information before them, were irrational and/or unreasonable, and failed to give adequate consideration to the precautionary principle, in breach of sections 24O(1)(b), 24(4) and 2(4)(a)(vii) of NEMA, and Regulation 41(6) of the EIA Regulations.

A105

The EA and the Minister's decision to uphold it are accordingly reviewable on one or more of the following PAJA review grounds:

149.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

149.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

149.3. the action was procedurally unfair, as contemplated in section 6(2)(c) of PAJA;

149.4. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

149.5. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

150. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

Review Ground 2 – Public Participation

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151. The second ground of review is that the public participation process followed in the EIA did not ensure that persons in vulnerable and disadvantaged communities were given sufficient opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, or ensure that community well-being and empowerment was adequately promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.

152. Public participation must be meaningful and sufficient to give effect to the constitutional rights of the affected communities in the Bill of Rights, including their rights to administrative justice, to health and well-being, to human dignity, and to equality.

153. Section 2(4)(f) of NEMA states that that the participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.

154. Section 2(4)(h) of NEMA states that community well-being and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.

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155. In this matter, the EAP did not achieve the objectives of sections 2(4)(f) or (h) of NEMA in respect of people like me in marginalised and disadvantaged communities.

156. Although the EIA Regulations have a standard set of minimum requirements related to public participation, they apply equally to all types of applications for EA. For example, the minimum public participation required to apply for an EA to develop a jetty in an estuary (Listing Notice 1 activity 17), is the same minimum public participation process as the present matter.

157. Compliance with the minimum requirements in the EIA Regulations does not necessarily imply that public participation is effective, or that it fulfils the objectives of NEMA contained in section 2(4)(f) and (h).

158. This failure is abundantly clear from the findings and recommendations in the SIA, referred to below.

159. The social background reflected in the BAR (in par 9.3.1.1 on pg 222) states in relation to the impacts on social heritage: "*The public meetings and focused discussions with interlocutors have shown that these communities and groupings are struggling economically due to decades of turmoil in the fishing industry.*"

160. The BAR (in par 11.1.5 on pg 245), in regard to the social assessment states:

"TGS, as well as other companies that want to do surveys or exploration in the area, currently do not have social license to operate. A large part of this is due to a lack of meaningful consultation by previous applicants from a community perspective. If TGS or any other seismic survey company wants to proceed with the project, they will need to engage in meaningful conversation with the communities and try to restore relationships. From a community and social risk perspective this is not negotiable."

161. The BAR states further, *"From a social perspective it is recommended that the project proceed subject to the mitigation measures (i.e. meaningful consultation, local research, education, and awareness raising in the project-affected communities) forming part of the conditions for authorisation and being implemented prior to the commencement of the actual survey."*

162. The recommended mitigation measures for implementation were the following (SIA para 9 pp 108-109):

162.1 **TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism.**

162.2 **TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. Collaboration across seismic operators**

with holders of hydrocarbon exploration and the industry as a whole to collectively fund pro-active research would provide opportunity for the development and implementation of a structured and experimentally sound acoustic study. This would quantitatively inform the authorities and stakeholders of acoustic impacts to the various faunal groups in South African Waters.

162.3 Consult with communities on potential ways in which to make a positive contribution to the communities.

162.4 A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with establishing the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective. Given the risk of stakeholder fatigue, it would be most beneficial if this can take place on an industry level.

162.5 TGS should initiate discussions in the industry. The seismic survey industry should re-assess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will

not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.

163. Both the SIA and the HIA are dated September 2022, that is, after the initial public meetings were held in August 2022, and prior to the 30-day consultation period required for the BAR process, which took place in October and November 2022. In terms of the SIA, in September 2022, TGS had no social licence to operate.

164. This could not be, and was not, remedied by the 30-day public participation process in October and November 2022.

165. First I will summarise what took place in the pre-application meetings, and after that what took place in the BAR application meetings.

166. The record of public participation in Annexure A6.6 shows that six pre-application meetings took place, scheduled for a two-hour period from 16.00 to 18.00 on separate days between 29 August 2022 and 3 September 2022, in each of Hout Bay, 3-Anchor Bay, Saldanha Bay, Lamberts Bay, Hondeklip Bay and Port Nolloth.

166.1. I attended this meeting in Port Nolloth, where I live and work, although

my name does not appear in the attendance register. In previous EIA processes, consultants have used meeting registers to claim that people support their projects. Because of this, myself and other small-scale fishers do not want to sign the register as we outright reject the tick-box exercise of consultation that is carried out by the EAP.

166.2. There are no attendance lists for Hout Bay, 3-Anchor Bay or Port Nolloth meetings.

166.3. It appears from the minutes of the meetings that two people participated in Hout Bay, four in 3-Anchor Bay, and that the meeting in Hondeklip Bay was only attended by three Petroleum Association of South Africa (PASA) members apart from the presenters.

166.4. From the attendance lists it appears that the attendance at Saldanha Bay was 21 people, at Lamberts Bay 52 people, and at Hondeklip Bay 23 people, including the presenters, but I do not know how many people were there and whose names do not appear on the attendance registers.

166.5. The minutes of these pre-application meetings show that the two presentations in A6.6 were made, one on the consultation process and the way ahead – approximately seventeen pages/slides – followed by a chance for questions, and the second one an outline of the project – approximately twenty five pages/slides, about half of which provided

technical information which was relatively superficial. In both presentations it was indicated that thorough public participation would take place in the EIA process.

167. The public participation process in regard to the Draft BAR, according to Annexure A6.9, consisted of notices of the process, a 30-day comment period, and meetings. A two-hour meeting was held either between 10.00 and 12.00 or between 16.00 to 18.00, in each of the following eight places between 31 October and 5 November 2022:

167.1. on Tuesday 1 November 2022, afternoon meetings in Port Nolloth, attended by 11 people, and Hondeklip Bay, attended by 23 people, and a morning meeting in Garies from 10.00 to 12.00 attended by 12 people, according to the attendance registers.

167.2. I attended the meeting in Port Nolloth but my name does not appear on the attendance register.

167.3. on Thursday 3 November 2022, morning meetings in Lamberts Bay, attended by 19 people, St Helena Bay, attended by 8 people, and afternoon meetings in Saldanha Bay, attended by 18 people, and Sea Point, attended by 8 people;

167.4. on Saturday 5 November 2022 a morning meeting in Hout Bay,

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attended by 7 people; and

167.5. including the presenters, a total of approximately 106 people attended the public meetings regarding the Draft BAR.

168. It is not stated in the BAR or the expert studies what the population numbers of the relevant coastal communities are. The SIA gives the populations of the local municipalities (in Table 1 on pg 54), and the combined total of the affected district municipalities, which are Namakwa and West Coast District Municipalities, which is 551,891 people (2016).

169. The number of participants in the small-scale fishing communities along the South African west coast is estimated to be approximately between and 2500 and 5000. (Marine study, Figure 83 on pg 149.)

170. The participation of the small-scale fishing communities in the public participation process was very low in the circumstances, even allowing for a small number of people who did not sign the attendance registers.

171. The minutes of the meetings support the observations and findings in the SIA mentioned above.

172. A factor highlighted in the SIA was stakeholder fatigue and disillusionment, something I personally can vouch for strongly.

172.1. The SIA states that stakeholder disillusionment is related to stakeholder fatigue, which can occur during a project or can be a legacy of past involvement in stakeholder participation. (SIA para 8.3.7 on pg 98.)

172.2. The same party who conducted the public participation in the present matter conducted a similar public participation process for another reconnaissance project, TEEPSA, between July 2022 and August-September 2022, overlapping with the TGS public participation, which was in August and October-November 2022.

172.3. During the same period, SLR Consulting (Pty) Ltd conducted an EIA public participation process on behalf of TEEPSA in relation to an exploration licence for drilling, in June-July 2022, and Triplo4 Sustainable Solutions conducted an EIA public participation process in relation to an application by Karpowership Saldanha relating to power generation from gas, in October-November 2022.

172.4. In addition to these oil and gas projects, our west coast communities are also facing multiple applications for mining activities along the coast and near to us, which also have EIA processes ongoing, calling for comments and in some cases, public meetings.

172.5. The Draft BAR documents made available to the communities in the present matter are voluminous. The Draft BAR report, the EMPr and the five expert reports alone run to over a thousand pages, and are very

complex. The documents in the other matters were no less voluminous or complex.

172.6. Neither I nor the small-scale fishers I know had the capacity to understand what was contained in the Draft BAR well enough to engage on the science and intricacies of the application process without assistance.

172.7. I myself dropped out of school in grade 8. In our community it was common for black and coloured people not to complete basic education under the Apartheid system.

172.8. No attempt at capacity-building was made in order to remedy this.

172.9. As an example of the stakeholder disillusionment and fatigue, at the meeting in Hondeklip Bay on the Draft BAR, the minutes show that John Adams stated: *"The meeting goes too fast. We want to understand how the process runs from point A to point B. We're a bit confused because it's a similar submission that's being done, for another company, and it's said that it's just comments, but then we'll hear at a next time there's an application. We are needy communities and have in the past suggested that plans be made to see if anything can be done here. I would also like to understand just what was said in the meeting in Garies."*

172.10. Others from the small-scale community expressed concern about the

impacts of oil and gas, disappointment at being excluded from the benefits of the oil and gas industry, and scepticism about promises made. The level of engagement shows very little knowledge of the assessment and mitigation of social, economic and environmental risks in the Draft BAR.

172.11. A comment recorded at the Lamberts Bay meeting on the Draft BAR by Chief Regan James was, *"How far is the application area from the country? And how far does the sound travel from the boat? From our side, our sonar messes up the fish's heads. We are not against projects, but now you are coming to us. Ever since they started with the oil and gas surveys a long time ago and now there are no more fish left. It is unacceptable to us that you now come to the communities and explain, where you should have come and talked to us in the first place and asked permission to do the studies."*

172.12. The ability of vulnerable communities to effectively participate in the process in the circumstances requires considerably more than was done by TGS in this matter.

173. I attach hereto confirmatory affidavits by John Adams, Chief Regan James and Carmelita Mostert, being community members who attended some of the information sessions. We also assisted Jacqueline Sunde and attach her confirmatory affidavit.

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174. It is inconceivable to me that affected coastal communities were able to respond to each of these processes in a meaningful way. Fishers must fish for a living, requiring them to be out at sea daily or for extended periods of time during the fishing seasons; March to July is snoek season and 15 October to 15 February is the usual lobster season. Even if we wish to do so, we do not have the time or resources to attend multiple public meetings, engage with voluminous technical information in our comments.

175. The result, even if unintended, is that those of us who have less resources, who are required to be out at sea to make our livelihoods, and who are unable to fully understand the different proposals and processes, are not able participate and engage meaningfully.

176. The chilling effect is that we are significantly prejudiced by the onslaught of applications.

177. There are many people, particularly those of us in the small-scale fishing communities and co-operatives, who will be impacted by the project and who do not have access to the resources and expertise required to access, consider and comment on the records relating to the project, which are voluminous and technical in nature.

178. Annexure A12.5 hereto, which was attached to the second and third applicants' appeal, is a letter from Carmelita Mostert which was also separately sent to the Appeals Authority, clearly sets out opposition to the seismic surveys based on

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the impact on fisheries, and points out their difficulties with having to find hardcopy reports and with having to consider how her community's comments have been considered by the EAP.

179. To ensure access to a reasonable, adequate and fair public participation process, TGS and its appointed EAP and consultants should have used reasonably distinctive and appropriate alternative methods to inform and educate affected communities and small-scale fishers of the significant adverse impacts that this project could have on them.

180. Running a public participation process during the 30-day time period could not achieve meaningful and effective consultation. Much more should have been done in the pre-application and application phases.

181. The Department of Environmental Affairs has published a *Guideline on Public Participation* in terms of NEMA as a guide. This is an "implementation guideline" contemplated in section 24J of NEMA and accordingly its contents were a relevant factor in the decision-making process in terms of section 24O(1)(b)(viii).

182. The NEMA guideline on public participation provide, among others, that the public participation process must:

182.1. provide for the opportunity for all role players to obtain clear, accurate and understandable information about the environmental impacts of the

proposed activity or implications of a decision;

182.2. provide for role players to voice their support, concerns and questions regarding the project, application or decision;

182.3. to provide opportunities for clearing up misunderstandings about technical issues, resolving disputes and reconciling conflicting interests;

182.4. to encourage transparency and accountability in decision-making;

182.5. to contribute toward maintaining a healthy, vibrant democracy;

182.6. consider the use of the following PP mechanisms over and above the requirements: public meetings and open days; conferences; press releases; questionnaires or opinion surveys; information desks and/or info lines (helpline); web-based platforms/social media; and meetings/workshops with constituencies; and

182.7. where IAPs include rural or historically disadvantaged communities, consider the following in order to facilitate their participation or overcome potential constraints:

182.7.0. announcing the PPP on a local radio station in a local language, at an appropriate time (e.g. peak hours);

182.7.1. using participatory rural appraisal and participatory learning and action approaches and techniques to build the capacity of the IAPs to engage and participate more effectively;

182.7.2. specific approaches to existing community structures, committees and leaders;

182.7.3. holding public meetings at times and venues suitable to the community;

182.7.4. holding separate meetings with vulnerable and marginalised groups; and

182.7.5. appropriate access to information must be provided.

183. The inclusion of the mitigation measures in the SIA referred to above, repeated in the Draft BAR, try to remedy the failures of the public participation process by means of mitigation after the granting of the EA. This does not remedy the failure of public participation in the BAR process.

184. The public participation process failed adequately to take into account the needs and values of the communities (and small-scale fishers) who were opposed to the seismic survey. Our voices in opposition to the seismic survey remained unheard in the final BAR and EA.

185. Engaging and involving coastal communities in the decision-making process is crucial. Meaningful consultation and participation allow communities to express their concerns, share their knowledge, and contribute to the development of effective mitigation measures. Failure to include the perspectives and needs of these communities can result in measures that do not adequately address our cultural and heritage associations and may lead to further marginalization.

186. Despite the apparent expert knowledge and the level of understanding expressed in the BAR, and recommendations made in the BAR regarding the potential effects of the seismic survey proceeding, it is clear that necessary deep conversations with coastal communities were not conducted.

187. This impacted negatively on the well-being of my community, and will also have negative consequences for future generations of small-scale fishers.

As a result of this,

188.1. the communities' identity, sense of place, and spiritual, cultural, and indigenous rights were not effectively upheld and protected; and

188.2. the decisions in this matter failed adequately to consider the interests, needs, and values of all interested and affected parties, including acknowledging all forms of knowledge, including traditional and ordinary knowledge.

189. Consequently, insufficient information was placed before the decision-makers, and he/she neglected to afford sufficient weight to the indigenous and cultural rights of coastal communities.

190. In light of the above, I submit that the public participation process, including the SIA conducted, did not constitute meaningful consultation with communities and local people (and in particular small-scale fishers), and that the mitigation measures requiring further consultation after the EIA has been conducted and a decision on authorisation made do not cure this flaw in the EIA process.

191. The second ground of review is that the public participation process followed by the EAP in the EIA process did not ensure that persons in vulnerable and disadvantaged communities were given sufficient opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, or ensure that community well-being and empowerment was adequately promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means. The failure is in breach of Regulation 40 of the EIA Regulations read with section 2(4)(c), (f), (g), (h) (o) and section 24(1A)(c) of NEMA, with the NEMA Guideline on Public Participation, and with sections 9, 10, 24 and 33 of the Constitution. The EA and the Minister's decision to uphold it are accordingly reviewable on one or more of the following PAJA review grounds:

191.1. a mandatory and material procedure or condition prescribed by an

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empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

191.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

191.3. the action was procedurally unfair, as contemplated in section 6(2)(c) of PAJA;

191.4. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

191.5. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

192. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

Third Ground of Review – Need and Desirability

193. The third ground of review is that the Minister failed to consider the reduced need for the seismic survey due to part of the Project area already having been

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surveyed, and the BAR failed to conduct a rational assessment of need and desirability as required by regulation 18 of the EIA Regulations in that the BAR:

193.1. considered only the potential positive impacts of the production of oil and gas for the purposes of determining need and desirability and not the potential negative impacts thereof, which was inconsistent and irrational;

193.2. failed to conduct a proper assessment of the option of not implementing the activity; and

193.3. failed to conduct an assessment of the potential social, economic and environmental impacts of the exploration and production of oil and gas.

194. I will first explain the analysis that the EAP and the decision-makers were required to engage for purposes of the need and desirability inquiry, and after that explain what was in fact done.

Need and desirability properly construed

195. Regulation 18 of the EIA Regulations provides that:

"When considering an application the competent authority must have regard to section 24O and 24 (4) of the Act, the need for and desirability

of the undertaking of the proposed activity, the requirements of these Regulations, any protocol or minimum information requirements relevant to the application as identified and gazetted by the Minister in a government notice or any relevant guideline published in terms of section 24J of the Act."

196. One of the objects of a BAR, described in section 2(b) of Appendix 1 to the EIA Regulations, is to *"describe the need and desirability of the proposed alternatives"*. Section 3(1)(f) of Appendix 1 requires the BAR to contain *"a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location"*.

197. This assessment of "need and desirability" is fundamental to an environmental impact assessment process. It is the point of departure for the essential inquiry that must be undertaken by the competent authority in terms of NEMA – *viz.* are the adverse environmental impacts of the proposed activity justifiable in light of the positive socio-economic impacts? Put differently, does the proposal represent 'the best practicable environmental option"?

198. According to the Need and Desirability Guideline, the notion of "need and desirability" flows from the concept of sustainable development, which is guaranteed in section 24(b)(iii) of the Constitution and foundational to the system of environmental management provided in NEMA.

199. The need and desirability inquiry is a tool to ensure that sustainable

development is promoted in individual applications for environmental authorisation. Its purpose is to determine whether the proposed activity serves a broader societal purpose, such that any adverse environmental impacts are justified. This notion is captured in the Guideline as follows:

> *"Ultimately development must not exceed ecological limits in order to secure ecological integrity, while the proposed actions of individuals must be measured against the short-term and long-term public interest in order to promote justifiable social and economic development – i.e. ensuring the simultaneous achievement of the triple bottom-line. Considering the merits of a specific application in terms of the need and desirability considerations, it must be decided which alternatives represent the "most practicable environmental option", which in terms of the definition in NEMA and the purpose of the EIA Regulations are that option that provides the most benefit and causes the least damage to the environment as a whole, at a cost acceptable to society, in the long-term as well as in the short-term." (pg 10)*

200. Therefore, it must first be determined whether a societal *need* is in fact served by the proposed activity. The notion of "need" is clarified in the Guideline as follows:

> *"With regard to the issue of "need", it is important to note that this "need" is not the same as the "general purpose and requirements" of the activity. While the "general purpose and requirements" of the activity might to some extent relate to the specific requirements, intentions and reasons*

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that the applicant has for proposing the specific activity, the "need" relates to the interests and needs of the broader public." (pg 10)

201. It must then be determined whether the proposal is *desirable* by reference to the identified need and in the light of any adverse ecological impacts. In essence, the question at this stage is whether the proposed activity is the best way of meeting the identified need, having regard to its particular environmental impact. For purposes of this analysis, the Guideline explains that:

> *"Consistent with the above aim and purpose of EIA, the concept of "need and desirability" relates to, amongst others, the nature, scale and location of development being proposed, as well as the wise use of land. While essentially, the concept of "need and desirability" can be explained in terms of the general meaning of its two components in which need primarily refers to time and desirability to place (i.e. is this the right time and is it the right place for locating the type of land-use/activity being proposed?), "need and desirability" are interrelated and the two components collectively can be considered in an integrated and holistic manner." (pg 10)*

202. As for the overall evaluation:

> *"The consideration of 'need and desirability' in EIA decision-making therefore requires the consideration of the strategic context of the development proposal along with the broader societal needs and the public interest. The government decision-makers, together with the environmental assessment practitioners and planners, are therefore*

accountable to the public and must serve their social, economic and ecological needs equitably. Ultimately development must not exceed ecological limits in order to secure ecological integrity, while the proposed actions of individuals must be measured against the short-term and long-term public interest in order to promote justifiable social and economic development." (pg 10)

203. Significantly, the point is made in the Guideline that "*what is needed and desired for a specific area should primarily be strategically and democratically determined beyond the spatial extent of individual EIAs.*" I wish to add at this point that I am advised that an environmental management instrument usually used for this purpose is a strategic environmental assessment ("SEA"), such as is called for in the mitigation measures contained in the SIA that I referred to above.

204. The Guideline (from pg 11) provides a list of questions intended to elicit information bearing on these essential questions, including:

204.1. *What is the socio-economic context of the area, based on... strategic plans, frameworks of policies applicable to the area?* [in the context of this application, it can be accepted that the relevant "area" is South Africa as a whole]

204.2. *Will the development complement the local socio-economic initiatives?*

204.3. *Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and*

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specifically also on the socio-economic objectives of the area?

204.4. *Do the proposed location, type and scale of development promote a reduced dependency on resources?*

204.5. *Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?)*

205. Having regard to the above, it is clear that in the context of TGS's application, there is only one way of approaching the need and desirability inquiry:

205.1. The purpose of the reconnaissance activities is to establish whether oil or gas deposits are present in the project area as a first step toward the ultimate purpose of extracting this resource. The broader purpose to which the proposal is directed is thus (for purposes of this inquiry) oil or gas production.

205.2. Whether or not there is a need to produce oil or gas on the project area must be considered by reference to pertinent strategic plans and policies, which in these circumstances include the National Development Plan, the National Climate Change Response White Paper, LEDS 2050, the IRP 2019, and the marine spatial planning process in terms of the Marine Spatial Planning Act 16 of 2018.

205.3. If it is found that there is a need for oil or gas extraction, it must then be considered whether the project is a desirable way of meeting this need, having regard to its ecological and socio-economic impacts and the opportunity costs of the oil and gas exploration and production. This evaluation should, of course, begin with a consideration of whether there is another more sustainable way of meeting the need.

205.4. If there is no need for oil or gas production, or if extraction is not desirable, then the environmental, social and economic risks associated with exploration cannot be justified.

(a) Inconsistency

206. The analysis of environmental impacts of the Project is narrowly interpreted in the BAR, that is, with reference only to the specific seismic activities in the Project area. However, it gives a wider interpretation to the positive impacts of the Project for the purposes of need and desirability. This gives rise to a fundamental inconsistency in the analysis of need and desirability in the BAR.

207. The same inconsistent approach was adopted by the decision-makers.

208. The BAR discusses need and desirability in Part 5 in page 21. It refers to the Need and Desirability Guideline and purports to comply with it. The BAR (at pp 33 – 34) describes in detail South Africa's need for natural gas for the

generation of electric power, based on the lower carbon omissions compared to coal and oil, its potential as a transition fuel on the path to the carbon neutral goal of the Paris agreement, the 2019 IRP and government policy, among others.

209. The BAR summarises the positive aspects of the Project (on pg 238) as, firstly, the opportunity to identify potential oil and gas resources within the Project area, including potential future contribution to the economy of South Africa; secondly, the opportunity to conduct independent research on how fish species on the West Coast such as snoek respond to seismic surveying; and thirdly, the provision of job or training opportunities (described as very limited).

210. The BAR explains the need for the acquisition of the seismic data based primarily on the possible oil and gas exploration and production that could potentially take place in the future as a result of the survey. However, the BAR declines to report on, consider or assess the environmental impacts and risks associated with oil and gas exploration and production that could potentially take place. The reason it gives for not doing so is that the specific details of these potential future activities are not known, and that they would need to be assessed in detail during subsequent scoping and EIA processes, should exploration drilling or production be proposed (BAR para 5.2 with heading "*The Need for Seismic Data*" on pp 33 – 34.)

211. I understand that, in terms of the EIA Regulations, seperate applications would need to be made for EA in respect of an offshore exploration right and for a

production right. At those stages, more specific details of the respective projects and their impacts would be assessed.

212. I shall set out below the reasons why it is possible to estimate the impacts related to production sufficiently for the purpose of considering the need and desirability of a seismic reconnaissance survey. The BAR should have done this, and its failure to do so gave rise to the fundamental inconsistency I have referred to.

213. The applicants' hold that it is artificial not to consider the potential positive and negative impacts of the production of oil and gas for the purposes of assessing need and desirability of reconnaissance to the extent that they can be considered at this stage. For this reason I shall set out relevant information in this regard, which provides a basis for such assessment, and which was not considered by the DG or the Minister.

214. Even if it were to be found that it is not feasible to estimate the impacts related to production sufficiently for the purpose of considering the need and desirability of a reconnaissance survey, and the negative impacts and risks of production should not be assessed, consistency would require that the benefits thereof should also not be considered for the purposes of need and desirability. The decisions of the decision-makers would accordingly still be irrational.

(b) The alternative of not proceeding with the activity

215. The BAR failed to conduct a proper assessment of the alternative of not implementing the activity and contained no information regarding the likelihood that the reconnaissance activities in this matter will disclose the presence of viable hydrocarbons in the sea bed.

216. Whether or not the reconnaissance activities in this matter will disclose the presence of viable petroleum in the sea bed is unknown. The BAR contains no information regarding the likelihood thereof. A possible result of the seismic survey is that there are no viable petroleum resources.

217. All the BAR says in this regard (in para 5.2 regarding the need for seismic data, on p 32.) is *"It cannot be said with absolute certainty that exploration drilling, let alone production activities, will be undertaken in the future."*

218. The question whether the cost of acquiring the seismic data, in the light of a proper understanding of need and desirability, exceeds the benefit of doing so was not considered in the BAR, and there is no indication that it was considered by the decision-makers either.

219. Section 24(4)(b)(i) of NEMA requires an EIA to investigate the potential consequences or impacts of the alternatives to the activity, including the option of not implementing the activity.

220. The summary of the positive and negative impacts and risks of the proposed activity and identified alternatives in Chapter 11 of the BAR does not contain

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any assessment whatsoever of the alternative of not implementing the activity, and the benefits thereof.

221. The BAR, in Chapter 9.3, on the description and assessment of impacts, at p 236, purported to investigate the alternative of not implementing the activity, but did so in a perfunctory manner with no risk assessment or proper investigation and assessment. All that the BAR says is the following:

> *"9.3.6 NO-GO ALTERNATIVE*
>
> *The no go alternative would imply that no survey activities are undertaken and, as such, the negative impacts as stated above, would not materialise. However, conversely, this will negate the potential positive impacts associated with the proposed survey activities, including:*
>
> - *The opportunity to identify potential oil and gas resources within the Application Area including potential future contribution to the economy of South Africa;*
> - *opportunity to conduct independent research on how fish species on the West Coast such as snoek respond to seismic surveying; and*
> - *Provision of job or training opportunities (very limited during the survey phase).*
>
> *Since there are no mitigation measures, the impact significance will be low pre- and post-mitigation and final significance will be the same."*

222. The option of not implementing the activity is mentioned nowhere in the impact matrix in Appendix 4 to the BAR, Annexure A8 hereto.

223. The assessment of the alternative of not proceeding should have taken into consideration the fact that other seismic surveys reconnaissance permits have been applied for and granted in respect of the same area, as reported in the BAR, and one survey has already commenced, as I shall detail in a further ground of review below. The reported need may be met by other means if the Project does not proceed.

224. The failure properly to assess and evaluate the option of not implementing the activity fundamentally skewed the BAR's analysis of need and desirability, and was also in breach of the EIA Regulations which require that alternative to be assessed.

(c) The impacts of production of natural gas

225. In this section I summarise considerations that the decision-makers should have considered in the EIA process but did not because they were not contained in the BAR, due to the flawed interpretation of need and desirability.

226. The exploitation of natural gas as a non-renewable resource falls under the overarching legislation for energy governance in South Africa, namely, the National Energy Act, 34 of 2008 ("the Energy Act"), whose objects include, "[illegible]

ensure that diverse energy resources are available in sustainable quantities and at affordable prices, to the South African economy in support of economic growth". (preamble)

227. Section 6 of the Energy Act mandates the Minister responsible for Energy to develop, review and publish an "integrated energy plan" for South Africa. In terms of section 6(e), the integrated energy plan must "take account of plans relating to transport, electricity, petroleum, water, trade, macro-economy energy infrastructure development, housing, air quality management, greenhouse gas mitigation within the energy sector and integrated development plans of local and provincial authorities."

228. The Electricity Regulation Act, No. 4 of 2006, establishes a national regulatory framework for the electricity supply industry and provides for matters related to electricity planning.

229. The types of new generating capacity that are brought online by the responsible organs of State is determined by the Minister responsible for Energy in terms of section 34 of the Electricity Regulation Act.

230. The integrated resource plan is a planning instrument provided for by the Electricity Regulation Act and the Electricity Regulations on New Generation Capacity, to guide such determinations and to direct how new generating capacity must be added to the electricity system.

231. The current iteration of the integrated resource plan is the Integrated Resource Plan 2019 ("the IRP 2019").

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232. I shall set out the relevant considerations related to the production of natural gas under the following headings: firstly, climate change law and policy; secondly, the broader context of the project; thirdly, the relationship between reconnaissance, exploration and production; and fourthly, a rational evaluation of "need and desirability".

Climate change law and policy

233. Petroleum projects that could take place in the Project area have the potential to generate significant quantities of greenhouse gases ("GHGs") over their lifetime. They accordingly implicate domestic law and policy relating to climate change. I will outline the relevant statutory and policy framework below. Before I do so, it is necessary to explain the global context in which it arises, in terms of both science and law.

234. The phenomenon of "climate change" is explained in the National Climate Change Response White Paper, 2011 as follows:

> *"... an ongoing trend of changes in the earth's general weather conditions as a result of an average rise in the temperature of the earth's surface often referred to as global warming. This rise in the average global temperature is due, primarily, to the increased concentration of gases known as greenhouse gases in the atmosphere that are emitted by human activities. These gases intensify a natural phenomenon called the "greenhouse effect" by forming an insulating layer in the atmosphere that reduces the amount of the sun's heat that radiates back into space and therefore has the effect of making the earth warmer... GHGs are*

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emitted from, and are reabsorbed by, a variety of natural sources, but the rate at which human economies and societies are emitting these gases far exceeds the capacity of natural ecosystems to reabsorb them. Increased industrial activity since the mid-18th century has led to a rapid increase in the atmospheric concentration of GHGs such as carbon dioxide, methane and nitrous oxide, in large part due to the burning of fossil fuels derived from oil, coal and natural gas." (pg 8)

235. Authoritative statements on climate change as a scientific phenomenon are produced periodically by the Intergovernmental Panel on Climate Change ("IPCC").

236. The IPCC is a body established by the United Nations to, among other things, produce reports on the latest scientific findings related to climate change. The work of the IPCC is performed by scientists nominated by 195 Member States. It produces a comprehensive evaluation of developments in climate science every five to seven years in the form of assessment reports.. It is currently in its seventh assessment cycle.

237. Based on the contents on the AR6 reports, it is reasonable to say that there is broad scientific consensus on the following essential positions:

237.1. The average global temperature of earth has already warmed by approximately 1.1°C above pre-industrial levels (the period before 1850) as a result of increased GHG emissions.

237.2. At a point between 1.5°C and 2°C warming, there is a risk that rising temperatures will activate what are referred to as "tipping points". A tipping point is a critical threshold beyond which the climate system will be irreversibly altered. The activation of multiple tipping points may lead to a feedback mechanism that sees global warming increase very rapidly. This is often referred to as "runaway climate change".

237.3. The expected consequences of runaway climate change would include significant sea-level rise, widespread species extinction, severe disruptions to agriculture, and large-scale displacement of human populations.

237.4. If warming is to be kept below 1.5°C, global GHG emissions need to reach net zero by around 2050.

238. Based on certain submissions made by TGS in its responding statement to the appeals, I have assumed that it agrees that action to mitigate climate change is necessary and that it will not place these issues in dispute in this application. I therefore will not adduce any material to substantiate these statements but reserve the right to do so should this become necessary.

239. Formal efforts by the global community to address concerns related to climate change in international law date back to the adoption of the United Nations Framework Convention on Climate Change ("UNFCCC") in 1992.

240. The object of the UNFCCC was to "stabilise greenhouse gas concentrations in

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the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". All 197 member states of the UN, including South Africa, are parties to the Convention.

241. The UNFCCC requires that an annual "conference of the parties" is convened. The most significant instrument adopted under the UNFCCC was negotiated and drafted at the 21st conference of the parties – the "Paris Agreement". It has been ratified by 194 states, including South Africa.

242. The Paris Agreement records that the parties will endeavour to "hold the increase in the global average temperature to well below 2°C above pre-industrial levels" and "[pursue] efforts to limit the temperature increase to 1.5°C above pre-industrial levels" (art. 2). It binds the parties "to undertake and communicate ambitious efforts" in this regard (art. 3).

243. To this end, each of the parties is required, among other things, to communicate a "nationally determined contribution" ("NDC") on a five yearly basis, recording the reduction in GHG emissions that it intends to achieve (art. 4(2)).

243.1. Each successive NDC must be "a progression beyond" its predecessor and reflect that State's "highest possible ambition" (art. 4(3)).

243.2. Each of the parties must strive to formulate and communicate long-term low GHG emission development strategies (art. 4(19)).

244. South Africa's domestic law and policy relating to climate change is directed toward ensuring that we make our fair contribution to the global effort to reduce

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GHG emissions in terms of the Paris Agreement.

245. South Africa's most recent NDC was submitted to the UNFCCC in 2021 ("the NDC 2021"). It undertakes that national emissions of CO_2-eq will peak between 2020 and 2025 in a range from 398 to 510 megatons (Mt) of CO_2-eq, and thereafter plateau and decline.

246. To place this commitment in context, the National Greenhouse Gas Inventory Report, published by the Department of Environmental Affairs in 2015, indicates that South Africa's total gross GHG emissions (excluding forestry and other land use) increased by 23% between 2000 and 2015, rising from 439 Mt CO_2-eq to 541 Mt CO_2-eq. Forestry is treated as a "CO_2 sink" and reduced gross emissions by 5% in 2015. Accounting for this effect, South Africa's net GHG emissions in 2015 were 512 Mt CO_2eq. A subsequent National Greenhouse Gas Inventory Report published in 2023 showed that net GHG emissions had declined to 442 million tonnes in 2020. (For clarity, I point out that CO_2-eq is a standard unit used to express the climate impact of a given greenhouse gas; this is necessary because some gases trap more heat in the atmosphere than others).

247. A strategy for achieving the targets recorded in the NDC 2021 has been laid out in South Africa's Low Emissions Development Strategy 2050 ("LEDS 2050").

248. The point of departure in LEDS 2050 is the following "vision statement":

> *"South Africa follows a low-carbon growth trajectory while making a fair contribution to the global effort to limit the average temperature increase,*

while ensuring a just transition and building of the country's resilience to climate change."

249. The strategy focuses on four key sectors, namely, (i) energy; (ii) industry; (iii) agriculture forestry and land use; and (iv) waste. The focus on the energy sector is clearly explicable on the basis that it is the largest contributor to GHG emissions in South Africa. As is observed in LEDS 2050, South Africa is one of the top 20 global emitters and has a high dependence on fossil fuels (pg 1), and the energy sector accounted for 79.5% of the total gross emissions for South Africa in 2015 (pg 12).

250. Broadly stated, the LEDS 2050 lays down sector specific interventions as well as "cross-cutting measures to support low-carbon development". The specific interventions for the energy sector are addressed in section 4.1. It is explained in the introduction to this section that:

"Energy supply is the mandate of the Department of Mineral Resources and Energy. Decarbonisation of energy supply will largely be driven through the Integrated Energy Plan, the Integrated Resource Plan and the Industrial Biofuels Strategy, issued by the Department of Energy, the predecessor of this Department."

251. The integrated energy plan and the integrated resource plan are thus considered the primary instruments for decarbonising the energy sector. This is clear from the following statements in the same section:

"The IEP update with a clear trajectory for the energy sector is critical to guiding overall energy planning for the country, including in the context of this document to support a just transition away from fossil fuels towards a low carbon future." (pg 22)

"The Integrated Resource Plan (IRP) guides the evolution of the South African electricity supply sector, in that it identifies the preferred electricity generation technologies to be built to meet projected electricity demand. It thus provides a mechanism for Government to drive the diversification of the country's electricity generation mix and promote the use of renewable energy and other low-carbon technologies." (pg 23)

"The 2019 IRP is based on the current articulation of the PPD trajectory. Future updates to the IRP will need to take into account any future modifications to the emissions trajectory. In this way electricity supply planning will be aligned with the country's increasing national ambition." (pg 26)

252. The following passage is of relevance:

"On the one hand, rapid implementation must begin in all areas where pathways to achieving the Paris Goals are already clear (such as investments in renewable energy power generation, solar water heaters, etc) while on the other, steps taken will need to enable future action at

scale, as much as (or perhaps more than) drive immediate emissions reductions."

253. The envisaged "cross-cutting measures" are dealt with in section 4.6 (from pg 38). The following four measures are identified:

253.1. a carbon tax;

253.2. sectoral emissions targets;

253.3. carbon budgets; and

253.4. phasing out of fossil fuel subsidies.

254. Of particular relevance for present purposes are measures 1 to 3. Taken together, these measures envisage a regime in which all commercial actors in South Africa, (including those like Total, Shell and Petro SA who own blocks in the project area), will be required to operate with limits upon the GHGs that they can freely emit and will, in addition, be subject to a tax on their emissions.

255. The statutory framework necessary to implement this regime is now in place in the form of the Carbon Tax Act, No. 15 of 2019, and the Climate Change Act, No. 22 of 2024. T

256. The Climate Change Act provides that the Minister must list categories of GHGs and activities that emit such GHGs (section 26). Listed emitters will be assigned a carbon budget in terms of section 27 of the Act. The carbon budgets so

assigned will correspond to the "sectoral emissions targets" determined in terms of section 25. Sectoral emissions targets will in turn be aligned to "the national greenhouse gas emissions trajectory" set in terms of section 24. The national greenhouse gas emissions trajectory is a greenhouse gas emissions reduction objective specified by the Minister in conformity with South Africa's international obligations and the principles and objectives of the Climate Change Act.

257. The Carbon Tax Act provides for a tax levied on GHG emissions and sets out the mechanisms for the calculation of this tax.

258. To illustrate the relevance of these considerations, I refer to the expert evidence of Mark New that will be filed together with this affidavit, which confirms that in the light of leading climate science there is international consensus that no new oil and gas fields should be developed if the world is to achieve the 1.5°C target set by the Paris agreement.

259. To summarize his findings,

259.1. Climate change is already having very significant negative impacts on people and ecosystems throughout the world, including in South Africa. The significance of the Paris Agreement target of 1.5°C above pre-industrial levels is that it reflects a global consensus that the level of risk to humanity becomes unacceptably high once that threshold is crossed

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259.2. Climate change is having, and will continue to have, disproportionately severe impacts on South Africa, and on poor and marginalised communities, women, children and future generations.

259.3. The IPCC states, "Risks and projected adverse impacts and related losses and damages from climate change will escalate with every increment of global warming (very high confidence). They are higher for global warming of 1.5°C than at present, and even higher at 2°C (high confidence).".

259.4. Based on a review of selected climate and energy scenarios by intergovernmental organizations, including the IPCC, International Renewable Energy Agency (IRENA), and the International Energy Agency (IEA), the International Institute for Sustainable Development (IISD) noted a consensus that no new oil and gas fields should be developed if the world is to achieve the 1.5°C target.

259.5. In order for there to be a 50% likelihood of limiting warming to 1.5°C, the Remaining Carbon Budget, set in 2022, is shrinking fast due to ongoing annual emissions, and the window of opportunity within which humanity can take measures to avoid overshooting the 1.5°C and 2.0°C thresholds for dangerous, and perhaps catastrophic, climate change, is closing fast..

259.6. Similarly, in 2021, the International Energy Agency declared that "there is no need for investment in new fossil fuel supply" in its scenario for achieving net zero emissions by 2050—a finding it reiterated again in 2023.

259.7. The likelihood of reaching a climate tipping point increases in the Paris agreement range of 1.5 to < 2°C warming. It is virtually certain that the world will overshoot 1.5 °C within the next few years and enter a zone of very significant risk.

259.8. Climate change is having, and will continue to have, disproportionately severe impacts on South Africa, and on poor and marginalised communities, women, children and future generations.

259.9. If a deep water gas field were to be developed, it is reasonable to assume it would not start producing gas until about 2035. Extremely steep reductions in emissions will be necessary well before this date to meet the goal of net-zero emissions by 2050, meaning that it is extremely unlikely that the field could operate and be consistent with South Africa's 2050 net-zero commitment.

259.10. The magnitude of natural gas production on GHG warming depends strongly on the level of fugitive emissions (gas that escape into the atmosphere during production and transport and is therefore not burnt for energy production). In many cases, the net GHG effect of natural

gas use is greater than that of oil or coal, because of these fugitive emissions.

259.11. The argument that natural gas is a lower impact "transition fuel" that should be exploited in place of oil and gas is untrue in most gas production cases to date.

260. A further consideration, as discussed below, is that South Africa is particularly vulnerable to the adverse effects of climate change at present levels of warming - warming above 1.5°C could be devastating for South Africa.

261. To summarize, climate change law and policy considerations that are relevant to need and desirability and that should have been reported on and assessed in the BAR are that:

261.1. natural gas production in the Project area has the potential to generate significant quantities of GHGs;

261.2. this would have significant implications for global warming, climate change and South Africa's international commitments in terms under the Paris agreement; and

261.3. no new oil and gas fields should be developed if the world is to achieve the 1.5°C target set by the Paris accord.

The broader context of the project

262. The extent of the exploration and production activity in South Africa's exclusive economic zone (EEZ) is relevant in so far as it has a bearing on the question of need and desirability and cumulative impact, as will shortly become clear.

263. I attach hereto as Annexure A15, a hub map provided by the Petroleum Agency of South Africa ("PASA") showing these operations. As can be seen from this image, a large amount of the ocean acreage comprising South Africa's exclusive economic zone is subject to an exploration right.

264. Although there is very little publicly available information about the magnitude of the oil and/or gas reserves thought to be located in this area, the Phakisa report gives some indication.

265. Operation Phakisa was an initiative of the Presidency. Its purpose is explained on the dedicated Operation Phakisa website (www.operationphakisa.gov.za) as being to *"fast track the implementation of development solutions on critical development issues."* Phakisa literally means "hurry up" in Sesotho. According to the website, the "methodology" for the process was the following:

> *"The methodology consists of eight sequential steps. It focusses on bringing key stakeholders from the public and private sectors, academia*

as well as civil society organisations together to collaborate in detailed problem analysis, priority setting, intervention planning and delivery. These collaboration sessions are called laboratories (labs). The results of the labs are detailed (3 foot) plans with ambitious targets as well as public commitment on the implementation of the plans by all stakeholders."

266. One such lab was designated "Offshore Oil and Gas exploration". I will refer to it simply as "the lab".

267. The Presidency has released a report recording the outcomes of the lab entitled "*Unlocking the economic potential of South Africa's oceans*" ("the Phakisa report"). A copy of the Phakisa report is attached marked Annexure "A16".

268. As appears from page 1 of the Phakisa report, the theoretical target that this lab sought to "unlock" was 30 exploration wells in ten years. The following statement appears at page 10 of the report:

> "*South Africa has possible in-place resources of ~9 bn barrels of oil and ~60 Tcf of gas offshore, but uncertainty is high.*"

269. It is clear from the Phakisa report that reconnaissance activities are an inseparable part of a broader strategy to produce oil and gas.

The relationship between reconnaissance, exploration and production

270. The relationship between the reconnaissance, exploration and production phases of a petroleum project is relevant because the EAP and the decision-makers declined to engage with any material or concerns related to exploration and production on the project area on the basis that reconnaissance, exploration and production are separate and unrelated activities.

271. While it is so that a distinct environmental authorisation is required for the activities related to a reconnaissance permit, an exploration right and a production right, these phases are not separate and unrelated undertakings, as I have explained above.

272. While the discussion of the need for the Project in the BAR (at pg 33) mentions that natural gas serves as a transition fuel on the path to the carbon-neutral goal and assist in reducing carbon emissions from coal for electricity generation, and that South Africa does not currently have enough gas resources, it states that from a climate change perspective it is "not currently possible to accurately assess" the risks associated with oil and gas activities.

273. In doing so, the BAR implies that the assessment of the negative impacts and

risks associated with oil and gas activities is a relevant consideration. However, it declines to assess the negative impacts and risks on the grounds of impossibility by focussing on the need for accuracy with regard to the precise details of production.

274. On the basis of alleged impossibility, the BAR concludes, illogically, that exploration and production activities are separate and unrelated to reconnaissance.

275. I shall show below that a rational evaluation of "need and desirability" is indeed possible.

276. The decision-makers uncritically accepted the BAR's conclusion that reconnaissance activities are unrelated to exploration and production.

277. The DG's conclusion as to need and desirability was expressed in a single paragraph 3.4 of the Reasons for Decision:

> *"The motivation for the need and desirability of the proposed 3D seismic survey activity is in line with the requirements of the EIA Regulations, 2014 and addresses key issues in the Need and Desirability Guideline."*

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278. The Minister's evaluation of need and desirability is given at paragraphs 2.21.2 to 2.21.4 of her appeal decision:

> *"2.21.2. I note that some of the concerns raised by the Appellants extend beyond the proposed project activity in respect of which the EA was granted. I confirm that any activity beyond the EA will be subject to a separate application and a separate assessment process. Accordingly, it is not relevant and therefore not necessary to consider submissions in respect of activities that fall outside the EA for the purposes of this appeal.*
>
> *2.21.3. I have considered the needs and desirability of the Project. The BAR on page 21-33 thereof addresses the needs and desirability of the Project and further covers the context of the oil and gas industry, applicable policies and planning frameworks (local, national, and international) and broadly societal needs and public interest. I note that the Project is in alignment with government policies and plans such as the Integrated Resources Plan 2019 (IRP) which recognises the need for South Africa to employ a diversified energy mix to meet the country's electricity requirements. I have furthermore considered the Guideline on Need and Desirability as well as the No- Go alternative which is also addressed on page 36 of the final BAR.*
>
> *2.21.4. I am therefore satisfied that the criteria for the need and*

desirability for the Project has been demonstrated by the Applicant, in particular that the Project accords with legislative requirements and government policies and plans, including the IRP, the National Development Plan (NDP) and the draft Marine Spatial Planning Sector Plans which includes a Marine Offshore Oil and Gas Sector Plan (the Draft MS Plan). The IRP and the Integrated Energy Plan (IEP) recognise natural gas as a required source to produce electricity and direct thermal energy. Its role to contribute to maintaining base-load electricity and peak-load electricity is acknowledged, and it is also recognised as a way to transition South Africa towards a lower carbon economy providing the flexibility required to complement renewable energy sources and as a lower carbon option compared to coal." (The relevance of the parts I have emphasised will become clear shortly.)

A rational evaluation of "need and desirability"

279. It is clear from the treatment of "need and desirability" in both the BAR and the decisions, in particular the appeal decision, that the "desirability" of acquiring a reconnaissance permit, and any subsequent exploring and producing petroleum in the project area, is considered to relate primarily to the prospect that gas will be found and produced. The reason for this appears to be that gas is considered to be a "transition fuel" that will aid in transitioning the energy system, specifically the electricity system, away from a coal and therefore help to reduce GHG emissions.

280. This being the case, the EIA should have been approached on the basis that the ultimate purpose of the reconnaissance activities was production of gas. Had this occurred the EAP and the decision-makers would have found it necessary to consider the specifics of the proposal to address South Africa's gas utilisation by means of gas extracted offshore.

281. Had they done so, they would have brought to light the considerations referred to above, including those contained in the expert evidence of Mark New in his affidavit.

282. Also relevant are the key findings in the article by New and Meckle dated October 2024 attached to Mark New's affidavit, which include the following:

282.1. Information on GHG emissions from exploitation of future, yet to discovered, oil and gas reserves in South Africa can (and should) be used in support of development of the country's Nationally Determined Contribution for reducing greenhouse gas emissions, as required by the Paris Agreement of the UNFCCC.

282.2. Estimation of yet to be discovered, commercially viable, oil and gas reserves for South Africa are possible, using well established methodologies. These estimates carry large uncertainties, but can usefully be applied to determine likely upper and lower limits for these resources.

282.3. Well established emission factors, which determine the CO_2-equivalent greenhouse gas emissions from use of oil and gas for different purposes, can be used to calculate the emissions that would be emitted from exploitation and use of yet to be discovered oil and gas reserves.

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283. In addition, the assumption of the desirability of the production of gas in the BAR failed to take into account potential negative social and economic considerations. In this regard I refer to the expert affidavit of Gillian Hamilton, which will be filed together with this affidavit. In her affidavit, Hamilton summarizes her opinion as follows:

283.1. The disparity between the narratives of African leaders and the realities faced by communities in sacrifice zones (a sacrifice zone refers to a geographic area that has been permanently impaired by environmental damage or economic disinvestment) illustrates a fundamental misunderstanding of the adverse effects fossil fuel investments can have on local economies.

283.2. Research shows that establishing an offshore oil and gas industry within South Africa is unlikely to yield significant economic benefits. Instead, it may exacerbate existing challenges. Past experiences across Sub-Saharan Africa indicate that actual benefits often fall short of forecasts.

283.3. With an accelerated global energy transition through increased shifts towards renewable energy and increasing climate mitigation commitments, the risks associated with oil and gas developments are profound. The financial, environmental, and social repercussions may well outweigh any anticipated economic gains in the form of increased levels of sovereign debt or lower credit ratings.

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283.4. It is imperative for South Africa to adopt a sustainable and renewable energy-focused economic approach, acknowledging the importance of protecting the socio-economic well-being of its citizens and environment.

284. All of these relevant factors would have had to be considered in determining whether a gas-predominant energy sector is desirable, and weighted against the ecological impact of the project.

285. I do not suggest that the assessment should have been exhaustive of all exploration and production phase impacts, obviously specific impacts would be determined by reference to the precise form and location of any exploration and production operations ultimately established. These matters are appropriately postponed to the later process to obtain EA for exploration and production activities. Rather, my contention is that the general ecological impact associated with exploration and production activities should have been assessed during this EIA process.

286. Importantly, this assessment would have included the cumulative ecological impact of such exploration and production activities, taken together with other reconnaissance, exploration and production activities that are proposed across South Africa's exclusive economic zone, as required by item 3(3)(j) of appendix 3 to the EIA Regulations.

287. While a general assessment of the impacts of exploration and production still leaves gaps in knowledge, it would be sufficient for the purposes of a consistent assessment of need and desirability.

288. All of the above considerations were omitted from the assessment in the BAR.

Part of the Project area already surveyed

289. A part of the Project area was surveyed by Searcher Geodata UK Limited "Searcher" in the first part of 2024, reducing the need to survey the whole Project area.

290. The relevant information I have access to in this regard is that:

290.1. Searcher conducted, but was unable to complete, a 3D seismic survey in 2024 for the area of 7863 km² represented on the map annexed and marked **A17**.

290.2. the area in A17 falls wholly within the Project area, as can be seen from the map showing that area overlaid on a map of the Project area, annexure **A18**.

290.3. The Searcher survey received an EA on 20 December 2022 (ref: 12/1/043) which was appealed against. I attach marked **A19** an extract from the EA.

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290.4. The appeals against the Searcher survey EA were dismissed on 23 September 2023 by the Minister, nine months before the Minister's decision in this matter. I attach marked **A20** an extract from the appeal decision.

290.5. The Searcher survey was commenced between January and April 2024 but was not fully completed and Searcher has applied for a new permit to complete it for the same activity over the same area. This has been disclosed in information sent to IAPs.

291. I do not know how much of the area was surveyed in the uncompleted seismic survey process by Searcher.

292. I do not anticipate that the above facts will be disputed since they appear in documents in the public domain, but I reserve the right to introduce them should that become necessary.

293. It stands to reason that the need for data in respect of the Project area no longer exists to the extent that such data has already been obtained by seismic survey.

294. It also calls into question the need for authorising multiple seismic survey activities for the same area, which is implicit in the assumption in the BAR that there may be three surveys, Searcher, TGS and GX Technologies occurring in

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the same survey window period. (BAR pg 211.) The need for multiple surveys in the same area is not explained in the BAR or by the decision-makers.

295. The Minister failed to consider this information or cause it to be integrated into the assessment of need and desirability in the BAR.

Conclusion on need and desirability

296. In the light of "need and desirability" properly construed, there were critical failures in the BAR and by the decision-makers to assess need and desirability rationally and to consider all relevant considerations, in that:

296.1. The approach adopted was fundamentally inconsistent and irrational;

296.2. A consistent approach requires that either both the costs and benefits of the production of natural gas be taken into consideration, or that such production should not be taken into consideration;

296.3. The negative impacts of production of natural gas outweigh the benefits thereof when one considers the relevant climate change law and policy, the broader context of the project, the relationship between reconnaissance, exploration and production, and a rational evaluation of "need and desirability";

296.4. The alternative of not proceeding with the Project was not properly

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assessed; and

296.5. The Minister failed to take into consideration that part of the Project area had already been surveyed when she took her decision.

297. The third ground of review is that the BAR failed to conduct a rational assessment of need and desirability in that the BAR:

297.1. considered only the potential positive impacts of the production of oil and gas for the purposes of determining need and desirability and not the potential negative impacts thereof, which was inconsistent and irrational, in breach of sections 2(b) and 3(1)(f) of Appendix 1 to the EIA Regulations read with Regulation 18 thereof;

297.2. failed to conduct a proper assessment of the option of not implementing the activity, in breach of section 24(4)(b)(i) of NEMA read with the EIA Regulations; and

297.3. failed to conduct an assessment of the potential social, economic and environmental impacts of the exploration and production of oil and gas, in breach of 24(4)(b)(i) of NEMA read with the EIA Regulations,

with the result that the EA and the Minister's decision to uphold it are reviewable on one or more of the following PAJA review grounds:

297.3.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as

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contemplated in section 6(2)(b) of PAJA;

297.3.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

297.3.3. the action was procedurally unfair, as contemplated in section 6(2)(c) of PAJA;

297.3.4. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

297.3.5. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

298. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

Fourth Ground of Review – Risks not assessed

299. The fourth ground of review is that conditions of authorisation in the EA required the submission of further plans by the developer to the Competent Authority for approval without the impacts, risks and mitigation measures related thereto

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having been identified, reported on or assessed on the BAR or included in the EMPr, or such plans having been subjected to public participation in the EIA process.

300. The EA, in paragraphs 5.5.6 and 5.5.7 on p 11, imposes two conditions of approval requiring the holder to submit two further plans for approval as follows:

> *"5.5.6 The holder must submit a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with MARPOL 73/78 Annex I and the National Oil Spill Contingency Plan (NOSCP).*
>
> *5.5.7 In addition to SOPEP, Emergency Response and Medical Evacuation Plan must be submitted. The said plans must take into consideration all resources that may be required in case of an oil spill incident or any emergency incident. The plans must be submitted to the Petroleum Agency SA (hereafter referred to as the 'Agency') thirty (30) days before the mobilisation of the seismic survey vessel."*

301. The need for these conditions of approval indicates that the DG formed the view that the authorised activity carries risks of an oil spill emergency or other emergency incident, some of which could require emergency evacuation.

302. Section 3(1)(h) of Appendix 1 to the EIA regulations requires a BAR to include, among others, a description of the impacts and risks identified and how they can be managed, avoided or mitigated.

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303. The BAR failed to identify and include in the description of impacts and risks, the risks of an oil spill emergency or other emergency incident, some of which could require emergency evacuation, and did not propose the mitigations contained in the aforementioned paragraphs 5.5.6 and 5.5.7 of the EA. This constituted a breach of section 3(1)(h) of Appendix 1 to the EIA regulations.

304. Section 1(1)(d) of Appendix 4 to the EIA regulations requires an EMPr to include, among others *"a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided managed and mitigated as identified through the EIA process."*

305. The EMPr did not include the mitigation and management measures contained in the aforementioned paragraphs 5.5.6 and 5.5.7 of the EA. This constituted a breach of section 1(1)(d) of Appendix 4 to the EIA regulations, which requires the EMPr to describe the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development. This constituted a breach of section 1(1)(d) of Appendix 4 to the EIA regulations.

306. No public participation was conducted in respect of the aforementioned risks of an oil spill emergency or other emergency incident, some of which could require emergency evacuation, or with a Shipboard Oil Pollution Emergency Plan or the Emergency Response and Medical Evacuation Plan contemplated in

paragraphs 5.5.6 and 5.5.7 respectively of the EA. This constituted a breach of Regulations 40 and 41 of the EIA Regulations read with section 2 of NEMA and the rights of IAPs in respect of *audi alteram partem*.

307. The fourth ground of review is that conditions of authorisation in the EA required the submission of further plans to the Competent Authority for approval without any public participation in regard thereto, in breach of section 3(1)(h) of Appendix 1 and section 1(1)(d) of Appendix 4 to the EIA regulations, Regulations 40 and 41 to the EIA regulations, and of the rights of IAPs in respect of *audi alteram partem*, with the result that the EA and the appeal decisions are reviewable on one or more of the following PAJA review grounds:

307.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

307.2. the action was procedurally unfair, as contemplated in section 6(2)(c) of PAJA;

307.3. the EA and appeal decision contravened a law and were not authorised by the empowering provision (section 6(2)(f)(i) of PAJA); and

307.4. the EA and the Minister's decision are not rationally connected to the purpose of the empowering provision, as contemplated in section

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6(2)(f)(ii)(bb) of PAJA.

308. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

Fifth Ground of Review – The ICMA

309. The fifth ground of review is that the BAR failed, with respect to the Integrated Coastal Management Act, No. 24 of 2008 ("the ICMA"), to determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context, or to contain the information that is necessary for the Competent Authority to consider and come to a decision on the application.

310. The ICMA falls within the definition of "*specific environmental management Act*" in section 1 of NEMA. Section 24(4)(b)(vii) of NEMA requires EIA procedures to include "*provision for the adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question*".

311. The objectives of the BAR process include, in terms of section 2(1)(a) of Appendix 1 to the EIA Regulations, to

"*determine the policy and legislative context within which the proposed*

activity is located and how the activity complies with and responds to the policy and legislative context;"

312. Section 3(1) of Appendix 1 requires a BAR to contain the information that is necessary for the Competent Authority to consider and come to a decision on the application.

313. Certain provisions of the ICMA are specifically relevant to decisions regarding EAs, and therefore form part of the applicable legal context. As such, the BAR was required to determine how the Project responds to the relevant provisions of the ICMA.

314. The ICMA regulates environmental authorisations for "coastal activities" and applies to South Africa's territorial waters and the Exclusive Economic Zone (EEZ).

315. Section 63(1) thereof requires a Competent Authority to take account of specific factors when deciding whether or not to grant an Environmental Authorisation for "coastal activities".

316. The Project is to take place in South Africa's EEZ. Therefore, it falls within the coastal zone and is a coastal activity regulated by the ICMA. As such, the decisions under review were obliged to take into account the factors listed in section 63 of the ICMA, in addition to the requirements of NEMA and the EIA Regulations. These factors include:

316.1. whether coastal public property will be affected by the activity and, if so, the extent to which the proposed development or activity is consistent with the purpose of establishing and protecting these areas; (Section 63(1)(c))

316.2. if the activity affects coastal public property, whether it is inconsistent with the objective of conserving and enhancing coastal public property for the benefit of current and future generations; (Section 63(1)(h)(i))

316.3. whether the activity would be contrary to "the interests of the whole community"; (Section 63(1)(h)(vii)) and

316.4. the objects of the ICMA. (Section 63(1)(k))

317. Broadly, the above provisions require the Competent Authority to give specific consideration to the compatibility of a proposed activity with the framework of principles and objectives established by the ICMA.

318. The following provisions of the ICMA are of particular relevance:

318.1. Coastal public property is vested in the citizens of the Republic and is held in trust and managed on their behalf by the State. (Section 11)

318.2. In performing this function, the State is under a duty to ensure that

coastal public property is managed, conserved and enhanced in "the interests of the community as a whole and to take whatever reasonable legislative and other measures it considers necessary to conserve and protect coastal public property for the benefit of present and future generations. (Section 12)

319. The ICMA is explicit in addressing how the public interest must be construed for purposes of the Act. The term "the interests of the community as a whole" is defined in section 1 to mean:

> *"the collective interests of the community determined by-*
>
> *(a) prioritising the collective interests in coastal public property of all persons living in the Republic over the interests of a particular group or sector of society;*
>
> *(b) adopting a long-term perspective that takes into account the interests of future generations in inheriting coastal public property and a coastal environment characterised by healthy and productive ecosystems and economic activities that are ecologically and socially sustainable; and*
>
> *(c) taking into account the interests of other living organisms that are dependent on the coastal environment".*

320. Thus, the ICMA seeks to ensure the protection of coastal resources and the coastal environment as a public good and to this end: first, gives particular prominence to the collective public interest and the interests of other living organisms that are dependent on the coastal environment, and second,

imposes specific duties on the State.

321. In order to comply with section 63 of the ICMA, the BAR would, at minimum, have had to consider –

321.1. whether the proposed project would affect coastal public property;

321.2. whether the proposed project is consistent with the objective of conserving, protecting and enhancing coastal public property for the benefit of current and future generations;

321.3. whether the proposed project would substantially prejudice any coastal management objective;

321.4. whether the proposed project is socially and economically justifiable and ecologically sustainable and consistent with section 24 of the Constitution regarding the interests of future generations in inheriting coastal public property and a coastal environment characterised by healthy and productive ecosystems and economic activities that are ecologically and socially sustainable;

321.5. whether the proposed project is in the interests of other living organisms that are dependent on the coastal environment;

321.6. whether granting an environmental authorisation for the proposed project is consistent with the duties of the decision-maker to conserve and protect coastal public property for the benefit of present and future generations and to ensure that it is used, managed, protected, conserved and enhanced in the interests of the whole community.

322. The BAR did none of this. Its only reference to the ICMA was its inclusion, in Table 5 on page 16, in a list of additional legislation that may be applicable. Next to the name of the ICMA, the BAR states the following:

> *"This Act supports the authorisation requirements of NEMA but specifies additional criteria for regulating activities or developments (Section 63) and provides for pollution control within the coastal zone (Sections 69 to 73), where the coastal zone includes the Exclusive Economic Zone defined in the Maritime Zone Act."*

323. Section 12 of the ICMA provides that the State, in its capacity as the public trustee of all coastal public property, must ensure that coastal public property is used, managed, protected, conserved and enhanced in the interests of the whole community.

324. The BAR fails to mention the requirements of section 12 or section 63, makes no mention of coastal public property, or the state being the public trustee thereof, or the objects, criteria and other considerations I have mentioned above.

325. The fifth ground of review is that the BAR failed, with respect to the ICMA, to determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context, or to contain the information that is necessary for the Competent Authority to consider and come to a decision on the application, as contemplated in sections 2(1)(a) and 3(1) of Appendix 1 of the EIA Regulations, read with sections 12 and 63 of the ICMA. The EA and the Minister's decision to uphold it are accordingly reviewable on one or more of the following PAJA review grounds:

325.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA; and

325.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

326. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

Sixth Ground of Review – Defective EMPr

327. The sixth ground of review is that the environmental management programme

("EMPr") is materially deficient and fails adequately to set out impacts and risks that need to be avoided, managed and mitigated, or to provide an identification of the manner in which the impact management outcomes will be achieved; the method of monitoring the implementation of the impact management actions; and the mechanism for monitoring compliance with the impact management actions.

328. This ground of review illustrates the scant regard that was had to the social impacts on the community when it comes to redressing them in any meaningful way.

329. The EMPr, Annexure A9, was approved in para 5.4.1 of the EA, attached as A2 hereto.

330. In terms of section 1(1) of Appendix 4 to the EIA Regulations, the EMPr must include, *inter alia*:

> *(d) a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including—*
>
> *(i) planning and design;*
>
> *(ii) preconstruction activities;*
>
> *(iii) construction activities;*

(iv) rehabilitation of the environment after construction and in the case of a closure activity, closure; and

(v) where relevant, operation activities;

(e) . . . . . .

"(f) a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, ...

(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);

(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);

(i) an indication of the persons who will be responsible for the implementation of the impact management actions;

(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;

(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f); . . ."

331. While the EMPr included mitigation measures recommended in the SIA in paragraph 13.7 of Table 5 of the EMPr, attached hereto as Annexure A21, it failed to comply with paragraphs (f), (g) and (k) of section 1(1) of Appendix 4 to the EIA Regulations.

332. Table 5 fails to comply with section 1(1) of Appendix 4 in material respects in that it omits certain critical requirements.

333. The EMPr in Table 5 avoids using terms used in Appendix 4 to the EIA Regulations, such as "risks that need to be avoided, managed and mitigated" in (d), "impact management outcomes" in (f), "impact management actions" in (f) – (k), and "the mechanism for monitoring compliance" in (k). Instead it uses vague terms such as "technical or management option", "target" and "performance indicators (monitoring tool)", making it difficult to identify which subparagraph of the regulation it purports to comply with.

334. As a result, regardless of the terminology, key elements are missing from Table 5. For example, in para 13.7 of the EMPr on pp 29 and 30, (Annexure A9 hereto), mitigation measures recommended by the SIA, (mentioned above in the second ground of review), are repeated in the first column, under the heading "Technical or Management Option". One of these, D, reads as follows:

> *"A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with readjusting the relationship between TGS and the traditional communities It will also cause significant delays in the application process. Given the current socio-political conditions in the coastal communities following prescribed legal processes is not sufficient to be seen as meaningful consultation from a community perspective."*

335. One would expect to find opposite this in Table 5, the impacts and risks that need to be avoided, managed and mitigated in order to achieve this management outcome, as required by section 1(d) of Appendix 4 to the EIA Regulations. In numerous instances these are omitted, rendering it impossible to determine the appropriate mitigation and management objective.

336. I point out, in the example quoted above, that the following words contained in the SIA recommended mitigation are omitted from the EMPr: "*This is an explicit request from community members and failing to do so will increase the reputational risk for TGS and weakens their social licence to operate further. It will also cause significant delays in the application process.*" These words describe the impacts and risks that need to be avoided, managed and mitigated, but the words do not appear in the EMPr.

337. Other similar examples relate to other mitigation measures recommended by the SIA in para 13.7 A to E of the EMPr on pp 29 and 30 (Appendix A20), where the EMPr fails to provide, or distinguish between, the specific impact management outcomes, impact management actions, and the mechanism for monitoring compliance in respect of the impacts and risks that need to be avoided, managed and mitigated required by Appendix 4. I summarise them as follows:

337.1. In paragraph A, the EMPr indicates that TGS is required to consult with the communities to develop a community engagement protocol that is based on the San Code of Research Ethics, including a communication

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strategy and grievance mechanism.

337.2. In paragraph B, the EMPr indicates that TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast respond to seismic surveys on the marine ecosystem.

337.3. In paragraph C, the EMPr states that TGS should consult with communities on potential ways in which to make a positive contribution to the communities and investigate opportunities for the employment of people from local communities and skills development.

337.4. In paragraph D, the EMPr indicates that a representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future.

337.5. Also in paragraph D, the EMPr indicates that TGS should initiate discussions in their industry, which should reassess its position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign.

337.6. In paragraph E, the EMPr states that TGS should approach the authorities and enter into conversation regarding a strategic impact assessment for the area that should be contributed to by all the

production/ exploration companies involved.

338. One would expect to find in Table 1 of the EMPr, if there was any serious intention to attain the objectives of the recommendations regarding mitigation made in the SIA, an identification of the manner in which the impact management outcomes will be achieved, the method of monitoring the implementation of the impact management actions, and the mechanism for monitoring compliance with the impact management actions.

339. What one finds instead is simply, under 'Target': *"ensure that socio-economic considerations are considered and implemented where necessary"*, and under "Performance Indicators (Monitoring Tool)": *"Consultation register and workshops (ECO Monthly audit)"* or words to that effect.

340. I have discussed elsewhere in this affidavit why these mitigation measures were imposed and the dire social conditions they were intended to mitigate as a precondition for the seismic survey. The scant attention they receive in the EMPr is a slap in the face for the communities concerned and is unlikely to engender the trust necessary in order to facilitate genuine consultation.

341. As a result, the EMPr fails to comply with sections 1(1)(f), (g) and (k) of Appendix 4 to the EIA Regulations.

342. The sixth ground of review is that the EMPr is materially deficient and fails adequately to set out the impacts and risks that need to be avoided, managed

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and mitigated, or to provide an identification of the manner in which the impact management outcomes will be achieved, the method of monitoring the implementation of the impact management actions, and the mechanism for monitoring compliance with the impact management actions, as required by sections 1(1)(f), (g) and (k) of Appendix 4 to the EIA Regulations, which constitutes a breach of Regulation 19(4) of the EIA Regulations read with s 24N(2) of NEMA. As a result, the EA and the Minister's decision to uphold it are reviewable on one or more of the following PAJA review grounds:

342.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

342.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

342.3. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

342.4. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

343. Alternatively, the EA and appeal decision are reviewable in terms of the

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constitutional principle of legality.

Seventh Ground of Review – No Locality Plan

344. The seventh ground of review is that the EA failed to contain a plan which locates the proposed activity or activities authorised at an appropriate scale as required by the EIA Regulations.

345. Regulation 25 provides for the issue of an EA. Regulation 26 stipulates what an EA must contain, and Regulation 26(c) states that the EA must specify, among others,

> *"a description of the location of the activity, including- ...*
>
> *(iv) a plan which locates the proposed activity or activities authorised at an appropriate scale, or, if it is - ...*
>
> *(aa) a linear activity, a description and coordinates of the approved corridor of the activity or activities; ..."*

346. The EA, in Table 1 on p 8 of A2, authorised an area for the seismic survey represented by nine GPS coordinates but did not contain any plan which locates the proposed activity or activities authorised at an appropriate scale.

347. By way of contrast, the EA for the Searcher survey referred to above, does contain such a plan, as can be seen from annexure A19.

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348. The seismic blasting reconnaissance activity is not a linear activity and therefore the exception to regulation 26(c) does not apply. The EIA Regulations define a "linear activity" as meaning "*an activity that is arranged in or extending along one or more properties and which affects the environment or any aspect of the environment along the course of the activity, and includes railways, roads, canals, channels funiculars pipelines, conveyor belts, cableways, power lines, fences, runways, aircraft landing strips, firebreaks and telecommunication lines*".

349. In any event, the coordinates of the Project area in the locality plan in the BAR, which appear in the locality plan in Figure 1 of the BAR (on pg 9 of A4), and which is the plan that was used by the specialists, are represented by 15 GPS coordinates, none of which are the same as the coordinates of the authorised area.

350. The nine co-ordinates in the EA appear to be taken from pg 1 of the BAR, which describes them as "the Application Area corner coordinate points". However, they are not the same as the coordinates in the locality plan in Figure 1 of the BAR. They are also not all corner coordinates.

351. While eight of the nine coordinates are relatively near to the coordinates in Figure 1, one is materially different, as can be seen from annexure A22, which is a copy of a Google Earth map on which the polygon represented by the approved nine coordinates (in red) is superimposed on the polygon

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representing the fifteen coordinates in Figure 1 (in blue). As can be seen, a large triangle of area on the northern side depicts the difference between the approved area and the area in Figure 1.

352. The seventh ground of review is that the EA failed to contain a plan which locates the proposed activity or activities authorised at an appropriate scale, in breach of Regulation 26(c) of the EIA Regulations, with the result that the EA and the Minister's decision to uphold it are reviewable on one or more of the following PAJA review grounds:

352.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

352.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

352.3. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

352.4. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

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353. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

The eighth ground of review - Cumulative impacts

354. The eighth ground of review is that the BAR failed adequately to assess the cumulative impacts and risks of seismic blasting.

355. Section 2(d) of Appendix 1 to the EIA Regulations states that the objective of the BA process includes the undertaking of an impact and risk assessment process, inclusive of cumulative impacts, to determine the nature, significance, consequence, extent, duration and probability of the impacts occurring.

356. Section 3(1)(j)(i) of Appendix 1 to the EIA Regulations requires a BA report to contain an assessment of each identified potentially significant impact and risk, including cumulative impacts, and, in section 3(1)(o), a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed.

357. For ease of reference, I set out below the definition of a cumulative impact, as described in the EIA Regulations:

> *"cumulative impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered*

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together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities;

358. In particular, I note that cumulative impacts associated with both similar and diverse activities are required to be considered.

359. In addition, I shall briefly summarise the cumulative impacts related to the following:

359.1. other seismic surveys in or near the project area;

359.2. other exploration and production projects in or near the project area; and

359.3. cumulative climate impacts from exploitation of oil and gas resources.

Cumulative impacts of other seismic surveys

360. The BAR considers cumulative impacts in section 9.3.1.4 (page 209ff). It considers the possibility of up to three seismic surveys happening over the same area in the same seismic window, but does not consider the potential impacts of other oil and gas development activities in or near the project area.

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361. The second and third applicants submitted comments regarding cumulative impacts and made submissions in that regard in their appeal. These included:

361.1. the confounding and cumulative effects of seismic blasting with other stressors such as temperature, competition for food, and shipping noise;

361.2. effects on whole populations, not just individuals; and

361.3. the use of a 40 km buffer when simultaneous surveys occur – which is a mitigation in the EMPr but has been discredited in the USA.

Cumulative impacts of other exploration and production projects

362. The Project covers a number of petroleum licence blocks. The BAR (at page 8) describes that the following licence blocks are covered by the application area:

362.1. 12/3/274 ER;

362.2. 12/3/343 ER;

362.3. 12/3/339 ER; and

362.4. 12/3/248 ER.

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363. On page 10 of the BAR, Figure 2 indicates that the seismic area covers "OK Energy (ER) Norther Cape Ultra Deep", "TotalEnergies ER Various blocks" and "Africa Oil Corp (ER) Block 3B/4B". Of these blocks:

363.1. Shell Offshore Upstream South Africa B.V., as the operator, and its Joint Venture partners (Qatar Energy Umbono and OK Energy Limited) now jointly hold an exploration right for Licence Block Northern Cape Ultra Deep. At the time of signing this affidavit, a draft Environmental and Social Impact Assessment Report was made available for public comment on 11 November 2024, in terms of which it is planned to drill up to five exploration and/or appraisal wells and to conduct geophysical surveys.

363.2. The TotalEnergies blocks cover the Deep Water Orange Basin project. TotalEnergies EP South Africa B.V. was granted environmental authorisation on 23 October 2023 for the drilling of up to ten exploration wells. The EA sets out that the drilling is planned to commence between the first quarter of 2024 and fourth quarter of 2024. The Minister subsequently confirmed the EA in her appeal decision of 24 April 2024, and it is unknown at this stage when these drilling operations will commence. However, it is conceivable that these operations may overlap with the seismic operations of TGS or Searcher.

363.3. Africa Oil SA Corp, Ricocure (Pty) Limited and Azinam Limited were

granted environmental authorisation for exploration drilling of up to five exploration wells in Block 3B/4B on 16 September 2024. Appeals against that decision, including an appeal by the applicants, are currently before the Minister. Whilst I do not know when the exploration right was granted to the holders, the Scoping Report for this project indicates that the joint venture partners submitted an application to renew the Exploration Right, which was approved as the First Renewal Period for a two year term from 27 October 2022 to 26 October 2024. I do not know whether a third and final renewal of two years has been granted.

364. Given the existing rights that are held for these licence blocks, and the applications for environmental authorisation that were submitted to the Department of Mineral Resources and Energy, the proposed activities were within the knowledge of both the decision-makers at the time that they took their decisions.

365. **Despite the overlap of the licence blocks with the project area, and that the intentions for these blocks were known at the time that the EA was granted and confirmed on appeal, neither the BAR nor the decisions consider the cumulative impacts that arise from these overlapping activities.**

366. Given the limited remaining durations of the exploration rights held for the overlapping licence blocks, the possibility that the TGS seismic survey will be undertaken at overlapping times with exploration activities in the overlapping or nearby blocks, cannot be discounted and should have been included in the

assessment of cumulative impacts. Even where the activities may not directly overlap temporally or spatially, the multiple and confounding impacts on a disturbed marine environment should have been considered.

367. The second and third applicants submitted comments regarding cumulative impacts and made submissions in that regard in their appeal. TGS did not provide any response as to why the BAR failed to consider the impacts of other exploration and production activities.

368. In the DG's reasons for his decision in the EA, he simply states without further explanation, that "*The identification and assessment of potential impacts of the activity, including cumulative impacts, was adequately undertaken..*". In the Minister's decision, she states:

> "*2.5.4. In relation to cumulative impacts, I note that the cumulative impacts have been evaluated and set out in the BAR.*"

369. The Minister goes on to consider "cumulative noise impacts" and "noise acoustics". I deal with the insufficiency of the Minister's response to these aspects below, but, in relation to the impacts associated with exploration drilling and other activities in the overlapping and nearby licence blocks, the BAR simply does not consider these impacts at all. Short of any direct reference to consideration of these impacts in the DG's or Minister's decisions, of which there is none, the cumulative impacts associated with these activities have not been considered.

370. In terms of acoustic harms to marine ecosystems, the failure to consider cumulative impacts is a significant flaw, if not fatal. As described under the first ground of review above, Dr. Fournet, in her summary of her comments on the Acoustic study, explains that each additional project in or near the proposed survey region is associated with a set of risks that compound when they occur in close spatial or temporal proximity.

370.1. If multiple projects did occur at the same time, this would extend the overall high noise exposure to the environment, rendering the modelled sound emission level ("SEL") in the Acoustics Report incorrect, increasing the probability of harm for marine organisms, and increasing the probability for elevated stress levels in marine organisms at a regional level.

370.2. In turn, if multiple projects were to occur at the same time, it would also render the mitigation measures even less effective. For example, she explains, that part of the EIA mitigation plan hinges on there being a 'safe place' for marine organisms to retreat to avoid the impacts of extremely high amplitude sound, or by minimizing the spatial and temporal scale of sound exposure associated with the project.

370.3. These assumptions are untrue if multiple projects occur simultaneously.

Cumulative climate impacts from exploitation of oil and gas resources

371. In addition, the BAR did not consider the cumulative climate impacts of greenhouse gas emissions referred to in the third ground of review above, and in the expert affidavit of Mark New and in the report by New and Meckle attached thereto.

372. Having regard to the global Climate Emergency and South Africa's international commitment in the NDC to *'working with others to ensure temperature increases are kept well below 2°C above pre-industrial levels, which could include a further revision of the temperature goal to below 1.5°C in light of emerging science'* by reducing greenhouse gas (GHG) emissions, TGS's proposed 3D seismic survey would, if additional commercially viable resources are identified and developed through to production phase, inevitably add to South Africa's overall GHG emissions.

373. The same can be said for the dozen or so other offshore oil and gas projects that the government is greenlighting.

374. As a reasonably foreseeable future impact that may become more significant, especially in combination with impacts arising from similar offshore oil and gas exploration and production activities, it is submitted that the cumulative impacts of such GHG emissions need to be identified and assessed. It is further submitted that an evaluation of future emissions is entirely possible.

375. By approving each project in isolation, the government cannot know whether

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the major push to develop South Africa's oil and gas resources is consistent with the country's climate change obligations. Where effectively no oil and gas is being produced, the introduction of these many projects could have an outstanding influence on South Africa's carbon budget, potentially far exceeding its NDC targets. There is no adequate reason for why this type of cumulative GHG assessment was not done, and approving each project without this cumulative impact assessment is unreasonable and contrary to the requirements of NEMA.

376. New and Meckel agree, and provide a clear and relatively straightforward methodology to transparently estimate hydrocarbon volumes that might possibly be produced by a series of commercially-viable oil and gas projects in the future and the associated greenhouse gas (GHG) emissions from those projects.

377. Had the cumulative impacts of the Project been properly assessed, it would have been demonstrated that TGS has failed to prove, in the light of the cumulative impacts and the gaps in knowledge, that there is no risk of significant harm to marine life and to present and future generations of South Africans arising from climate change impacts.

378. Consequently, the application of the precautionary principle should have caused the EA to be refused.

379. While the BAR purported to assess cumulative impacts, as I have explained

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above, it failed to do so in respect of the gaps in knowledge I have identified above in respect of marine impacts, the impacts of other exploration and production projects in or near the project area; and cumulative climate impacts from exploitation of oil and gas resources.

380. The eighth ground of review is that the BAR failed adequately to assess the cumulative impacts and risks of seismic blasting, in breach of sections 2(d) and 3(1)(j)(i) and (o) of Appendix 1 to the EIA Regulations read with section 2(4)(a)(vii) of NEMA, with the result that the EA and the Minister's decision to uphold it are reviewable on one or more of the following PAJA review grounds:

380.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

380.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

380.3. the action was procedurally unfair, as contemplated in section 6(2)(c) of PAJA;

380.4. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

380.5. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

381. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

PART G: SUMMARY OF THE REVIEW GROUNDS

382. **The first ground of review** is that the BAR omitted relevant information and considerations in respect of impacts on marine life, and that the decisions of the DG and the Minister were not rationally connected to the information before them, were irrational and/or unreasonable, and failed to give adequate consideration to the precautionary principle, in breach of sections 24O(1)(b), 24(4) and 2(4)(a)(vii) of NEMA, and Regulation 41(6) of the EIA Regulations, with the result that the EA and the Minister's decision to uphold it are reviewable on one or more of the following PAJA review grounds:

382.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

382.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

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382.3. the action was procedurally unfair, as contemplated in section 6(2)(c) of PAJA;

382.4. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

382.5. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

383. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

384. The second ground of review is that the public participation process followed by the EAP in the EIA process did not ensure that persons in vulnerable and disadvantaged communities were given sufficient opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, or ensure that community well-being and empowerment was adequately promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means, in breach of Regulation 40 of the EIA Regulations read with section 2(4)(c), (f), (g), (h) (o) and section 24(1A)(c) of NEMA, with the NEMA Guideline on Public Participation, and with sections 9, 10, 24 and 33 of the

Constitution, with the result that the EA and the Minister's decision to uphold it are reviewable on one or more of the following PAJA review grounds:

384.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

384.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

384.3. the action was procedurally unfair, as contemplated in section 6(2)(c) of PAJA;

384.4. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

384.5. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

385. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

386. The third ground of review is that the Minister failed to consider the reduced

need for the seismic survey due to part of the Project area already having been surveyed, and the BAR failed to conduct a rational assessment of need and desirability in that the BAR

386.1. considered only the potential positive impacts of the production of oil and gas for the purposes of determining need and desirability and not the potential negative impacts thereof, which was inconsistent and irrational, in breach of sections 2(b) and 3(1)(f) of Appendix 1 to the EIA Regulations read with Regulation 18 thereof;

386.2. failed to conduct a proper assessment of the option of not implementing the activity , in breach of section 24(4)(b)(i) of NEMA read with the EIA Regulations; and

386.3. failed to conduct an assessment of the potential social, economic and environmental impacts of the exploration and production of oil and gas, , in breach of 24(4)(b)(i) of NEMA read with the EIA Regulations.

with the result that the EA and the Minister's decision to uphold it are reviewable on one or more of the following PAJA review grounds:

386.3.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

386.3.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

386.3.3. the action was procedurally unfair, as contemplated in section 6(2)(c) of PAJA;

386.3.4. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

386.3.5. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

387. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

388. The fourth ground of review is that conditions of authorisation in the EA required the submission of further plans by the developer to the competent authority for approval without any public participation in regard thereto, in breach of section 3(1)(h) of Appendix 1 and section 1(1)(d) of Appendix 4 to the EIA regulations, Regulations 40 and 41 to the EIA regulations, and of the rights of IAPs in respect of *audi alteram partem*, with the result that the EA and the appeal decisions are reviewable on one or more of the following PAJA review

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grounds:

388.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

388.2. the action was procedurally unfair, as contemplated in section 6(2)(c) of PAJA;

388.3. the EA and appeal decision contravened a law and were not authorised by the empowering provision (section 6(2)(f)(i) of PAJA); and

388.4. the EA and the Minister's decision are not rationally connected to the purpose of the empowering provision, as contemplated in section 6(2)(f)(ii)(bb) of PAJA.

389. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

390. The fifth ground of review is that the BAR failed, with respect to the ICMA, to determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context, or to contain the information that is necessary for the competent authority to consider and come to a decision on the application, as contemplated in sections 2(1)(a) and 3(1) of Appendix 1 of the EIA Regulations

read with sections 12 and 63 of the ICMA, with the result that the EA and the Minister's decision to uphold it are reviewable on one or more of the following PAJA review grounds:

390.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA; and

390.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA.

391. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

392. The sixth ground of review is that the EMPr is materially deficient and fails adequately to set out the impacts and risks that need to be avoided, managed and mitigated, or to provide an identification of the manner in which the impact management outcomes will be achieved, the method of monitoring the implementation of the impact management actions, and the mechanism for monitoring compliance with the impact management actions, as required by sections 1(1)(f), (g) and (k) of Appendix 4 to the EIA Regulations, which constitutes a breach of Regulation 19(4) of the EIA Regulations read with s 24N(2) of NEMA, with the result that the EA and the Minister's decision to uphold it are reviewable on one or more of the following PAJA review grounds:

392.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

392.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

392.3. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

392.4. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

393. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

394. The seventh ground of review is that the EA failed to contain a plan which locates the proposed activity or activities authorised at an appropriate scale, in breach of Regulation 28(c) of the EIA Regulations, with the result that the EA and the Minister's decision to uphold it are reviewable on one or more of the following PAJA review grounds:

394.1. a mandatory and material procedure or condition prescribed by an

empowering provision was not complied with, as contemplated in section 6(2)(b) of PAJA;

394.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

394.3. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

394.4. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

395. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

396. The **eighth ground of review** is that the BAR failed adequately to assess the cumulative impacts and risks of seismic blasting, in breach of sections 2(d) and 3(1)(j)(i) and (o) of Appendix 1 to the EIA Regulations read with section 2(4)(a)(vii) of NEMA, with the result that the EA and the Minister's decision to uphold it are reviewable on one or more of the following PAJA review grounds:

396.1. a mandatory and material procedure or condition prescribed by an empowering provision was not complied with, as contemplated in section

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6(2)(b) of PAJA;

396.2. relevant considerations were not considered, as contemplated in section 6(2)(e)(iii) of PAJA;

396.3. the action was procedurally unfair, as contemplated in section 6(2)(c) of PAJA;

396.4. the EA and appeal decision contravened a law and were not authorised by the empowering provision, as contemplated in section 6(2)(f)(i) of PAJA); and

396.5. the EA and the Minister's decision are not rationally connected to the information before them, as contemplated in section 6(2)(f)(ii)(cc) of PAJA.

397. Alternatively, the EA and appeal decision are reviewable in terms of the constitutional principle of legality.

RELIEF

398. The Applicants respectfully submit that this is not a case in which the decisions under review should be remitted to the decision-makers. For reasons fully canvassed above, the BAR is fatally flawed by reason of its limited scope and

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cannot serve as a basis for lawful decision-making.

399. In the premises, we submit that the Court should make an order in terms of section 8(1)(c)(ii)(a) declaring that the environmental authorisation is refused.

COSTS

400. The applicants have brought these proceedings in the public interest alongside the interests of Aukotswa. I am advised that in such circumstances a litigant is, as a rule, not liable for an adverse costs order in favour of the State Respondents, if unsuccessful, save in circumstances where the proceedings were vexatious, frivolous or misconceived.

401. I submit that none of the above exceptions apply in the circumstances of this case. This application is based on substantial grounds and has good prospects of success.

402. I am further advised that a litigant in the position of the applicants should not be liable for the costs of a private respondent such as TGS.

403. The question of costs will be fully addressed in argument at the hearing.

CONCLUSION

404. In the circumstances, I respectfully submit that the applicants have established

that the decisions fall to be reviewed and set aside in terms of section 6 of PAJA, alternatively, in terms of the constitutional principle of legality.

405. The applicants accordingly pray for an order in terms of the notice of motion, subject to the right to supplement the grounds for review upon receipt of the decision-makers records of decision in terms of rule 53.

JOHANNES WALTER STEENKAMP

I hereby certify that the deponent has declared that he knows and understands the contents of this Affidavit and that to the best of his knowledge and belief it is the truth, which Affidavit has been signed to and affirmed to before me at CAPE TOWN on this the 13 day of NOVEMBER 2024.

COMMISSIONER OF OATHS

NAME: RICHARD ALLAN LIDDLE
TITLE: COMMISSIONER OF OATHS (RSA)
PRACTISING ATTORNEY & CONVEYANCER (RSA)
ADDRESS: RICHARD LIDDLE ATTORNEYS
13 BELGRAVIA ROAD, ATHLONE
TEL: 021 697 8610

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"A1.1"

AUKOTOMA FISHERIES PRIMARY CO-OPERATIVE

(Registration Number: 2018/000121/24)

(Hereinafter referred to as the "Co-Operative")

RESOLUTION SUBMITTED TO THE DIRECTORS (CONSTITUTING ALL OF THE DIRECTORS OF THE CO-OPERATIVE):

1. **RECITALS**

WHEREAS the Co-Operative intends bring a review application in the High Court of South Africa having jurisdiction, in respect of TotalEnergies EP South Africa BV ("TEEPSA") and TGS Geophysical Company (UK) Limited ("TGS") for relief set out in the notices of motion (the "Applications"), *inter alia*, to apply for an order to review the decisions of the competent authorities and, more specifically, the following:

1.1. The Environmental Authorisation ("EA") granted by the Department of Mineral Resources and Energy to TEEPSA to undertake exploration drilling activities in the Deep Water Orange Basin ("DWOB"); and the appeal decision of the Ministry of Forestry Fisheries and the Environment to uphold the EA; and

1.2. The EA granted by the Department of Mineral Resources and Energy to TGS to conduct seismic survey activities in the DWOB and the appeal decision of the Ministry of Forestry Fisheries and the Environment to uphold the EA.

2. **RESOLUTIONS**

2.1. NOW THEREFORE BE IT RESOLVED THAT as per the decision of the Co-Operative on 14 October, the Co-Operative may and will proceed to bring the Applications in the appropriate division of the High Court or any forum with jurisdiction to adjudicate upon the Applications; and

2.2. BE IT FURTHER RESOLVED THAT the Co-Operative appoints and authorises Chennells Albertyn Attorneys, as attorneys of record for the Co-Operative, to proceed with any application, action or legal process to enforce the rights of the Co-Operative in respect of the Applications together with interest and legal costs; and

2.3. BE IT FURTHER RESOLVED THAT Johannes Wetta Shatoma (Identity Number: 7909085417083) in their capacity as Chair of the Co-Operative, be authorised to sign and/or depose to any and all documentation, inclusive of founding affidavits, replying affidavits and/or any ancillary affidavits, certificates or supporting documents in support of the Application.

Co-Operative Executive Committee:	Position	Signature:	Date of Signature:
Johannes Wetta Shatoma	Chair person		24/10/2024
Morgan Johns	Authorised Deputy Chair		24/10/2024
Rudi Young	Secretary Aukotoma		24/10/2024
Terisa Ouico	Aukotoma	Ouico	24/10/2024

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Co-Operative Executive Committee:	Position	Signature:	Date of Signature:
Willem Rassouw	Treasurer		24/10/2024

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AUKOTOWA FISHERIES **14 Oktober 2024**

Presensielys

Vergadering met Lede

Naam	Van	Kontak Nommer	Handtekening
André	Cloete	672 872 5297	
Berend	Diergaardt		
Berend	Van Wyk	0823807597	
Bronwen	De Klerk	6605096464	
Bruce	De Klerk		
Charles	Townsend		
Chris	Diergaardt		
Christiaan	Mackenzie		
David	Cloete	0607672864	
Elroy	Adams		
Elton	Duraan		
Eric	De Wet		
Eugene	Cloete		
Freddie	Joseph		F JOSEPH
Gert	Saal		
Glen	Rooi	0823613061	
Harry	Coraizen		
Hendrik	Van Wyk		
Jakobus	Saal	0723436111	
Jerome	Ovies		

Joseph G	Cloete		
Josef H G	Cloete	0763232960	
Josef	Louw		
Joey	Cloete		
Johannes	Cloete		
John	Arendse	0642528813	
John	De Wet	0791885103	
John	Dirkse		
John	Martin		J. MARTIN
Juliana	Rooi	0621414248	
Koos	Van Wyk		
Margaret	Malan		M. MALAN
Marius	Stuurman		
Melvin	Tsoaeli		
Morgan	Johnson	0764581548	
Petrus	Carolus	0787479124	
Pieter	Olivier	0760176611	
Rendall	Uys	063 721 9628	
Renthia	Van Wyk	0637219428	
Richard	De Wee	0622216114	
Rose	Malan	0729129396	
Rudi	Young	065 141 497	
Samuel	Slander		

Silino	Jaftha	0635806577	
Stanley	Young		
Stuart	Thomas		
Terisa	Ovies	0823617923	
Vivian	Van Wyk	VIVIANVAN WYK	
Walter	Steenkamp	084 087 5199	W.J. Steenkamp
Willem	Rossouw	061 669 5065	
William	Kleasen		
William	Ruiter		

IN THE HIGH COURT OF SOUTH AFRICA

(WESTERN CAPE DIVISION, CAPE TOWN)

CASE NO.: ...../2024

In the matter between:

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	First Applicant
THE GREEN CONNECTION NPC	Second Applicant
NATURAL JUSTICE	Third Applicant

and

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	First Respondent
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	Second Respondent
TGS GEOPHYSICAL COMPANY (UK) LIMITED	Third Respondent
MINISTER OF MINERAL AND PETROLEUM RESOURCES	Fourth Respondent

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CONFIRMATORY AFFIDAVIT: PRIYANKA NAIDOO

I, the undersigned,

PRIYANKA NAIDOO

do hereby make oath and state as follows:

1. I am the Legal and Outreach Advisor of The Green Connection NPC ("Green Connection").

P.N.

2. The Green Connection NPC's registered office is situated at Unit B1, Clareview Business Park, 236 Imam Haron Road, Claremont, Cape Town.

3. I am duly authorised to depose to this affidavit on behalf of The Green Connection NPC, who is the second applicant.

4. The facts contained in this affidavit are within my personal knowledge, unless the context indicates otherwise, and are, to the best of my knowledge and belief, both true and correct.

5. I have read the founding affidavit deposed to by Johannes Walter Staenkamp. I confirm all of the allegations in the founding affidavit insofar as they pertain to me and to The Green Connection NPC.

PRIYANKA NAIDOO

I hereby certify that the deponent knows and understands the contents of this affidavit and that it is to the best of the deponent's knowledge both true and correct. This affidavit was signed and sworn to before me at _____ on this the ___ day of _____ 2024, and that the Regulations contained in Government Notice R.1258 of 21 July 1972, as amended by R1648 of 19 August 1977, and as further amended by R1428 of 11 July 1989, having been complied with.

_____
COMMISSIONER OF OATHS
Full names:
Address:
Capacity:

IN THE HIGH COURT OF SOUTH AFRICA

(WESTERN CAPE DIVISION, CAPE TOWN)

CASE NO.: ...../2024

In the matter between:

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	First Applicant
THE GREEN CONNECTION NPC	Second Applicant
NATURAL JUSTICE	Third Applicant

and

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	First Respondent
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	Second Respondent
TGS GEOPHYSICAL COMPANY (UK) LIMITED	Third Respondent
MINISTER OF MINERAL AND PETROLEUM RESOURCES	Fourth Respondent

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CONFIRMATORY AFFIDAVIT: DELME CUPIDO

I, the undersigned,

DELME CUPIDO

do hereby make oath and state as follows:

1. I am the Southern African Hub Director of Natural Justice.

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2. Natural Justice's principal place of business is situated at Mercantile Building, 83 Hout Street, Cape Town, 8000, South Africa.

3. I am duly authorised to depose to this affidavit on behalf of Natural Justice, who is the third applicant.

4. The facts contained in this affidavit are within my personal knowledge, unless the context indicates otherwise, and are, to the best of my knowledge and belief, both true and correct.

5. I have read the founding affidavit deposed to by Johannes Walter Steenkamp. I confirm all of the allegations in the founding affidavit insofar as they pertain to me and to Natural Justice.

DELME CUPIDO

I hereby certify that the deponent knows and understands the contents of this affidavit and that it is to the best of the deponent's knowledge both true and correct. This affidavit was signed and sworn to before me at CAPE TOWN on this the 13 day of AUGUST 2024, and that the Regulations contained in Government Notice R.1258 of 21 July 1972, as amended by R1648 of 19 August 1977, and as further amended by R1428 of 11 July 1989, having been complied with.

COMMISSIONER OF OATHS

Full names: RICHARD ALLAN LIDDLE
Address: COMMISSIONER OF OATHS (RSA)
PRACTISING ATTORNEY & CONVEYANCER (RSA)
Capacity: RICHARD LIDDLE ATTORNEYS
13 BELGRAVIA ROAD, ATHLONE
TEL: 021 697 8610

TGS Geophysical Company (UK) Limited-12/1/040

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Enquiries: Ms Sinazo Mnyaka
EAP Reg No.: 2022/5486
Email Address: mnyakas@petroleumagencysa.com

By E-MAIL
The Project Development Manager
TGS Geophysical Company (UK) Limited
TGS, Dukes Court Street
Woking, GU21 5BH
United Kingdom

Attention	: Mr Jevon Hilder
Cell	: +44 7788 315682
Tell	: +44 1483 742644
Email	: jevon.hilder@tgs.com

ENVIRONMENTAL AUTHORISATION IN TERMS OF SECTION 24 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998) AS AMENDED, READ WITH REGULATION 19 OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS, 2014 AS AMENDED, FOR THE PROPOSED 3D SEISMIC SURVEY ACTIVITIES LOCATED BETWEEN APPROXIMATELY 120 KM OFFSHORE OF ST HELENA BAY, EXTENDING NORTH ALONG THE WESTERN COASTLINE TO APPROXIMATELY 230 KM OFFSHORE OF HONDEKLIP BAY, OFF THE WEST COAST OF SOUTH AFRICA.

I, **Mr Jacob Mbele**, in terms of the powers delegated to me, in terms of regulation 24 of the National Environmental Management Act, 1998 (Act 107 of 1998): Environmental Impact Assessment Regulations, 2014 (hereafter referred to as 'EIA Regulations') decided to grant an environmental authorisation (hereafter referred to as the authorisation) in respect of the application lodged on 06 September 2022. Herewith attached, is the copy of the authorisation and reasons for the decision to grant.

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You are instructed in terms of regulation 4(2) of the EIA Regulations to notify all interested and affected parties (I&APs), in writing, within fourteen (14) days of the date of the decision, of the outcomes of your application. You are also required to inform I&APs of the procedure to submit appeals against the decision as contained in the National Environmental Management Act, 1998 (Act 107 of 1998): National Appeals Regulations, 2014 (hereafter referred to as 'Appeals Regulations').

Should you wish to appeal the decision or any aspect thereof, you must submit an appeal in the prescribed form and in accordance with Chapter 2 of the Appeals Regulation, within twenty (20) days from the date of notification of the decision. The said must be submitted to the Minister of Forestry, Fisheries, and the Environment, and copies sent to the Department of Mineral Resources and Energy (Head Office) and the Petroleum Agency SA by one of the following means:

1) **Department of Forestry, Fisheries, and the Environment**
   Appeals and Legal Review Directorate
   Attention : Director: Appeals and Legal Review
   Email : appeal@dffe.gov.za
   Post : Private Bag x 447, Pretoria, 0001
   By Hand : Environmental House, Corner Steve Biko and Soutspansberg Street, Arcadia, Pretoria, 0083

2) **Copy(s) of the lodged appeal(s) to the Petroleum Agency SA**
   Attention : The Chief Executive Officer
   Email : EAappeals@petroleumagencysa.com
   Post : Private Bag x 5111, Tygervalley, 7536
   By Hand : Heron Place, Second Floor, Heron Close, Century City, Cape Town

3) **Copy(s) of the lodged appeal(s) to the Department of Mineral Resources and Energy**
   Legal Services Directorate
   Attention : Director: Legal Services
   Email : Pieter.Alberts@dmre.gov.za
   Facsimile : 086 710 0877
   Post : Private Bag x 59, Arcadia, 0007
   By Hand : Trevenna Campus, Building 2C, c/o Meintjes and Francis Baard Street, Sunnyside

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The authorised activities shall not commence within twenty (20) days of the date of signature of this authorisation. Please note that should the Minister of Forestry, Fisheries, and the Environment receive appeals against this authorisation or conditions thereof, this authorisation will be suspended in accordance with section 43(7) of NEMA pending the decision on such appeals.

Yours sincerely,

.....

MR JACOB MBELE
DIRECTOR-GENERAL
DATE: 17/4/2023

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mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Enquiries: Ms Sinazo Mnyaka
EAP Reg No.: 2022/5486
Email Address: morrison@patrolsumaresrsa.com

ENVIRONMENTAL AUTHORISATON IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF1998) AS AMENDED ("NEMA") AND ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 AS AMENDED

IN RESPECT OF

THE PROPOSED 3D SESIMIC SURVEY ACTIVITIES OFFSHORE, OFF THE WEST COAST, SOUTH AFRICA

APPLICATION DETAILS

Application Reference Number	12/1/040
Holder of Environmental Authorisation	TGS Geophysical Company (UK) Limited
Location of the Activity	The EA application area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay. It covers several petroleum license blocks.
Size of the Environmental Authorisation application area	Approximately 5 740 000 ha

This authorisation does not negate the holder of the authorisation of the responsibility to comply with any other statutory requirements that may be applicable to the undertaking of the proposed activity.

DECISION ON THE AUTHORISATION

ACRONYMS

AGENCY	: Petroleum Agency SA
BAR	: Basic Assessment Report
DEPARTMENT	: Department of Mineral Resources and Energy
ECO	: Environmental Control Officer
EA	: Environmental Authorisation
EIA	: Environmental Impact Assessment
EIA REGULATIONS	: EIA Regulations, 2014, as amended
EMPr	: Environmental Management Programme
I&APs	: Interested and Affected Parties
MPRDA	: Mineral and Petroleum Resource Development Act, 2002 (Act 28 of 2002), as amended
NEMA	: National Environmental Management Act, 1998 (Act 107 of 1998), as amended

The Department is satisfied with the information made available to it, and subject to compliance with the conditions of this authorisation, that the applicant should be authorised to undertake NEMA EIA listed activities specified below. Details regarding the basis on which the Department reached this decision are set out in Annexure 1 of this authorisation.

ACTIVITY (S) AUTHORISED

By virtue of the powers conferred on it by the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA") and the Environmental Impact Assessment Regulations, 2014 ("EIA Regulations") the Department hereby grants the authorisation to TGS Geophysical Company (UK) Limited to undertake NEMA EIA listed activities specified in section 3 below and as described in the BAR/EMPr submitted on 06 December 2022.

The granting of this authorisation is subject to compliance with conditions specified under section 5 below.

1. DETAILS OF THE HOLDER OF THIS ENVIRONMENTAL AUTHORISATION

TGS Geophysical Company (UK) Limited
TGS, Dukes Court Street
Woking, GU21 5BH
United Kingdom

Contact Person	. Mr Jevon Hilder
Tel	: +44 1483 742644
Cell	: +44 7788 315682
Email	: jevon.hilder@tgs.com

2. DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

Environmental Impact Management Services (Pty) Ltd
PO Box 2083
Pinegowrie
2123

Contact Person	: Mr Liam Whitlow
Tel	: +27(0) 11 789 7170
Email	: liam@eims.co.za

3. LIST OF ACTIVITIES AUTHORISED

The following activity as listed under the EIA Regulations, 2014: Government Notice No. R983 of 04 December 2014, is authorised:

Listing Notice 1

Activity Number	**: 21(b)**
Listed Activity	: Any activity including the operation of that activity which requires a reconnaissance permit in terms of section 74 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), as well as any other applicable activity as contained in this Listing Notice or

TGS Geophysical Company (UK) Limited-12/1/040

In Listing Notice 3 of 2014, required to exercise the reconnaissance permit, excluding:

(a) any desktop study; and

(b) any arial survey.

The holder of this authorisation is authorised to conduct the following activities within the area described under section 4 below:

- Acquisition of 3D seismic survey data, which involves generation of high-level, low frequency sound pulses by an acoustic instrument towed behind a survey vessel below the sea surface. The sounds are directed towards the seabed and the seismic signal is reflected by the geological interfaces below the seafloor. The reflected signals are received by an array of receivers or sets of hydrophones towed behind the vessel in a single streamer (2D) or in multiple streamers (3D) and are fed back to the recording instruments on board.
- The survey would involve a seismic sound source and multiple hydrophone streamers, which would be approximately 6 000 m long and 2 000 m wide. The streamers would be towed at a depth of 8 m below the surface and would not be visible, except for the tail-buoy at the terminal end of the cable.
- The array has an operating pressure of 2 000 pounds per square inch. The sound source would be towed behind the vessel at a depth of between 5 – 25 m below the surface. As the survey vessel would be restricted in maneuverability, other vessels should remain clear of it. Therefore, a support vessel usually assists in the operation of keeping other vessels at a safe distance.
- Each triggering of a sound source is termed a seismic pulse, and these are discharged at intervals of 6 – 20 seconds (depending on water depth and other environmental characteristics). Each seismic pulse is usually only between 5 and 30 milliseconds in duration, despite peak levels within each pulse being high, the total energy delivered into the water is low.
- Seismic sources have an energy frequency range of 5-300 Hz, with the optimal frequency required for deep penetration seismic work being 50-60 Hz. Sound levels from individual sound sources used today in the seismic industry range from 200 to 255 dB re 1 µPa at 1 m, for small to large individual seismic sources, respectively.
- For sound source arrays, sound levels range from 235 dB re 1 µPa at 1 m for a small array (500 cubic inches) to 260 dB re 1 µPa at 1 m for large arrays (7 900 cubic inches). Most of the produced energy is below 250 Hz, with 90% of the energy between 70 to 140 Hz, although pulses do contain some higher frequencies up to 16 kHz. It must be noted, however, that the sound level specifications for sound source arrays refer to sound levels in the vertical direction directly beneath the sound source array, generally near its centre, with nominal sound levels in the horizontal direction being ~10-20 dB lower.

- The seismic vessel travels along a transect of a prescribed grid within the application area chosen to cross any known or suspected geological structure in the area at a speed of between four and six knots during acquisition of data. The survey vessel length is approximately 100 m.

4. LOCATION OF THE APPLICATION AREA

The EA application area is located in the Northern and Western Cape Provinces approximately 120 km offshore of St Helena Bay extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay. It covers several petroleum license blocks. The area is approximately 5 740 000 hectares in extent and is adjacent to the Namaqualand and West Coast District Municipalities. The application area coordinates are listed in Table 1 below.

Table 1: Coordinates of the application area

Point	Latitude	Longitude	Point	Latitude	Longitude
1	32°59'53.46"S	16°35'02.75"E	6	30°40'18.36"S	13°20'38.26"E
2	32°59'57.95"S	13°53'17.25"E	7	30°22'53.91"S	13°35'15.39"E
3	32°39'06.43"S	13°53'26.20"E	8	30°15'21.82"S	14°04'05.31"E
4	32°09'29.22"S	13°58'04.38"E	9	30°15'27.76"S	14°52'28.65"E
5	31°31'44.64"S	13°39'01.12"E			

5. CONDITIONS OF THE AUTHORISATION

5.1 SCOPE OF AUTHORISATION

5.1.1 The holder is authorised to undertake activities specified in section 3 above.

5.1.2 The authorised activities must only be carried out within the application area specified in section 4.

5.1.3 The holder of this authorisation is responsible for ensuring compliance with the conditions of this authorisation.

5.1.4 Any person(s) acting on behalf of the holder, inclusive of contractor(s), subcontractor(s), consultant(s), and employees are also subject to the conditions of this authorisation. This condition, however, does not exonerate the holder from its accountability and responsibility to ensure compliance with the conditions of this authorisation.

5.1.5 Any changes to, or deviations from, and amendments to the proposed activities and conditions of this authorisation must be approved in writing by this Department before such changes, deviations or amendments are effected. The Department reserves the right to request the submission of information deemed necessary to assess and evaluate the significance and impacts of such changes, deviations, and amendments. Any changes, deviations and amendments may be subject to the provisions of Chapter 5 of the EIA Regulations, 2014 pertaining to the amendments of this authorisation.

5.2 NOTIFICATION AND APPEAL OF AUTHORISATION

5.2.1 The holder must, in writing, within fourteen (14) days of the date of this authorisation, notify all I&APs of the outcome of the application.

5.2.2 The notification contemplated above must, amongst other issues:

5.2.2.1 Stipulate the date of the decision, and the date of issue of the authorisation

5.2.2.2 Provide reasons for the decision.

5.2.2.3 Inform I&APs of the appeals procedure in terms of the National Environmental Management Act, 1998. National Appeals Regulations (GN R 993 of 08 December 2014).

5.2.2.4 Draw the attention of the I&APs to the manner in which they may access the decision, including obtaining the copy of the authorisation.

5.3 COMMENCEMENT OF THE ACTIVITY(S)

5.3.1 This authorisation will only be effective in the event that an application for reconnaissance permit is granted in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002). None of the activities listed in this authorisation may therefore commence without a reconnaissance permit.

5.3.2 The authorised activities shall not commence within twenty (20) days of the date of this authorisation, pending potential lodgement of appeal(s).

5.3.3 Where an appeal is lodged against the decision by any party, this authorisation or any provision or condition thereof will be suspended in accordance with section 43(7) of the National Environmental Management Act, 1998; and as such you may not commence with any activity, until a decision on the appeal(s) is taken.

5.3.4 The authorised activities must commence within a period of one (1) year from the date of issue of this authorisation. If commencement of the authorised activities does not occur within the said period, the authorisation lapses, unless an extension is granted in terms of regulation 30 of the EIA Regulations, 2014. If the authorisation lapses and the holder intends undertaking the authorised activity(s), a new authorisation in terms of the EIA Regulations, 2014 must be obtained.

5.4 MANAGEMENT, MONITORING AND AUDITING OF OPERATIONS INCLUDING REPORTING REQUIREMENTS

5.4.1 The BAR/EMPr is hereby approved. It is hence mandatory for the holder to implement all the recommendations and management measures stipulated in the EMPr throughout all phases of the proposed activities.

5.4.2 Any non-compliance with the EMPr constitutes non-compliance with this authorisation, and any non-compliance with this authorisation may result in its suspension and may render the holder guilty of an offence in terms of section 49A of NEMA and may, if convicted, be liable for penalty as contemplated in terms of section 49B(1).

5.4.3 Should there be changes in the operation and management of the authorised activities, the EMPr must be amended to accommodate those changes and be submitted to the competent authority for approval before implementation commences.

5.4.4 The holder of this authorisation must undertake the necessary measures, to ensure that operators, contractors, subcontractors, and any person(s) acting on behalf of the holder, has full awareness of the recommendations of the EMPr before commencing with any authorised activity

5.4.5 The EMPr must be included in all contractual documentation entered thereto between the holder and contractor(s).

5.4.6 A copy of the EMPr must always be kept onboard survey vessel(s).

5.4.7 The holder must, before the commencement of the authorised activity, appoint the following:

5.4.7.1 An independent and experienced Environmental Control Officer (ECO) who will ensure that the conditions of this authorisation and recommendations of the EMPr are implemented and adhered to.

5.4.7.2 Independent, qualified, and experienced Marine Mammal Observers (MMO), Passive Acoustic Monitoring (PAM) Operators and Fisheries Liaison Officer (FLO) to monitor the interaction between marine mammals and survey operations and interactions with other marine users for the duration activity.

5.4.8 The holder of this authorisation must submit daily and monthly environmental monitoring reports during seismic survey operations. Furthermore, the holder must within sixty (60) days of completion of the 3D seismic survey, submit a survey closure report, completed by the ECO.

5.5 SPECIFIC CONDITIONS

5.5.1 The holder or appointed ECO must, thirty (30) days before the commencement of the seismic surveys, distribute notifications to the I&APs including the Agency informing them of the operational plans. The said notifications must include the following:

5.5.1.1 Commencement date, including survey and support vessel(s) mobilisation date, and anticipated duration of the survey.

5.5.1.2 Details of the seismic survey and support vessels.

5.5.1.3 Sketch plans showing the operational area(s) including survey grids.

5.5.1.4 Details of the ECO, FLO, MMO, PAM Operators and contact details for reporting environmental issues associated with the planned activities.

5.5.1.5 Invitation to I&APs to confirm if they should be included in the distribution list for daily MMO, PAM and FLO reports.

5.5.2 Avoid operating during periods of peak fishing efforts and migratory season of cetaceans and their aggregates on the summer feeding grounds between St Helena Bay and Dassen Island.

5.5.3 The National Environmental Management: Protected Areas Act, 2003 prohibits any exploration activities within the Marine Protected Areas, National Parks, and Nature Reserves. The holder must ensure that none of the authorised activities take place within these areas. Furthermore, a 5 km buffer zone must be implemented around all Marine Protected Areas during seismic survey data acquisition.

5.5.4 Marine Mammal Observers must be equipped with infra-red cameras.

5.5.5 Passive Acoustic Monitoring is mandatory where visual observations are not possible due adverse weather conditions or at night. If PAM system is not functional, operations must temporarily be suspended to prevent any potential impacts to marine mammals.

5.5.6 The holder must submit a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with MARPOL 73/78 Annex I and the National Oil Spill Continency Plan (NOSCP).

5.5.7 In addition to SOPEP, Emergency Response and Medical Evacuation Plan must be submitted. The said plans must take into consideration all resources that may be required in case of an oil spill incident or any emergency incident. The plans must be submitted to the Petroleum Agency

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SA (hereafter referred to as the ' Agency") thirty (30) days before the mobilisation of the seismic survey vessel.

5.5.8 Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or existing tail buoys are fitted with either exclusion or deflector 'turtle guards'.

5.5.9 Ensure that solid streamers are used instead of fluid-filled streamers to avoid leaks.

5.5.10 Maintain a pre-acquisition watch of sixty (60) minutes before any instances of seismic source testing, to confirm that there are no penguins or feeding aggregations of diving seabirds, shoaling large pelagic fish, turtles, seals, or cetaceans within 500 m of the seismic source, and implement a "soft- start" procedure as defined in the approved BAR/EMPr. If only a single lowest power seismic source is tested, the pre-acquisition watch period can be reduced to thirty (30) minutes.

5.5.11 Line changes and break in acquisition must follow the procedures defined in the approved BAR/EMPr and must be synchronized with "soft-start" procedures as defined in the approved BAR/EMPr.

5.5.12 Terminate seismic source on detection and/or observation of mortality or injuries of marine life within the 500m mitigation zone.

5.5.13 Illegal dumping of waste or any equipment aboard the vessels is prohibited. In the event of loss of any equipment that presents risks to the navigational activities, other marine users and the environment, measures to retrieve lost equipment must be undertaken, and such incidents must be reported to the Agency and South African National Hydrographic Office within twelve (12) hours of occurrence.

5.5.14 During the demobilisation process, the holder must ensure that the survey area is left as it was prior to the operations and all I&APs must be informed of the completion of the survey. The holder remains accountable and liable for any residual or latent risks that may occur or are identified at completion of the surveys. In this regard, necessary measures to address such risks are mandatory.

5.5.15 Develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities and must include a community strategy and grievance mechanism.

5.5.16 All recommended mitigation measures included in the BAR/ EMPr dated 08 December 2022 are deemed to be conditions of this authorisation and must therefore be adhered to.

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6. GENERAL

A copy of this authorisation and the EMPr must be kept onboard the seismic survey vessel to ensure appropriate implementation of the mitigation measures.

7. DISCLAIMER

The Department shall not be responsible for any damages or losses suffered by the holder in an instance where the operation is temporarily or permanently stopped for reasons of non-compliance with the conditions as set out herein or any other subsequent document or legal action emanating from this decision.

8. RECOMMENDATION

In view of the above, and having taken into consideration environmental management principles as set out in section 2 of NEMA, and information presented in the environmental authorisation application and BAR, and subject to compliance with conditions of this authorisation, this Department is satisfied that the proposed activities will not be in conflict with the objectives of the Integrated Environmental Management set out in Chapter 5 of NEMA and will not result to any detrimental risks to the environment and public. The authorisation is accordingly granted.

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MR JACOB MBELE
DIRECTOR-GENERAL
DATE OF THE EA: 17/4/2023

EWS

APPENDIX 1: REASONS FOR DECISION

1. Information Considered in Making the Decision

All the information presented to the Department was considered in making this decision. The said information includes amongst others:

1.1 The provisions of Chapter 5 of the NEMA which relates to the Integrated Environmental Management and section 2 NEMA principles; the EIA Regulations, 2014 and other relevant NEMA regulations and guidelines.

1.2 Environmental Authorisation application dated 06 September 2022.

1.3 The information contained in the final BAR/EMPr, compiled by an independent Environmental Assessment Practitioner (EAP) registered with the Environmental Assessment Practitioner Association of South Africa (EAPASA) from Environmental Impact Management Services (Pty) Ltd, submitted to the Department on 06 December 2022

1.4 The information contained in the following specialist reports received by the Department on 06 December 2022:

1.4.1 Biodiversity and Ecosystem Services Assessment prepared by Pisces Environmental Services (Pty) Ltd

1.4.2 Fisheries Specialist Study prepared by Capricorn Marine Environmental (Pty) Ltd.

1.4.3 Heritage Impact Assessment prepared by PGS Heritage (Pty) Ltd.

1.4.4 Social Impact Assessment prepared by Equispectives Research & Consulting Services.

1.4.5 Sound Transmission Loss Modelling prepared by SLR Consulting Australia (Pty) Ltd.

1.5 The results of the Public Participation Process submitted with the BAR/EMPr, which highlighted issues, objections, concerns, and comments raised by various I&APs and responses by the EAP.

2. Submission and Consideration of the Basic Assessment Report and Environmental Management Programme

2.1 In terms of regulation 19(1)(a) and (b) of the EIA Regulations, 2014, the applicant must, within ninety (90) days of receipt of the application by the competent authority, submit to the competent authority-

(a) A basic assessment report, inclusive of specialist reports, an EMPr and where applicable a closure plan, which was subjected to a public participation process of at least thirty (30) days and which reflects the incorporation of comments received, including any comments of the competent authority; or

(b) a notification, in writing, that the basic assessment report, inclusive of the specialist reports, and EMPr and where applicable a closure plan, will be submitted within one hundred and forty (140) days of receipt of the application by the competent authority, as significant changes were made or significant new information was added to the basic assessment report or EMPr or, where applicable, a closure plan, which changes or information was not contained in the report or plans consulted on during the initial public participation process contemplated in sub-regulation (1)(a) and that the revised reports or EMPr or, where applicable, a closure plan will be subjected to another public participation process of at least thirty (30) days.

2.2 An application for the authorisation was submitted on 06 September 2022 and acknowledged on 19 September 2022, informing the applicant to submit a BAR/EMPr on or before 06 December 2022. The BAR/EMPr was submitted to the Department on 06 December 2022.

3. Key Findings

Careful consideration of information submitted to the Department, thus resulted in the following conclusions:

3.1 All fundamental and procedural requirements prescribed in the applicable legislation is satisfied.

3.2 The proposed 3D seismic survey is a widely used oil and gas exploration technology worldwide. The said technology is currently used in South Africa and is generally regarded as non-intrusive in nature. The technology poses potential impacts on fisheries and marine fauna. However, majority of the impacts were assessed to range between low to very low significance with mitigation.

3.3 The identification and assessment of potential impacts of the activity, including cumulative impacts, was adequately undertaken, and the proposed mitigation and management measures are aligned with potential impacts. Furthermore, the implementation of mitigation measures in all phases of the proposed 3D seismic survey activities will ensure that the planned activities will not result in any detrimental impacts on the environment.

3.4 The motivation for the need and desirability of the proposed 3D seismic survey activity is in line with the requirements of the EIA Regulations, 2014 and it addressed key issues in the Need and Desirability Guideline

3.5 Project Alternatives: The location, layout, scheduling, technology, and no-go alternatives were identified and briefly assessed. However due to the nature of proposed exploration operations, no in-depth assessments were carried out. The preferred location was selected based on its high likelihood of containing significant hydrocarbon reserves. The preferred 3D seismic survey is considered a suitable technology to achieve the intended objective of the proposed project. In addition, seismic survey technology is currently the only commercially available technology to achieve the desired objectives of the project. The no-go alternative was not preferred due to the positive impacts that might be derived from undertaking the planned project. The layout and scheduling alternatives were assessed in consideration of sensitive areas and periods of peak fishing activity and marine fauna movements. The layout and scheduling of the proposed project will therefore consider the aforementioned aspects.

3.6 The Public Participation Process (PPP) complied with chapter 6 of the EIA Regulations, 2014 and related guidelines. The PPP included the following:

(a) Identification and notification of I&APs inclusive of authorities, fisheries, and non-governmental organizations.

(b) Notifications in English, Afrikaans and isiXhosa were distributed to pre-identified I&APs through registered mail, fax, email, and SMS.

(c) Site notices written in English, Afrikaans and isiXhosa were placed at 100 onshore locations along the west coast from 16 to 20 August 2022.

(d) Newspaper advertisements were published in five newspapers i.e., Cape Times (English and IsiXhosa), Sentinel News (English and Afrikaans), Weslander (English and Afrikaans), Ons Kontrei and Die Platteriander (English and Afrikaans) between 19 and 26 August 2022.

(e) Radio advertisements were published in four radio stations i.e., KFM (English), Radio NFM (English and Afrikaans), Radio West Coast (English and isiXhosa) and Radio Namaqualand (English and Afrikaans) between 26 August to 03 September 2022.

(f) Initial series of public meetings were held in Cape Town, Hout Bay, Saldanha Bay, Lamberts Bay, Hondeklip Bay and Port Nolloth between 29 August and 03 September 2022.

(g) A second series of public meeting were held in the same locations between 31 October and 05 November 2022, including a virtual meeting held on MS Teams on 10 November 2022

(h) Comments and issues raised by I&APs were adequately addressed in the BAR/EMPr.

4. Conclusion

In view of the above and having taken into consideration environmental management principles as set out in section 2 of NEMA this Department is satisfied that the proposed activities will not conflict with the objectives of the Integrated Environmental Management set out in Chapter 5 of the National Environmental Management Act, 1998 and will not result to any detrimental risks to the environment and public. This environmental authorisation is accordingly granted.

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MR JACOB MBELE
DIRECTOR-GENERAL
DATE OF THE EA: 17/4/2023

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"A3"

MINISTER

FORESTRY, FISHERIES AND THE ENVIRONMENT

REPUBLIC OF SOUTH AFRICA

Reference: LSA 231667

APPEAL DECISION

APPEALS AGAINST THE DECISION TAKEN BY THE DEPARTMENT OF MINERAL RESOURCES AND ENERGY, TO GRANT AN ENVIRONMENTAL AUTHORISATION TO TGS GEOPHYSICAL COMPANY (UK) LIMITED FOR THE PURPOSE OF THE PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT PROJECT, LOCATED OFFSHORE OFF THE WEST COAST, SOUTH AFRICA

Western Cape Department of Environmental Affairs and Development Planning	First Appellant
Ajkolowa Fisheries Primary Cooperative Ltd	Second Appellant
Angela Joubert	Third Appellant
Oceans not Oil Coalition	Fourth Appellant
Elaine Mills	Fifth Appellant
Natural Justice/Green Connection	Sixth Appellant
TGS Geophysical Company (UK) Limited	Applicant
Department of Mineral Resources and Energy	Competent Authority

APPEALS AGAINST THE DECISION TAKEN BY THE DEPARTMENT OF MINERAL RESOURCES AND ENERGY, DATED 17 APRIL 2023 TO GRANT AN ENVIRONMENTAL AUTHORISATION TO TGS GEOPHYSICAL COMPANY (UK) LIMITED FOR THE PURPOSE OF THE PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT PROJECT, LOCATED OFFSHORE OFF THE WEST COAST, SOUTH AFRICA.

Appeal: These appeals were lodged against the decision taken by the Department of Mineral Resources and Energy to granting an Environmental Authorisation to TGS Geophysical Company (UK) Limited, on 17 April 2023, for certain 3D seismic survey activities in the orange basin, located offshore off the West Coast of South Africa, approximately 120km offshore of St Helena Bay, extending north along the West Coastline to approximately 230km offshore of Hondeklip Bay.

1. BACKGROUND

1.1 On 22 September 2022, TGS Geophysical Company (UK) Limited (the Applicant) applied to the Department of Mineral Resources and Energy (DMRE) for an Environmental Authorisation (EA) to conduct specified 3D seismic survey activities in the Orange Basin, located offshore off the West Coast of South Africa, approximately 120km offshore of St Helena Bay, extending north along the West Coastline to approximately 230km offshore of Hondeklip Bay.

1.2 This application was submitted in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as amended, read with the Environmental Impact Assessment Regulations, 2014 (2014 EIA Regulations) to the DMRE, being the Competent Authority (CA) in respect of this application.

1.3 As required by regulation 12 of the 2014 EIA Regulations, the Applicant commissioned Environmental Impact Management Services (Pty) Ltd (EIMS) as an independent environmental assessment practitioner (EAP), to prepare and submit the application for EA.

1.4 In support of this application for an EA, and as required by Regulation 19 of the 2014 EIA Regulations, the EAP submitted the Basic Assessment Report (BAR) dated 6 December 2022 for consideration and decision making.

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APPEALS AGAINST THE DECISION TAKEN BY THE DEPARTMENT OF MINERAL RESOURCES AND ENERGY, DATED 17 APRIL 2023 TO GRANT AN ENVIRONMENTAL AUTHORISATION TO TGS GEOPHYSICAL COMPANY (UK) LIMITED FOR THE PURPOSE OF THE PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT PROJECT, LOCATED OFFSHORE OFF THE WEST COAST, SOUTH AFRICA.

1.5 In terms of the BAR:

1.5.1 The proposed project area is located between approximately 120km offshore of St Helena Bay, extending north along the western coastline to approximately 230km offshore of Hondeklip Bay over a number of petroleum licence blocks. The Application Area for the proposed 3D seismic survey is approximately 57 400 km² in extent (the Area);

1.5.2 It is proposed that a single survey vessel equipped with seismic sources and streamers be used. The proposed 3D survey would be supported by up to two escort vessels. The 3D survey will take in the order of 70 days including downtime;

1.5.3 The application is, in accordance with the NEMA-Listed activity/ies for Listed Activity 21(b) (GNR 983) as follows:
"Any activity including operation of that activity which requires a reconnaissance permit in terms of section 74 of the Mineral and Petroleum Resource Development Act, as well as any other applicable activity as contained in the Listing Notice or in Listing Notice 3 of 2014, required to exercise the reconnaissance permit, excluding- (a) any desktop study; and (b) any aerial survey."

1.6 On 17 April 2023, the DMRE granted the EA to the applicant under DMRE reference number PSA Ref: 12/1040.

1.7 The registered and affected parties (I&APs) were informed of the decision to grant the EA on 26 April 2023.

1.8 The Directorate: Appeals and Legal Review (Appeals Directorate) within the Department of Forestry and Fisheries and the Environment (the Department) received the following appeals against the decision that was taken to grant the Applicant an EA:

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APPEALS AGAINST THE DECISION TAKEN BY THE DEPARTMENT OF MINERAL RESOURCES AND ENERGY, DATED 17 APRIL 2023 TO GRANT AN ENVIRONMENTAL AUTHORISATION TO TGS GEOPHYSICAL COMPANY (UK) LIMITED FOR THE PURPOSE OF THE PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT PROJECT, LOCATED OFFSHORE OFF THE WEST COAST, SOUTH AFRICA.

1.8.1 First Appellant – Western Cape Department of Environmental Affairs and Development Planning on 15 May 2023

1.8.2 Second Appellant - Aukotowa Fisheries Primary Cooperative Ltd on 15 May 2023;

1.8.3 Third Appellant - Angela Joubert on 12 May 2023;

1.8.4 Fourth Appellant - Oceans not Oil Coalition on 12 May 2023;

1.8.5 Fifth Appellant - Elaine Mills on 12 May 2023; and

1.8.6 Sixth Appellant - Natural Justice/Green Connection on 12 May 2023.

1.19. These appeals were lodged in terms of section 43(1) of NEMA, read together with Regulation 4 of the National Appeal Regulations, 2014 (2014 Appeal Regulations).

1.20. On or between 2-12 June 2023, the Applicant submitted its responding statements to the appeals in terms of Regulation 5 of the 2014 EIA Regulations.

1.21 The DMRE submitted comments in respect of the First, Second, Fourth and Fifth Appellants' grounds of appeal on 26 June 2023.

1.22. The appeals are premised on the grounds summarised below:

1.22.1 First Appellant's grounds of appeal

- Cumulative impacts not assessed and lack of scientific knowledge to gauge the impact of seismic acoustic blasts and their effect on the marine environment;
- Activities approved in the absence of a Strategic Environmental Assessment.

1.22.2. Second Appellant's grounds of appeal

- Concerns about the consultation process;
- Concerns that the process was not open and a transparent participatory in accordance with NEMA;

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- Questioning the submissions from the Applicant regarding the "perceived impact" of proposed activities as opposed to the "actual impact".
- Concerns that granting the EA does not meet South Africa's climate change goals, e.g., Paris Agreement and Kyoto Protocol, and effort to achieve net zero.

1.22.3. Third Appellant's grounds of appeal:

- lack of in-depth studies on impact of acoustics instruments on the ocean and marine life.

1.22.4. Fourth Appellant's grounds of appeal:

- Need and desirability of the project;
- invasive nature of seismic surveys;
- Repeated, persistent or cumulative exposure impacts;
- No formal analysis of impact on livelihoods;
- No-go not properly considered.

1.22.5. Fifth Appellant's grounds of appeal:

- Need and desirability of the project;
- invasive nature of seismic surveys;
- Repeated, persistent or cumulative exposure impacts;
- No formal analysis of impact on livelihoods;
- No-go not properly considered.

1.22.6. Sixth Appellants' grounds of appeal:

- Need and desirability of the project;
- Invasive nature of seismic surveys;
- Repeated, persistent or cumulative exposure impacts;
- No formal analysis of impact on livelihoods;
- No-go not properly considered

1.23. This is an appeal in a "wide" sense. I have therefore approached the appeal by reassessing and re-determining the merits of the EA application.

1.24. Before I deal with each of the grounds of appeal, I wish to stress that I was guided in this appeal by the principles set out in section 2 of NEMA. These principles apply alongside all of the other appropriate and relevant considerations, including Government's responsibility to respect, protect, promote and fulfil the social and economic rights in Chapter 2 of the Constitution and in particular the basic needs of persons disadvantaged by unfair discrimination. My decision has therefore been guided after a careful consideration of all of the principles set out in section 2 of NEMA, including section 2(2) which provides that 'environmental management must place people and their needs at the forefront of its concern and serve their physical, psychological, developmental, cultural and social interests equitably"; also section 2(3) which provides that "*development must be socially, environmentally and economically sustainable*". Moreover, when I considered the issue of sustainable development, I did so with section 2(3) in mind and I considered the proper application of the factors articulated in section 2(4)(a) to (r).

1.25. I am also guided by the judgement in *Earthlife Africa Johannesburg v Minister of Environmental Affairs and Others*[1] where at para 80 of this judgment, the Honourable Murphy J explained that:

> "*NEMA, the act legislation, must be interpreted purposively and in a manner that is consistent with the Constitution, paying due regard to the text and context of the legislation. Section 2 of NEMA sets out binding directive principles that must inform all decisions taken under the Act, including decisions on environmental authorisations. The directive principles serve as guidelines (by reference) to which any organ of state must exercise any function when taking any decision in terms of NEMA or any statutory provision concerning the protection of the environment. They guide the interpretation,*

[1] [2017] 2 All SA 519 (GP)

administration and implementation of NEMA, and any other law concerned with the protection or management of the environment. Competent authorities must take into account the directive principles when considering applications for environmental authorisation. The directive principles promote sustainable development and the mitigating principle that environmental damage must be avoided, minimised and remedied. The environmental impact assessment process is a key means of promoting sustainable development, by ensuring that the need for development is sufficiently balanced with full consideration of the environmental impacts of a project with potential environmental impacts. The directive principles caution decision-makers to adopt a risk-averse and a careful approach, especially in the face of incomplete information."

1.26. **With this in mind, I now deal with the grounds of appeal submitted by each of the appellants and where I deem it appropriate, I shall address those grounds of appeal that are overlapping in nature or duplicated under a single ground of appeal.**

2. GROUNDS OF APPEAL, RESPONSES AND COMMENTS

First Appellant's Grounds of Appeal

2.1. The First Appellant raised the following grounds of appeal:

2.1.1. Cumulative Impacts was not assessed in that there is insufficient scientific knowledge to gauge the impact of seismic acoustic blasts and their effect on the marine environment; and

2.1.2. Activities were approved in the absence of a Strategic Environmental Assessment (**SEA**).

First Appellant's Submissions

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APPEALS AGAINST THE DECISION TAKEN BY THE DEPARTMENT OF MINERAL RESOURCES AND ENERGY, DATED 17 APRIL 2023 TO GRANT AN ENVIRONMENTAL AUTHORISATION TO TGS GEOPHYSICAL COMPANY (UK) LIMITED FOR THE PURPOSE OF THE PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT PROJECT, LOCATED OFFSHORE OFF THE WEST COAST, SOUTH AFRICA.

2.2. The First Appellant made the following submissions in support of its grounds of appeal:

2.2.1. The impact of seismic acoustic blasts is not conclusive and therefore presents an environmental risk to the marine environment if undertaken. It was submitted that in terms of section 2 of NEMA the "precautionary principle" applies in South Africa and that unlike other counties, South Africa's policy and legal framework requires more conclusive evidence to support an activity with a potential significant impact over a large area;

2.2.2. The cumulative impacts of reconnaissance, exploration and mining and drilling activities have not been assessed and evaluated in the context of the impact on other marine and coastal-based economic activities;

2.2.3. it (the First Appellant) commented on the BAR and noted the inconclusiveness of scientific knowledge on the impact of seismic surveys incorporating acoustic blasts on the marine environment;

2.2.4. Reference was made to the decision of the Western Cape High Court judgement in the case of *Christian John Adams & Others v Minister of Mineral Resources and Energy & Others (case number: 13062/22)* where the applicants in that matter presented the argument that cumulative impacts of seismic surveys have not been studied in South Africa and that the impact on fish assemblages was difficult to interpret; and

2.2.5. The activities have been approved in the absence of SEA, which would serve to coherently plan/co-ordinate the activities to manage the cumulative impacts. The decisions taken are "piece-meal" and do not ensure the development of the nation's mineral and petroleum resources in a proper, orderly and ecologically sustainable manner while promoting justifiable social and economic development as per the objectives set out in section 2(h) of the Mineral and Petroleum Resource Development Act 28 of 2002 (MPRDA).

Applicant's response:

2.3. The Applicant responded to the First Appellant's grounds of appeal as follows:

2.3.1. The assumptions and limitations, including knowledge gaps, were included in the BAR. Having regard to these information gaps, the assessment of the impact of the proposed activities adopted a strongly precautionary approach. It is acknowledged that information on deep-water habitats and their associated biota is lacking however, this is primarily due to the difficulties and high costs associated with sampling beyond the inner continental shelf;

2.3.2. Virtually all of the limited information available has been obtained during hydrocarbon exploration projects, which in themselves provided a good opportunity for collecting baseline data at depths beyond which commercial fisheries operate. Information from such ecological baseline surveys is, however, not always made publicly available as it is often considered proprietary information;

2.3.3. Even with the information gaps, the level of certainty (confidence rating) of the impact predictions in the marine fauna report is considered high;

2.3.4. Furthermore, the Project may be able to contribute to conducting independent research on how fish species on the West Coast (such as snoek) respond to seismic surveying. As the location of this particular survey is far offshore, the impact on the biophysical environment is expected to be relatively low. The Project is seen as a good opportunity to obtain local data and to conduct local research that could be useful for similar projects and applications that may take place in the future. The Applicant undertook to liaise with relevant scientific research institutions to investigate the potential of collaborating in independent on-water research during the survey, as recommended in the BAR;

2.3.5. The the decision referred to by the First Appellant in *Christian John Adams & Others v Minister of Mineral Resources and Energy* is not directly comparable to the application for EA, primarily because the extent of the proposed application area is significantly smaller and is located approximately 200km offshore. Thus, the extent of sensitive environments within the Project area is substantially smaller and will affect a substantially smaller number of users;

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2.3.6. For both technical and commercial reasons, it is unlikely that concurrent seismic surveys will be undertaken in the same area during the same survey window. However, the cumulative impacts associated with multiple surveys were assessed and detailed in Section 9.3.5 of the BAR. Furthermore, the cumulative impacts were considered as part of each of the impacts identified for the entire project as detailed and described where relevant in Section 9.3 of the BAR.

2.3.7. In addition, the offshore activities are proposed and authorised within a framework of existing legislation, policies and management plans, such as those described in detail in Sections 4 and 8.6 of the BAR. In addition, the law currently does not require that a SEA be undertaken as a precursor to a project receiving an EA.

2.3.8. Furthermore, it was the submission of the First Appellant that undertaking a SEA would be purely speculative in the context that the Project relates to the reconnaissance for a resource and directly to the development of the resource that may potentially be located offshore. Thus, while a SEA would provide an additional framework within which the potential future development of the resources should be considered, such a SEA would rely on the outcome of the exploration to define the nature and extent of the potential resource. Accordingly, without this information a SEA for development of the resource would be purely speculative.

2.3.9. Finally, as stated in section 8.3.10 of the Social Impact Assessment Report (Mitigation and Management), assessing all cumulative impacts of the seismic survey industry on the livelihoods of communities and addressing perceptions and alleviating fear from a strategic perspective is not the Applicant's responsibility and falls outside the scope of the environmental impact assessment. It is the responsibility of the relevant authorities and the industry. However, the seismic survey industry as a whole has and should continue to assess on an ongoing basis its position and social license to operate as an industry in a South African context and work with stakeholders to conduct a SEA of the impact of the industry and further embark on an awareness raising and education campaign. A participatory process, beyond only having meetings is needed including workshops where communities can engage in experiential learning. If the seismic survey industry fails to

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address the community's need for education and cooperation, it will result in significant delays and increase the risk for social unrest. The Applicant has already commenced working with the energy industry alliance, EnerGeo, and with PASA to initiate discussion within the industry. EnerGeo has also been engaged in the consultation process on PASA's new community consultation guidelines.

Competent Authority's Response:

2.4. The Competent Authority responded as follows:

2.4.1. The precautionary principle was considered and followed throughout the EIA process. This process assessed potential and cumulative impacts of the proposed activity and recommended mitigation measures. The recommendations and implementation of the mitigation measures for potential impacts is a precautionary measure.

2.4.2. Whilst gaps in knowledge and limitations in experiments on marine species are acknowledged, precautionary measures have been put in place to manage potential impacts. It should be noted that the limitations in experiments are because the experiments were conducted in controlled environments and therefore, the impacts were noted early and were exaggerated. The literature indicates that the behavior of the tested species would differ in their natural environment. Seismic surveys are undertaken globally with standard and specific mitigation measures without any evidence of injuries and behavioral changes of species that were related to the operations. It can therefore be concluded that the implementation of recommended globally used mitigation measures minimizes the impact on marine species.

2.4.3. The Competent Authority is not responsible for conducting a SEA. Furthermore, the authorised activity followed and met the minimum requirements of the current relevant legislation. Hence, it was approved.

2.4.4. It is therefore satisfied with the assessment conducted by the EAP on behalf of the Applicant.

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2.5. Evaluation (Reasons for Decision)

2.5.1. The crux of this ground of appeal relates to the cumulative impact of reconnaissance, exploration and mining on the ocean and sea life in general.

2.5.2. In this regard, I take note that the seismic survey right was granted to the applicant under section 24 of the 2014 EIA Regulations and in respect of specific and limited areas being the areas specific to 120km offshore of St Helena Bay, extending north along the Western Coastline to approximately 230km offshore of the Hondeklip Bay, off the West Coast of South Africa.

2.5.3. The EA also sets out detailed conditions that must be met by the Applicant, in conducting the intended seismic surveys and I refer to each of the conditions set out in 5.5 of the EA, as if specifically incorporated herein. These conditions incorporate the mitigation measures set out in the BAR which are specifically designed to limit any interference to marine and sea life in the vicinity of the intended survey, and to ensure adequate and proper monitoring of the intended activities on such marine life.

2.5.4 In relation to cumulative impacts, I note that the cumulative impacts have been evaluated and set out in the BAR.

Cumulative noise impacts:

2.5.5. In light of the limited studies on cumulative impacts and on seismic activities, I note that EAP has recommended a number of measures specifically aimed and curbing any cumulative noise impacts associated with multiple studies, albeit that it is unlikely that such activities will be undertaken during the same survey window due to impacts on operation and data acquisition. Thus, whilst there are currently two EA applications for seismic

surveys pending before the DMRE, which overlap the areas of the Project, it is unlikely that they will proceed at the same time as the Project.

2.5.6. Even if these activities are undertaken during the same window, in considering the associated impacts to marine fauna as a result of the three potential surveys, the EAP concludes that such impacts would be of high intensity and extend regionally over a short term and concludes therefore that the consequence for cumulative survey is medium[2]. In particular EAP notes that three seismic surveys of regional extent, undertaken simultaneously, would be expected to result in an impact of medium negative significance on the large pelagic longline sector, both with and without the application of mitigation measures, but without any residual impact once the activities are completed. The impacts are thus limited to the planning and operational phases, and it is not anticipated that there will be any need for closure or rehabilitation once the 3D surveys have been concluded. Closure will be limited to waste generation and disposal and water contamination and pollution measures which aligns with the pre-development.

2.5.7. I further note that the following mitigation measures in relation to noise have been recommended and included in the EMPr :

- A distance of at least 40 km is maintained between survey vessels until sufficient objective evidence is obtained so that a reduced buffer distance is acceptable;
- Each of the additional activities to those described in the technical noise report would be considered required only in the case where a 40 km buffer distance between active survey ships cannot be maintained;
- Should surveys run simultaneously, it would be required to amend the EMPr, which would be subject to further assessment and consultation.

2.5.8. Having considered that it is firstly unlikely that three survey activities will be conducted during the same window and over the same area and taking into account the mitigation

[2] BAR, para 9.35

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measures proposed by the EMPr, which are part of the specific conditions of the EA, I find that any cumulative impacts on the marine fauna and species is adequately catered for in a precautionary manner.

Noise acoustics

2.5.9. At page 240 of the BAR, it is noted that the impact from immediate exposure to individual airgun array pulses, the maximum zones of PTS effect for sea turtles, are predicted to be within 19 metres from the source location. The behavioural disturbance for sea turtles caused by the immediate exposure to individual pulses are predicted to be within 1.3 km of the source array. In terms of the impact from cumulative exposure to multiple airgun array pulses, the noise impacts related to recoverable injury and TTS on sea turtles are expected to be high at the near field from the source location

2.5.10. As a result, the following mitigation, measures to minimise the seismic impact on assessed marine fauna species has been recommended, and included as part of the EMPr :

- Recommended safety zones- based on the maximum threshold distances modelled for PTS (marine mammals and sea turtles) and potential mortal injury (fish) due to immediate exposure from single pulses and cumulative exposure from multiple pulses;
- Implementing a soft-start procedure if testing multiple seismic sources. Delaying soft-starts if shoaling large pelagic fish, turtles, seals, or cetaceans are observed within the zone of impact;
- Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented that would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior to the commencement of the survey and then operational levels of noise during the survey;

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- Lower source levels could be achieved through better system optimization, i.e. a better pairing of source and receiver characteristics, and better system gain(s). For example, new receiver technologies, such as fibre optic receivers, may allow the use of lower amplitude sources through a higher receiver density and/or a lower system noise floor. Some evidence exists which indicates that re-engineered seismic sources with "mufflers" can be used to attenuate unwanted high frequency energy without affecting frequencies of interest. In addition, kerosene free hydro-streamers should be used. It is also important to ensure that 'turtle-friendly' tail buoys are used or that existing tail buoys are fitted with either exclusion or deflector "turtle guards'.

2.5.11. In light of the mitigation measures provided, the proposed survey activities to be undertaken by the Applicant are expected to result in impacts on marine invertebrate fauna in the Orange Basin, ranging from negligible to very low significance.

2.5.12. The EAP also considers that some migratory species are now present year-round off the West Coast, e.g. baleen and toothed whales. The BAR recommends that data collected by independent onboard observers should form part of a survey close-out report to be forwarded to the necessary authorities, and any incidence data and seismic source output data arising from surveys should be made available for analysis of survey impacts in Southern African waters. This recommendation has been incorporated into the EA and also sees to the stoppage of any activities in the event of spotting such marine species.

2.5.13. I further note on page 227 of the BAR that the Applicant specifically addresses the concerns in relation to cumulative impact and notes examples where communities can successfully co-exist.

2.5.14. Moreover, I note that the EAP, in the *Impact Prioritisation*, included that each potentially significant impact has been assessed in terms of cumulative impacts as found on page 194 of the BAR.

2.5.15. I am nevertheless aware of the fact that there are certain limitations and gaps in knowledge as confirmed by the Applicant in their response. In this regard, I note that the location of this survey is faroffshore and that the impacts on the biophysical environment are expected to be relatively low. Furthermore, due to the limited local data there is a need for these types of surveys to be conducted to enable the authorities to obtain the much-needed data and conduct local research that will be useful to inform future applications of this manner.

2.5.16. I note the submission that a SEA should have been conducted, however I do not believe that the absence of a SEA is an impediment to the granting of an EA, because neither NEMA nor the EIA Regulations prohibit the undertaking of reconnaissance activities where there is no SEA or Marine Spatial Plan (MSP).

2.5.17. In the circumstances, these grounds of appeal are without merit and are accordingly dismissed.

Second Appellant's Grounds of Appeal

2.6. The Second Appellant raised the following grounds of appeal:

2.6.1. Concerns about the consultation process.

2.6.2. The process was not an open and a transparent participatory process in accordance with NEMA.

2.6.3. The submissions from the Applicant regarding the "perceived impact" of proposed activities as opposed to the "actual impact".

2.6.4. Concerns that granting the EA does not meet South Africa's climate change goals, e.g., Paris Agreement and Kyoto Protocol.

Second Appellant's Submissions

2.7. The Second Appellant made the following submissions in support of its grounds of appeal:

2.7.1. That the consultation process was not properly conducted, and the information presented during the consultation process was not accurate. As community and small-scale fisher organisation, it does not share Government's position of promoting oil and gas exploration especially as there are various concerns related to such activities. Furthermore, this position of Government is particularly concerning when regard is had to the state of the environment in other countries that have adopted a similar approach. It (the Second Appellant) is concerned about safeguarding South Africa's environmental resources for future generations.

2.7.2. The consultation process was not open and transparent as required by NEMA. There was a failure to consult meaningfully with communities on ways to make a positive impact on communities and that this issue should form part of the consultation process. Instead, communities were presented with limited options that do not have regard to the specific needs of communities. Accordingly, the consultation process is not meaningful.

2.7.3. That the reference "perceived impact" as opposed to the "actual impact" is of concern because there are studies that show the actual impact of the proposed activities on marine life. The Second Appellant cites the incident of the 2010 Gulf of Mexico, Deepwater Horizon blowout as an example.

Applicant's Response

2.8. The Applicant submits that:

2.8.1. The Public Partnership Process (PPP) was conducted in line with the 2014 EIA Regulations and the Second Appellant was specifically identified as a key Interested and Affected Party (I&AP) and thus included in the PPP throughout the basic assessment process. It (the Applicant) scheduled public meetings with the Second Appellant, both at the pre-application and at the BAR review phases; however the Second Appellant refused to engage meaningfully during such meetings.

2.8.2. The purpose of the pre-application meeting was to capture the initial concerns of the members and key I&AP's including the Second Appellant. Community members attended this meeting but only for the purposes of publicly protesting and they left before any presentations could be made. During the BAR review phase meeting, members of the Second Appellant did attend and were given an opportunity to present their views and interact with the EAP.

2.8.3. The information in the BAR report regarding the impact of the proposed project is based on the latest research and that the proposed project will not significantly add to the marine traffic in South African waters as it will only involve two vessels. Whilst the Applicant acknowledges that there may have been projects in other countries that have negatively impacted the environment, lessons have been learnt from these projects and protective and mitigatory measures implemented contributing to internationally accepted best practice as reflected in the BAR. These mitigation measures are set out in the EMPr which has been approved.

2.8.4. Significant measures are taken to ensure that there are no unplanned spills and notes further that the vast majority of exploration industry related pollution events have been down to drilling and extraction activities rather than surveying and further, that the findings

of the specialist studies concluded that there are no fatal flaws that should prevent the proposed project from proceeding. Furthermore, the significant levels of identified negative impacts can generally be reduced to acceptable levels through the recommended mitigation measures that form part of the EA.

2.8.5. The consultation process was carried out in compliance with NEMA, read together with the 2014 EIA Regulations. The Applicant noted that the purpose of consultation was not consent seeking but rather an opportunity for affected parties to raise concerns and for these concerns to be considered and brought to the attention of the decision makers, which in this case is the DMRE. In this regard, there was compliance and that the consultations were therefore meaningful.

2.8.6. It (the Applicant) noted that the use of the offshore environment is not restricted to fishing activities and insofar as the small scale fishing industry is concerned, in terms of the impact assessments undertaken and with the implementation of the approved mitigation measures, the significance of the impact of the proposed project can be reduced to acceptable levels and thus would not lead to significant impacts on users of the same environment in terms of biological and socio-economic environment. Accordingly, the proposed project would not lead to the destruction of the livelihood of small-scale fishing industries.

Competent Authority's Response

2.9. The Competent Authority responded as follows:

2.9.1. It found that that the PPP was undertaken in accordance with the PPP Guideline and thus the minimum requirements of NEMA were met. The Second Appellant had an opportunity to and was involved in the PPP process from the onset and was identified as an I&AP and received all relevant information and notifications.

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2.9.2. All information provided during the PPP was related to the proposed activity and general information was provided relevant to oil and gas in South African and globally. The information referred to by the Second Appellant is unclear and it is therefore not possible to provide a clear response thereto. Oil and gas projects are undertaken in a sustainable manner as regulated by NEMA. Furthermore, the EIA process is designed to ensure that the proposed project is undertaken in a sustainable manner.

2.9.3. The PPP is undertaken in relation to the proposed project activities. In this instance, the proposed project concerned the activity of a seismic survey. The Second Appellant's participation in the PPP is related to raising their concerns, views, objections, and any other related matter that might help in minimizing the impacts of the proposed project activity. As such, the Applicant cannot undertake development activities proposed by communities. It is also important to note that the proposed project has the potential to produce long-term benefits to South Africa, even though immediate benefits are limited. According to the results of the EIA process, the proposed project activity will not result in detrimental impact to the receiving environment.

2.9.4. The impacts on fishing sector were assessed, including impacts on catch rates and it was found that any such negative impacts will be low. The BAR sets out various mitigation measures, such as avoidance of the peak fishing season for the affected sector, and these mitigation measures formed part of the conditions of the EA. Furthermore, blowouts are not expected during the proposed activity.

2.9.5. Past incidences, such as the Deepwater Horizon incident, has led to great improvements in terms of safety during the undertaking on oil and gas activities globally. However, it is to be noted that the proposed project activity differs from the activities undertaken during this incident. Therefore, the potential impacts will also differ. The scientific reports and

information referred to by the Appellant is unclear and therefore it is not possible to respond clearly thereto.

2.9.6. However, there are various resources engaged to monitor and secure the environment and in particular in relation to the fishing activities of the Second Applicant. An Environmental Officer will be appointed to ensure implementation of the approved EMPr. The Marine Mammal Observer and Passive Operator are responsible for monitoring movements of marine species and advising the crew on actions to take. The Fisheries Liaison Officer is responsible for monitoring impacts on marine fauna and communications with maritime vessels.

2.9.7. The authorised activities will not result in detrimental impacts on the receiving environments and therefore, the need for compensation is not expected. The affected area is an open space and thus the focus action would be to clean up the area and make it safe for the activities to continue, should there be a need.

2.9.8. The protocols referred to recognise that there is a need for an energy mix in South Africa and reference various policies that provide for minimization of climate change impacts. The nature and the duration of the planned activities make it impossible to assess the impacts on climate change. According to the results of the EIA, the proposed activity will not result in detrimental impacts on the receiving environment. Whilst there are no immediate benefits anticipated from the proposed activity, however, dependent on the success of the proposed project, there might be future benefits.

2.10. <u>Evaluation (Reasons for Decision)</u>

2.10.1. I have addressed aspects regarding the veracity of the application process and compliance with NEMA, above.

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2.10.2. Regarding whether the Applicant conducted the PPP in accordance with the 2014 EIA Regulations, I am mindful that one of the purposes of the public participation provisions in NEMA and the 2014 EIA Regulations is to afford I&APs the opportunity to express their views on matters affecting them. This principle was reiterated by the Constitutional Court in *Fuel Retailers Association of Southern Africa v Director General Environmental Management Department of Agriculture and Conservation and Environment Mpumalanga Province*[3] (the Fuel Retailers case).

2.10.3. The 2014 EIA Regulations prescribes the specific requirements for the public participation process (PPP).

2.10.4. Regulations 41(2)(b) & (c) and 41(3) of the 2014 EIA Regulations requires the person conducting the PPP to "*give notice to all potential interested and affected parties of an application or proposed application which is subjected to public participation*" by giving written notice, in any of the manners provided for in section 47D of the Act, and by placing an advertisement in a local newspaper, which "*give details of the application or proposed application which is subjected to public participation.*

2.10.5. Regulations 3(8), 19, 40(1) and 43(1) of the 2014 EIA Regulations require that potential or registered I&APs be given a period of at least 30 days to submit their comments on the BAR and EMPr, amongst other reports, prior to submitting the BAR to the competent authority for decision-making purposes.

2.10.6. Regulation 41(6) of the 2014 EIA Regulations requires the person conducting the PPP to ensure that information containing all relevant facts in respect of the application is made available to potential I&APs and that participation by potential or registered I&APs is

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3 *Fuel Retailers Association of Southern Africa v Director General Environmental Management Department of Agriculture and Conservation and Environment Mpumalanga Province* 2007 (6) SA 4 (CC) at para 76.

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facilitated in such a manner that they are provided with a reasonable opportunity to comment on the application or proposed application.

2.10.7. Regulation 44(1) requires the applicant to ensure that the comments of I&APs are recorded in the report and that such written comments, including responses to such comments, are attached to the reports that are submitted to the competent authority.

2.10.8. These provisions are written in peremptory terms.

2.10.9. In evaluating the Second Appellants' contentions that they were not adequately consulted in respect of the EA application for the proposed project, I considered page 37 of the BAR, which sets out the process followed in terms of PPP, and which cites the following:

2.10.9.1. The Applicant identified organs of state and Key Stakeholders on page 37 of the BAR who was consulted, and the Second Appellant's name is reflected on page 37;

2.10.9.2. The PPP commenced on 14 August 2022 with an initial notification and call to register as I&APs for a period of 30 days;

2.10.9.3. Notification letters were distributed in English, IsiXhosa and Afrikaans to all I&APs;

2.10.9.4. Newspaper advertisements describing the proposed project and EIA process was placed in the Cape Times (English and isiXhosa), Sentinel News (English and Afrikaans), Weslander (English and Afrikaans), Ons Kontrei (English and Afrikaans) and Die Plattelander (English and Afrikaans) as well as in the National Gazette;

2.10.9.5. Site notices were placed in English Afrikaans and IsiXhosa at 100 onshore locations adjacent to the application area during the week of 16 to 20 August 2022;

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2.10.9.6. Radio adverts were aired on KFM Radia NFM Radio Namakwaland and Radio West Coast;

2.10.9.7 The BAR was placed for public review to all registered I&APs for a period of 30 days from 21 October -32 November 2022 and hard copies were made available at various venues as set out on page 41 of the BAR;

2.10.9.8. Public meetings were held from 29 August -3 September 2022 at various venues as set out in page 41 of the BAR.

2.10.10. Accordingly, the information before me confirms that the Applicant conducted the PPP in accordance with Chapter 6 of the 2014 EIA Regulations.

2.10.11. Insofar as the Second Appellant has expressed concerns about the perceived impact of the proposed project activities on small scale fishers, I note that with the implementation of the project controls and mitigation measures, that the residual impact of the proposed survey is considered to be of low negative significance.

2.10.12. I further take note that the impact on catch rates due to sound elevation levels was also assessed. The noise effects assessed included physiological effects (physical injurypermanent threshold shift (PTS) and temporary threshold shift (TTS)) and behavioural disturbance due to either immediate impact from single airgun pulses or cumulative effects of exposure to multiple airgun pulses over a period of 24 hours. Sound levels for the seismic survey could notionally be expected to attenuate to below levels for behavioural disturbance at a distance of 4 km from the source. The spatial extent of the impact of sound (produced by the airgun array) on catch rates is expected to be regional, although localised at any one time. In this regard I note that the impact is considered to be of intermediate duration and reversible without additional time or cost. Based on the distance of fishing grounds from the Reconnaissance Permit area, only the large pelagic longline and tuna pole-line sectors are considered to be susceptible to effects of elevated sound. The EAP notes that with the implementation of the project controls and mitigation,

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measures, the residual impact due to seismic noise is considered to be of low negative significance. There is no impact expected on the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, linefish, west coast rock lobster, netfish and small-scale fishing sectors.

2.10.13. The BAR also confirms that the application Area does not overlap with the key spawning or nursery areas therefore the risk of noise disturbance to spawning behaviour and fishery recruitment is considered unlikely.

2.10.14. I also note that the following mitigation measures imposed to limit any impact on the fisheries concerned:

2.10.14.1. In order to mitigate the impacts on the large pelagic longline sector, the survey should avoid taking place during June and July;

2.10.14.2. Prior to the commencement of survey activities, affected parties should be informed of the navigational co-ordinates of the proposed survey acquisition area, timing and duration of proposed activities and any implications relating to the safety zone that would be requested, as well as the movements of support vessels related to the project (FishSA, SA Tuna Association, SA Tuna Longline Association and Fresh Tuna Exporters Association);

2.10.14.3. Other key stakeholders should be notified prior to commencement and on completion of the survey (DFFE, the South African Navy Hydrographic Office (SANHO), South African Maritime Safety Association (SAMSA) and Ports Authorities);

2.10.14.4. For the duration of the survey, a navigational warning should be broadcast to all vessels via Navigational Telex (Navtex) and Cape Town radio;

2.10.14.5. Updates of the scheduled weekly survey plan should be circulated to the operators of affected fishing vessels on a daily basis;

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2.10.14.6.A Fisheries Liaison Officer (FLO) should be present on board the seismic vessel or escort vessel for the duration of the survey In order to facilitate communications between the seismic and fishing vessels in the project area.

2.10.15.Considering the mitigation measures from the specialist studies, I find that the measures to limit the survey to avoid sensitive areas and periods for some marine fauna; movement of migratory cetaceans (particularly beleen whales) from their southern feeding grounds into low latitude waters (June/July and late October/November) and their aggregation on the summer feeding grounds between St Helena Bay and Dassen Island from late October to late December; ensure that migration paths are not blocked by seismic operations; and to avoid periods of peak fishing activity during June and July in order to reduce the probability of disruption to the large pelagic longline fishing sector and tuna pole line fishing sector; are reasonable and sufficient to mitigate against any impact to such fisheries.

2.10.16.I have also considered the Heritage and Social Assessment impact studies report and note that the identified impact on fishing stock is confirmed to be low for all species. By inference, a potential impact on fishing yield could be expected and thus potential economic impact on communities due to reduced caught fish volumes. Pre-mitigation negative impact on a regional scale over the long term with a moderate intensity is predicted due to the potential indirect impact on the communities and, ultimately, their heritage, with a high probability of this impact occurring. The pre-mitigation impact on heritage resources is rated as medium. The potential residual impact on heritage resources, with mitigation measures from the scientific studies, is projected as low with a medium confidence factor.

2.10.17.Although the marine fauna and fisheries specialists have indicated that the impacts on the marine fauna would be negligible, the concern of communities remains that there are significant gaps in the available data. Fishing communities, with generations of experience in the ocean, fear that the behaviour of the fish will change and that this would affect their

catch rates and consequently their livelihoods. The concern of cumulative impacts that will push the ocean beyond recovery from such activities is raised. I do however note that the EAP indicated that the Applicant, as well as other companies that want to do surveys or exploration in the area, currently do not have social license to operate. A large part of this is due to a lack of meaningful consultation by previous applicants from a community perspective. If the Applicant or any other seismic survey company wants to proceed with the project, they will need to engage in meaningful conversation with the communities and try to restore relationships. From a community and social risk perspective this is not negotiable. I further note that the EAP suggested that the project proceed subject to the mitigation measure of meaningful consultation, local research, education, and awareness raising in the project-affected communities. These conditions were incorporated into the EA, which are requirements prior to the commencement of the survey.

2.10.18. I am accordingly satisfied that the impact on the fishing industry has been properly mitigated.

2.10.19. In the circumstances, there is no merit to these grounds of appeal, and they are dismissed.

Third Appellant's Grounds of Appeal

2.11. The Third Appellant raised the following grounds of appeal:

2.11.1. The impact of the 2D and 3D seismic surveys and the sound impulses and multiple hydrophone streamers on the marine mammals and environment is significantly high and detrimental to their well-being, survival and normal functioning, including marine life and the marine eco-system, both short-term and long-term, in various respects including:

- causing physical injuries as well as mobility and orientation within the ocean body, including sea turtles and whales;
- behavioural patterns will be altered;

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- Mortality rates may increase;
- Negative impact on entire populations and exerting cumulative pressures on already stressed species;
- Impacting on marine fish and mammal food sources like zooplankton.

2.11.2. Detailed impacts of seismic surveying are still unknown; and more research is required;

2.11.3. There is a risk of irreversible damage;

2.11.4. The resultant increase in noise levels is a high risk that will directly and negatively impact marine fish, mammals, fauna and flora and thus the environment.

Applicant's Response

2.12. There was no response from the Applicant.

Competent Authority's Response

2.13. There was no response from the Competent Authority.

2.14. **Evaluation (Reasons for Decision)**

The Third Appellant's appeal is concerned with the impact of the seismic pulses on marine mammals. This aspect has been addressed in detail in the preceding appeals and I refer to my comments in relation thereto.

2.14.1. Accordingly, there is no merit to this ground of appeal, and it is dismissed.

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Fourth, Fifth and Sixth Appellants' Submissions

2.15. The Fourth, Fifth and Sixth Appellants raise the substantially similar grounds of appeal, albeit that some submissions are more detailed than others. The Sixth Appellant made detailed submission in respect of these grounds of appeal and these submissions encapsulate the appeal grounds submitted by the Fourth and Fifth Appellants. As set out above, I address grounds of appeal that are overlapping in nature or duplicated under a single ground of appeal. It is to be noted that these grounds of appeal are extensive extending into over 100 pages. It is therefore not practical to restate the appeal submissions and instead, the grounds of appeal and responses are summarised herein. Regard can be had to the Appeal Response Reports for greater detail.

2.16. The following grounds of appeal were raised:

2.16.1. The desirability assessment is flawed for the following reasons:

- Climate Change Impacts
- The climate crisis
- South Africa's international climate change commitments
- Need for seismic data;

2.16.2. Failure to adequately consider the impact on Marine life;

- Underwater sound from acoustic seismic surveys.
- Harms to marine life
- Acoustic Modelling
- Heightened Legislative Requirements are Not Considered for Critical Biodiversity Areas (CBAs), Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs).
- CBAs
- EBSAs and MPAs.

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- Cape Fur Seals
- Whale and Dolphins.
- Fish.
- Zooplankton
- The proposed mitigation measures are inadequate to prevent unacceptable harm to marine life.
- Simultaneous Surveys
- Lack of baseline noise assessment
- Chronic Noise Impacts

2.16.3. Failure to adequately assess cumulative impacts;

2.16.4. Failure to conduct meaningful consultation with communities and local people (and in particular small-scale fishers), within the PPP, including the Social Impact Assessment process;

2.16.5. The BAR does not contain a proper and objective assessment of the negative impacts of the project on people's human rights;

2.16.6. Failure to consider relevant coastal management considerations or to comply with the National Environmental Management: Integrated Coastal Management, 2008(Act No. 24 of 2008);

2.16.7. Failure to provide adequate reasons for the decision.

- The Appeal was timeously submitted in accordance with the requirements of NEMA, the 2014 EIA Regulations and the Appeal Regulations, 2014, in writing and accompanied by a detailed appeal document, being a statement setting out the detailed grounds of appeal and accompanied by relevant supporting documentation;

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- There are grounds for judicial review under PAJA because the EA comprises administrative action that *inter alia* it:
  - is unconstitutional and unlawful;
  - was taken because of the failure to consider relevant considerations;
  - is not rationally connected to the information before the decision-maker in making the Decision or to the reasons provided by the decision-maker for the Decision; and
  - is so unreasonable that no reasonable person could have granted it.

<u>Response by the Applicant</u>

2.17. The Applicant also provided a comprehensive response to the grounds of appeal raised by the Sixth Appellant. A summary of the response is set out below and more detail can be obtained from the Appeal Response Reports. I note that the Applicant did not respond to the Fourth and Fifth Appellants; however, as indicated above, the grounds of appeal relied upon by these Appellants are encapsulated in the detailed grounds of appeal raised by the Sixth Appellant and accordingly so are the Applicant's responses.

2.18. The Applicants responds that thee Basic Assessment process was conducted in line with the requirements of the 2014 EIA Regulations. This included amongst others that:

2.18.1. The Need and Desirability of the Project was adequately addressed and assessed (Section 5 of the BAR); Marine and cumulative impacts were considered in detail (Section 9 of the BAR);

2.18.2. The EAP appointed for the project conducted an extensive Public Consultation Process, which resulted in meaningful consultation (Section 7 and Appendix 2 of the BA);

2.18.3. As stated in Section 11.3 of the BAR, the findings of the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are

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implemented. Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the reconnaissance activities, the findings of the specialist studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team and the EAP that the significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures and the project should be authorized;

2.18.4. It is not clear from the evidence presented by Appellant, that they have a sufficient mandate from the communities that they claim to represent.

Competent Authority's Response

2.19. The Competent Authority provided a response to the Fourth and Fifth Appellants' grounds of appeal but not to the Sixth Appellant's grounds of appeal. As indicated above, the grounds of appeal relied upon by these Appellants are the same and therefore, the Competent Authority's response applies to all these appeals.

2.20. The following response was submitted by the Competent Authority:

2.20.1. Due to the nature and the duration of the authorised activity, the assessment of the climate change impacts was impossible.

2.20.2. The GHG emissions from the activity will not differ from levels produced by vessels passing through the application area.

2.20.3. Seismic surveys are part of the non-destructive exploration activities as listed in Table 8 of Harris et al., 2022 paper, presenting a list of sea use activities and their compatibility. However, the impacts of seismic surveys are known and will be managed according to industry best practices.

2.20.4. The compatibility of seismic surveys on CBAs is conditional, hence the need to undertake the Impact Assessment to understand the impacts associated with the activity and the

measures to mitigate such impacts. Based on the outcomes of the assessment, the potential impacts of the authorised activity can be managed successfully with the implementation of recommended mitigation measures.

2.20.5. Heritage Impact Assessment undertaken by PGS Heritage (Pty) Ltd included in Appendix 3 of the Basic Assessment provide detailed assessment of intangible heritage. Section 8.8.4 of the BAR provides a synopsis of the intangible heritage aspects considered and assessed in the heritage study.

2.20.6. Cumulative impacts and the possibility of multiple surveys being undertaken simultaneously are considered and assessed in section 9.3.1.4 of the BAR. Cumulative impact of the multiple surveys was found to be of medium significance.

2.20.7. The impacts on livelihoods were assessed satisfactorily. The assessment began by first understanding the dynamics of the affected communities including other aspects that might have caused a negative impact on livelihoods such as the COVID 19 pandemic and lastly considered impacts of the activity. This means that the assessment also considered current impacts on communities' livelihoods. The assessment is in section 9.3.3 of the BAR and the impacts of the authorised activity on livelihoods was found to be on low significance with implementation of recommended mitigation measures.

2.20.8. The "no-go alternative" was considered but was not preferred based on the benefits that might be derived from the success of the authorised project. The project did consider climate impacts, but these could not be assessed due to the nature and duration of the authorised activity. Furthermore, the project will emit GHG emissions levels that will be below the threshold that requires reporting. This indicates that the project will not have significant negative contribution to climate change.

2.21. Evaluation (Reasons for Decision)

2.21.1. The Fourth, Fifth and Sixth Respondent's raise certain issues which have already been addressed in relation to the other appeals lodged and I accordingly refer to my assessment of these issues as set out above including:

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2.21.1.1. The cumulative impact of reconnaissance, exploration and mining on the ocean and sea life in general;

2.21.1.2. The PPP; and

2.21.1.3. The impact of the proposed project activities on small scale fishers.

2.21.2. I note that some of the concerns raised by the Appellants extend beyond the proposed project activity in respect of which the EA was granted. I confirm that any activity beyond the EA will be subject to a separate application and a separate assessment process. Accordingly, it is not relevant and therefore not necessary to consider submissions in respect of activities that fall outside the EA for the purposes of this appeal.

2.21.3. I have considered the needs and desirability of the Project. The BAR on page 21-33 thereof addresses the needs and desirability of the Project and further covers the context of the oil and gas industry, applicable policies and planning frameworks (local, national, and international) and broadly societal needs and public interest. I note that the Project is in alignment with government policies and plans such as the Integrated Resources Plan 2019 (IRP) which recognises the need for South Africa to employ a diversified energy mix to meet the country's electricity requirements. I have furthermore considered the Guideline on Need and Desirability as well as the No- Go alternative which is also addressed on page 36 of the final BAR.

2.21.4. I am therefore satisfied that the criteria for the need and desirability for the Project has been demonstrated by the Applicant, in particular that the Project accords with legislative requirements and government policies and plans, including the IRP, the National Development Plan (NDP) and the draft Marine Spatial Planning Sector Plans which includes a Marine Offshore Oil and Gas Sector Plan (the Draft MS Plan). The IRP and the Integrated Energy Plan (IEP) recognise natural gas as a required source to produce electricity and direct thermal energy. Its role to contribute to maintaining base-load

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electricity and peak-load electricity is acknowledged, and it is also recognised as a way to transition South Africa towards a lower carbon economy providing the flexibility required to complement renewable energy sources and as a lower-carbon option compared to coal.

2.21.5. Having considered the grounds of appeal and the response thereto by the Applicant and the Competent Authority, I am of the view that the potential impacts and mitigation measures in respect of the Project and environmental receptors have been adequately identified, considered and addressed.

2.21.6. I am satisfied that the socio-economic impacts and mitigation measure on *inter alia*, marine fauna, small scale and commercial fishing have been considered and addressed. Any spill is unlikely, and it is therefore unlikely that there will be a need for compensation.

2.21.7. Many of the comments made by the appellants were made on the assumption that the impacts associated with production had to be considered, not just those associated with exploration. This approach is incorrect. The EA and accordingly, this appeal is limited to considerations of the impacts of exploration which are far less significant and far less invasive than they will be if extraction and production takes place. As such, it is not necessary nor appropriate to consider the possible impacts of a project that is not yet planned and that falls outside the scope of the EA.

2.21.8. That being said, I am concerned about the plight of small-scale fishers and the communities that they belong to. I appreciate this Project presents a cause of concern and anxiety for small scale fishers and communities for whom the well-being of the sea, fish stocks and the environment is crucial to their own physical and emotional wellbeing.

2.21.9. Whilst I am satisfied that communities were consulted and that their concerns were taken into account, I nevertheless take the view that the Applicant needs to do more, on an ongoing basis, to allay their fears and anxiety. This can be done if the communities have

an open channel of communication with the Applicant. Thus, if they have concerns that arise from, for example, things that they may see or hear about that worry them or cause them anxiety, they should be able to raise these with the Applicant and the Applicant should spend time investigating the source of the fears and anxiety to allay them or otherwise address them.

2.21.10. For that reason, I am including a new condition in the EA, requiring the Applicant to appoint a community / fisheries liaison officer, who must be available to the affected communities. The communities must have access to the liaison officer who, in turn, must keep them informed of the activities at regular intervals and be available to answer any questions that they may have. This will go a long way to allying fears and anxiety. This is separate from the grievance procedure.

2.21.11. I note the grounds of appeal related to aspects of human rights and constitutionality. As discussed above, I am guided in this appeal by the principles set out in section 2 of NEMA which apply alongside all of the other relevant considerations including constitutional considerations. I am satisfied that the principles in NEMA are constitutionally sound and that the requirements of the Constitution were met during the EAI process. To the extent that parties are dissatisfied with the constitutional compliance of the process I am advised that the principle of subsidiarity applies and that the appropriate course of action would be for the Constitutionality of NEMA to be challenged.

2.21.12. I note that it is submitted that there was a failure to consider relevant coastal management considerations or to comply with the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) (ICMA). I have considered the BAR and am satisfied that that the provisions of the ICMA and section 63 were considered.

2.21.13. I am accordingly satisfied that all relevant factors have been considered that the decision is lawful and constitutionally sound and administratively fair.

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2.21.14. Therefore, save for including the new condition of creating a liaison officer, I find that the grounds of appeal have no merit and are accordingly dismissed.

3. DECISION

3.1. In reaching my decision on these appeals, I have taken the following information into consideration;

3.1.1. The EA dated 17 April 2023;
3.1.2. Responding statements submitted by the Applicant on 2, 6, 7 and 12 June 2023;
3.1.3. Comments submitted by the CA on 26 June 2023 ; and
3.1.4. The information contained in the project file PASA ref: 12/1/040;
3.1.5. The final EAR report, together with relevant specialist studies annexed thereto.

3.2. In terms of section 43(6) of NEMA, I have the authority, after considering the appeal, to confirm, set aside or vary the decision, provision, condition or directive or to make any other appropriate decision.

3.3. Having carefully considered the appeals and responses to them, together with all other relevant information, I have decided as follows:

3.3.1. The applicant's environmental authorisation is confirmed with the same conditions of authorisation as appeared in section 5 of the competent authority's Reasons for Decision dated 17 April 2023. I have however included a special direction, namely a community / fisheries liaison officer be appointed, and this is to be included in the EA.

3.4. In arriving at my decision, it should be noted that I have not responded to each, and every statement set out in the appeals and/or responses thereto. I have, however, considered all of them. Where a particular statement is not directly addressed, the absence of any

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response thereto should not be interpreted to mean that I agree with or abide by the statement made.

3.5. Should any party be dissatisfied with my decision, it may apply to a competent court to have my decision judicially reviewed. Judicial review proceedings must be instituted within 180 days of notification hereof in accordance with the provisions of sections 6 and 7 of the Promotion of Administrative Justice Act No.3 of 2000.

MS B D CREECY, MP

MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT

DATE: 22/5/2024 .

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ENVIRONMENTAL BASIC ASSESSMENT REPORT

PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT

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Appendices

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ACRONYMS AND ABBREVIATIONS

2D	two-dimensional
3D	three-dimensional
ALARP	as low as reasonably practicable
ASA	Acoustical Society of America
BA	Basic Assessment
BAR	Basic Assessment Report
CBA	Critical Biodiversity Area
CITES	Convention on International Trade in Endangered Species
CMS	Convention on Migratory Species
CPUE	Catch per unit effort
CUD	cumulative utilization distribution
DFFE	Department of Forestry, Fisheries and the Environment
DFA	Development Facilitation Act (Act No. 67 of 1995)
DMRE	Department of Mineral Resources and Energy
EA	Environmental Authorisation
EAP	economically active population
EAP	Environmental Assessment Practitioner
EBSA	Ecologically and Biologically Significant Area
ECA	Environment Conservation Act (Act No. 73 of 1989)
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services (Pty) Ltd
EMPr	Environmental Management Programme
ESAs	Ecological Support Areas
ESA	Early Stone Age
FALMDA	Fishing and Mariculture Development Association
FLO	Fisheries Liaison Officer
FRAP	Fishery Rights Allocation Process
GN	Government Notice
GPS	Global Positioning System
GRT	Gross Registered Tonnage
HABs	Harmful Algal Blooms
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IBA	Important Bird Area

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ICCAT	International Commission for the Conservation of Atlantic Tunas
ICHC	Intangible Cultural Heritage
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IFC	International Finance Corporation
IMO	International Maritime Organisation
IMMA	Important Marine Mammal Area
IRP	Integrated Resource Plan
ISO	International Organization for Standardization
IUCN	International Union for the Conservation of Nature
JNCC	Joint Nature Conservation Committee
kts	knots
LSA	Late Stone Age
MLRA	Marine Living Resources Act (Act No. 18 of 1998)
MMO	Marine Mammal Observer
MPA	Marine Protected Area
MPRDA	Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)
MSA	Middle Stone Age
NBA	National Biodiversity Assessment
NDM	Namakwa District Municipality
NDP	National Development Plan
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEMPAA	National Environmental Management Protected Areas Act (Act No. 57 of 2003)
NGOs	Non-Governmental Organisations
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
nm	Nautical Miles
PAM	Passive Acoustic Monitoring
PASA	Petroleum Agency of South Africa
PIM	Particulate Inorganic Matter
POM	Particulate Organic Matter
PPP	Public Participation Process
PTS	Permanent Threshold Shift
RMS	root-mean-square
ROV	Remote Operated Vehicle
S&EIA	Scoping and Environmental Impact Assessment
SACW	South Atlantic Central Water

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SAMPI	South African Multidimensional Poverty Index
SADSTIA	South African Deepsea Trawling Industry Association
SAEON	South African Environmental Observation Network
SAHLLA	South African Hake Longline Association
SAHRA	South African Heritage Resources Agency
SAMSA	South African Maritime Safety Authority
SANHO	South African Navy Hydrographic Office
SANBI	South African National Biodiversity Institute
SANHO	South African Navy Hydrographic Office
SLO	Social Licence to Operate
SOPEP	Shipboard Oil Pollution Emergency Plan
SPL	Sound Pressure Level
SSF	Small Scale Fishers
SSFP	Small-Scale Fisheries Policy
TAC	Total Allowable Catch
TAE	Total Allowable Effort
TCP	Technical Co-operation Permit
TOPS	Threatened and Endangered Species
TSPM	Total Suspended Particulate Matter
TTS	Temporary Threshold Shift
VMEs	Vulnerable Marine Ecosystems

EXECUTIVE SUMMARY

TGS Geophysical Company (UK) (hereafter TGS) has applied for Environmental Authorization (EA) for a 3D seismic survey off the West Coast of South Africa. Environmental Impact Management Services (Pty) Ltd (EIMS) has been appointed by TGS to prepare and submit an application for EA as per the requirements of the Environmental Impact Assessment (EIA) Regulations, 2014, as amended, promulgated under the National Environmental Management Act (Act No. 107 of 1998- NEMA) and the requirements of the Minerals and Petroleum Resources Development Act (Act No. 28 of 2002 – MPRDA).

The proposed project area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 290 km offshore of Hondeklip Bay over a number of petroleum licence blocks. The Application Area for the proposed 3D seismic survey is approximately 57 400 km² in extent. It is proposed that a single survey vessel equipped with seismic sources and streamers be used. The proposed 3D survey would be supported by up to two escort vessels. The 3D survey will take in the order of 70 days including downtime.

A Basic Assessment (BA) process is being undertaken to accompany the EA for the EIA Listing Notices listed activities applicable to the project namely:

- **GN983, Listing Notice 1: Activity 21(b):** Any activity including the operation of that activity which requires a reconnaissance permit in terms of section 74 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice or in Listing Notice 3 of 2014, required to exercise the reconnaissance permit, excluding -

  (a) any desktop study; and

  (b) any aerial survey.

PUBLIC PARTICIPATION PROCESS

The PPP for the proposed project has been undertaken in accordance with the requirements of the NEMA EIA Regulations (2014), and in line with the principles of Integrated Environmental Management (IEM). IEM implies an open and transparent participatory process, whereby stakeholders and other I&APs are afforded an opportunity to comment on the project and have their views considered and included as part of project planning.

The comments received from I&APs during the initial call to register and commenting period so far have been captured in the Public Participation Report (PPR) in Appendix 2. This BA report is being made available for public review from 21 October 2022 to 21 November 2022. A high-level summary of the key comments and concerns raised to date are presented below:

- Effects on migratory patterns of fauna along the West Coast;
- Long term marine life impact if the survey finds exploitable resources;
- Impacts on marine life between the survey site and the coast and how this will impact the future of tourism and agriculture;
- Climate change impacts associated with oil and gas;
- Effects on fisheries and catch rates;
- Food security;
- Free Prior and Informed Consent in public participation processes;
- Previous Public Consultation Processes have been viewed as a "tick box exercise";
- Impact on indigenous cultural heritage, historical connection to the sea;
- EIMS' independence if the applicant pays for the services rendered;
- Alternative technologies to seismic surveys;

- Cumulative impacts; and
- A lot of the communities are very poor. Concern that there will be no economic benefits for the communities as a direct result of the survey.

IMPACT ASSESSMENT

The BA report aims to achieve the following:

- Provide an overall assessment of the social and biophysical environments affected by the proposed project.
- Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed project.
- Identify and recommend appropriate mitigation measures for potentially significant environmental impacts; and
- Undertake a fully inclusive public involvement process to ensure that Interested and Affected Parties (I&APs) are afforded the opportunity to participate, and that their issues and concerns are recorded.

The most significant risks and impacts identified were those that remain high/medium in terms of significance even if post mitigation measures being considered. The following impacts were determined to have a potentially moderate negative final significance:

- Perceived impacts on livelihoods;
- Impacts on sense and spirit of place;
- Impacts on social licence to operate;
- Community expectations;
- Social unrest;
- Uncertainty from a social perspective;
- Concerns about cumulative social impacts; and
- Further marginalization of vulnerable groups.

Mitigation measures have been identified based on input from the Environmental Assessment Practitioner (EAP), public consultation, and specialist assessments. The associated EMPr Appendix 5) includes suggested mitigation mechanisms for avoidance, minimisation and / or management of the negative impacts.

The conclusions and recommendations of this BA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive, and every effort has been made to include representatives of all stakeholders in the study area. The main conclusions from each of the specialist studies are presented below.

NOISE / ACOUSTICS

The zones of potential injuries for fish species with a swim bladder (e.g. shoek), turtles and fish eggs and fish larvae are predicted to be within 180 m from the array source (noise source). However, fish species without swim bladders have higher injury impact thresholds, and therefore have smaller zones of potential injuries within 90 m from the airgun array source.

The zones of potential mortal injuries for fish species with a swim bladder, fish eggs, and fish larvae are predicted to be within 30 m from the adjacent survey lines for all the 24-hour survey operation scenarios considered. For recoverable injury, the zones of impact are predicted to be within 60 m from the adjacent survey lines for fish with a swim bladder for all the operation scenarios considered. Fish without swim bladder are not expected to suffer or any potential injury. The zones of temporary auditory threshold shift (TTS) affect for fish species with

and without swim bladders are predicted to be within 2.9 km from the adjacent survey lines for the relevant 24-hour survey operation scenarios considered. Existing experimental data regarding recoverable injury and TTS impacts for fish eggs and larvae is sparse and no guideline recommendations have been provided. However, based on a subjective approach, noise impacts are expected to be moderate for fish eggs and larvae. Impact is expected to be low for all of them at intermediate and far field from the source location.

Three (3) long range modelling source locations are proposed for the 3D seismic survey. The modelling is representative of the noise propagation within the proposed 3D seismic area. Source location L1 is adjacent to the marine sensitive area (Tripp Seamount – located to the north and outside of the Application Area). L2 represents the average depth of the south survey area and L3 is located towards the deeper water environment of the survey area. As can be seen from the horizontal and vertical contour figures, the received noise levels at far-field locations vary at different angles and distances from the source locations. This directivity of received levels is due to a combination of the directivity of the source array, and propagation effects caused by bathymetry and sound speed profile variations. Thus, it can be said that he sound levels don't change equally over vertical and horizontal distance from the source due to the shape of the sea floor and the direction of the noise source.

In general, the bathymetry profiles with significant upslope section across the continental slope region have the sound propagations experiencing significant attenuation due to the strong interaction between the sound signal and the seabed. The bathymetry profiles with downslope section have much less sound attenuation. These effects are evident in all locations for propagation paths towards shoreline directions.

For all source locations and except for downslope sections, the seabed depth variations are not significant along the propagation paths within the deep-water region. Therefore, the directivity of received noise is dominated by the directionality of the source array.

In terms of the impact from immediate exposure to individual airgun array pulses, the maximum zones of PTS effect for sea turtles are predicted to be within 19 m from the source location. On the other hand, the maximum zones of TTS effect for sea turtles are predicted to be within 24 m of the source array. The behavioural disturbance for sea turtles caused by the immediate exposure to individual pulses are predicted to be within 1.3 km of the source array.

In terms of the impact from cumulative exposure to multiple airgun array pulses, the noise impacts related to recoverable injury and TTS on sea turtles are expected to be high at the near field from the source location. The maximum zones of PTS impact are predicted to range within 10 m of the source array. The maximum zones of TTS effect for sea turtles are predicted to be within 500 m of the source array.

Relevant mitigation measures are recommended to minimise the seismic impact on assessed marine fauna species:

- Recommended safety zones are based on the maximum threshold distances modelled for PTS (marine mammals and sea turtles) and potential mortal injury (fish) due to immediate exposure from single pulses and cumulative exposure from multiple pulses.
- Implement a soft-start procedure if testing multiple seismic sources. Delay soft-starts if shoaling large pelagic fish, turtles, seals, or cetaceans are observed within the zone of impact.
- Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented that would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior to the commencement of the survey and then operational levels of noise during the survey.

MARINE ECOLOGY

The Reconnaissance Permit Area, which is approximately 57 400 km² in size, is located in water depths ranging from ~1 500 m to nearly 4 000 m off the South African West Coast between Alexander Bay and Cape Columbine. The seabed sediments comprise sandy muds. Although influenced by the Benguela Current the Reconnaissance

Permit area is located on the western extent of the coastal upwelling cells. Winds come primarily from the southeast, whereas virtually all swells throughout the year come from the S and SSW direction. The bulk of the seawater in the study area is South Atlantic Central Water characterised by low oxygen concentrations, especially at depth. Surface waters in the Reconnaissance Permit Application area will primarily be nutrient poor and clear, being beyond the influence of coastal upwelling, with seasonal (September to March) nutrient peaks expected on the eastern edge of the Reconnaissance Permit Area during periods of upwelling.

The Application Area falls into the Southeast Atlantic Deep Ocean Ecoregions. Although there is a lack of knowledge of the community structure and diversity of benthic macrofauna off the shelf edge, the South Atlantic bathyal and abyssal unconsolidated habitat types have been rated as 'Least Threatened', reflecting the great extent of these habitats in the South African Exclusive Economic Zone (EEZ). Only sections along the shelf edge and in the Cape Canyon are rated as 'Vulnerable' and 'Endangered' (outside of the Application Area). Geological features of note in, and adjacent to, the Application Area are Child's Bank situated at about 31°S and Tripp Seamount situated at about 29°40'S. Two canyons, the Cape Canyon and Cape Valley also occur to the south, but outside of, of the Reconnaissance Permit Area. Features such as banks and seamounts often host deepwater corals and boast an enrichment of bottom-associated communities relative to the otherwise low-profile, homogenous seabed habitats.

Due to its offshore location, plankton abundance is expected to be low, with the major fish spawning and migration routes occurring inshore on the shelf. The dominant fish in the area would include the migratory large pelagic species such as tunas, billfish and pelagic sharks. Seabirds will be dominated by the pelagic species such as albatross, petrels and shearwaters. Migrating turtles in the area would include the leatherback and loggerhead turtles. Marine mammals likely to occur offshore include a variety of baleen whales including humpbacks, Antarctic minke, fin and sei whales. Toothed whales will include sperm and killer whales, as well as a variety of beaked whales and dolphins. There are six offshore Marine Protected Areas (MPAs) in the general project area but none fall within the Reconnaissance Permit Area. The Application Area lies well offshore of these MPAs. There is some overlap of the Reconnaissance Permit Area with the Orange Seamount and Canyon Complex Ecologically and Biologically Significant Areas (EBSAs). Critical biodiversity areas (CBAs) within the Reconnaissance Permit area include both CBA1 (natural) and CBA2 (natural areas), with a small section of CBA2 (restore) being located in the north.

Potential impacts to the marine fauna as a result of the proposed 3D seismic acquisition include:

- Physiological injury and/or mortality;
- Behavioural avoidance;
- Reduced reproductive success/spawning;
- Masking of environmental sounds and communication;
- Collision of turtles/marine mammals with the survey and support vessels or entanglement in towed acoustic apparatus; and
- Indirect impacts on piscivorous predators due to seismic effects on prey species.

The highest sensitivities in response to the proposed 3D surveys are:

- Humpback whales, which migrate through the area between June and November (inclusive);
- Sperm whales, beaked whales and other odontocetes that frequent offshore waters;
- Large migratory pelagic fish and shark species that show seasonal association with Child's Bank and Tripp Seamount;
- Leatherback turtles which frequent offshore waters in low numbers and aggregate around seamounts to feed on jellyfish; and
- Various pelagic Albatross, Petrel, Storm Petrel and Shearwater species.

If all environmental guidelines, and appropriate mitigation measures recommended in this report are implemented, there is no reason why the proposed seismic survey programme should not proceed. It should also be kept in mind that some of the migratory species are now present year round off the West Coast, and that certain baleen and toothed whales are resident and/or show seasonality opposite to the majority of the baleen whales. Data collected by independent onboard observers should form part of a survey close-out report to be forwarded to the necessary authorities, and any incidence data and seismic source output data arising from surveys should be made available for analyses of survey impacts in Southern African waters.

FISHERIES ASSESSMENT

The potential impacts of the seismic survey programme on fisheries relate to :

- Exclusion of fishing vessels from accessing fishing ground;
- the impact on catch rates as a result of increased noise levels associated with the seismic survey operation;
- accidental loss of equipment from the survey array; and
- accidental release of marine diesel at sea.

Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part A, Rule 10), a seismic survey vessel that is engaged in surveying is defined as a "vessel restricted in its ability to manoeuvre" which requires that power-driven and sailing vessels give way to a vessel restricted in her ability to manoeuvre. Furthermore, under the Marine Traffic Act, 1981 (No. 2 of 1981), a vessel used for the purpose of exploiting the seabed falls under the definition of an "offshore installation" and as such it is protected by a 500m safety zone. It is an offence for an unauthorised vessel to enter the safety zone. In addition to a statutory 500 m safety zone, a seismic contractor would request a safe operational limit (that is greater than the 500 m safety zone) that it would like other vessels to stay beyond. Safety clearances for seismic surveys are usually 6 Nm ahead and astern and 2 Nm to either side of the survey vessel, resulting in an exclusion area of approximately 165 km^2 around the survey vessel. The temporary exclusion of fisheries from the safety zone may reduce access to fishing grounds, which in turn could potentially result in a loss of catch and/or displacement of fishing effort (direct negative impact). The safety zone would be implemented around the seismic vessel for the duration of the project, resulting in an immediate impact that would endure for the duration of the proposed survey (~70 days). The impact of exclusion from fishing ground was assessed on each fishing sector based on the type of gear used and the proximity of fishing areas relative to the Reconnaissance Permit area. With the implementation of the project controls and mitigation measures, the residual impact of the proposed survey is of LOW NEGATIVE significance to large pelagic longline and tuna pole-line sectors. There is no impact expected on the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, linefish, west coast rock lobster, netfish and small-scale fishing sectors.

The impact on catch rates due to sound elevation levels was assessed and sensitivity/vulnerability differences amongst the targeted fish species identified for each sector. Sound generated during the proposed seismic survey is expected to be in the order of 255 dB re 1 µPa at 1 m at an operating frequency range of 5 – 300 Hz. This falls within the hearing range of most fish species. A sound transmission loss modelling study (SLR 2021) identified predicted zones of impact for fish species (amongst other marine fauna species of concern) based on relevant noise impact assessment criteria. The noise effects assessed included physiological effects (PTS) and TTS) and behavioural disturbance due to either immediate impact from single airgun pulses or cumulative effects of exposure to multiple airgun pulses over a period of 24 hours. Based on the current project description, sound levels for the seismic survey could notionally be expected to attenuate to below levels for behavioural disturbance at a distance of 4 km from the source. The spatial extent of the impact of sound (produced by the airgun array) on catch rates is expected to be regional, although localised at any one time. The impact is considered to be of immediate duration and reversible without additional time or cost. Based on the distance of fishing grounds from the Reconnaissance Permit area, only the large pelagic longline and tuna pole-line sectors are considered to be susceptible to the effects of elevated sound. With the implementation of the project controls and mitigation measures, the residual impact due to seismic noise is considered to be of LOW NEGATIVE

significance. There is no impact expected on the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, linefish, west coast rock lobster, netfish and small-scale fishing sectors.

The Reconnaissance Permit area is situated in the Orange Basin, offshore of the shelf break and offshore of grounds of importance for many of South Africa's commercial fishing sectors, as well as small-scale and recreational fisheries. The large pelagic longline sector operates across the extent of the Reconnaissance Permit area, with activity focussed along the continental shelf break. The Application Area does not overlap key spawning or nursery areas therefore the risk of noise disturbance to spawning behaviour and fishery recruitment is considered unlikely.

In order to mitigate the impacts on the large pelagic longline sector, it is recommended that the survey avoid taking place during June and July. Prior to the commencement of survey activities, affected parties should be informed of the navigational co-ordinates of the proposed survey acquisition area, timing and duration of proposed activities and any implications relating to the safety zone that would be requested, as well as the movements of support vessels related to the project. The relevant fishing associations include FishSA, SA Tuna Association, SA Tuna Longline Association and Fresh Tuna Exporters Association.

Other key stakeholders should be notified prior to commencement and on completion of the survey. These include; Department of Forestry, Fisheries and the Environment (DFFE), the South African Navy Hydrographic Office (SANHO), South African Maritime Safety Association (SAMSA) and Ports Authorities. For the duration of the survey, a navigational warning should be broadcast to all vessels via Navigational Telex (Navtext) and Cape Town radio. In addition, it is recommended that updates of the scheduled weekly survey plan should be circulated to the operators of affected fishing vessels on a daily basis. A Fisheries Liaison Officer (FLO) should be present on board the seismic vessel or escort vessel for the duration of the survey in order to facilitate communications between the seismic and fishing vessels in the project area.

It is the reasoned opinion of the specialist that the reconnaissance activities may be authorised, subject to the implementation of the mitigation measures proposed.

HERITAGE ASSESSMENT

The scientific studies conducted for this project identified impacts on fishing stock as low for all species. By inference, a potential impact (albeit low) on fishing yield could be expected and thus potential economic impact on communities due to reduced caught fish volumes. The recommended mitigation measures, as listed in the specialist reports for the project, focus on the reduction of impacts on fish species and the projected reduction of the impact on the commercial and small-scale fishery catch yield. These mitigation measures should then indirectly positively impact the potential negative impacts on the cultural heritage of the communities to be impacted.

The cultural heritage and living heritage related to the communities linked to fisheries and ocean subsistence and further identifying as indigenous communities can potentially be impacted by the proposed project. A pre-mitigation negative impact on a regional scale over the long term with a moderate intensity due to the potential indirect impact on the communities and, ultimately, their heritage, with a high probability of this impact occurring. The pre-mitigation impact on heritage resources is rated as MEDIUM. The potential residual impact on heritage resources, with mitigation measures from the scientific studies, is projected as LOW with a medium confidence factor.

Considering the assessment based on the findings of the fieldwork as well as the scientific studies relating to the impact on fisheries, the specialist is of the opinion that the impact of the proposed project on the cultural heritage resources can be mitigated through the implementation of the recommendations in this report.

SOCIAL ASSESSMENT

TGS's activities for this application would be of short duration if approved, and if viewed in isolation considering only technical risks as discussed in various specialist reports conducted as part of the EIA process, the impacts will be negligible. However, communities feel that there are significant gaps in the available data and from a social perspective the non-technical or social risks can potentially cause significant impacts. Although the marine fauna and fisheries specialists have indicated that the impacts on the marine fauna would be negligible, the

communities, with generations of experience in the ocean, fear that the behaviour of the fish will change and that this would affect their catch rates and consequently their livelihoods. What is seen as a minor impact in a large ecosystem may be experienced as a major impact by an individual. The marine fauna might not be affected greatly, but the fishing community fear that marine fauna might change its behaviour in response and that is a main concern from a social perspective.

Another concern is the cumulative impact of activities in the ocean where these communities earn their livelihoods. Their fears about the tipping point where their source of livelihood does not recover from all the activities in the ocean, and they are no longer able to make their livelihood as fishing communities must be considered. Currently these communities are able to sustain themselves, although it is difficult. The communities are not against development, but they want to see it happen in a sustainable way that does not jeopardise their source of livelihood. They have already seen how their livelihoods are being affected by mining that is taking place in the sea, pollution, climate change, overfishing and businesses such as factories that come and go and often and do not leave in a socially responsible way.

TGS, as well as other companies that want to do surveys or exploration in the area, currently do not have social license to operate. A large part of this is due to a lack of meaningful consultation by previous applicants from a community perspective. If TGS or any other seismic survey company wants to proceed with the project, they will need to engage in meaningful conversation with the communities and try to restore relationships. From a community and social risk perspective this is not negotiable.

Seismic reconnaissance projects are controversial in South Africa and have been in the news frequently in the last year. For many stakeholders it is an emotional matter, for others the potential of impacting their livelihoods is the biggest fear. There are also stakeholders that feel that the exploration for fossil fuels is not in line with sustainable development and the fight against climate change. Other stakeholders feel that it is imperative for the growth and development of the South African economy to engage in these investigations.

From a social perspective it is clear that the communities and majority of local people are opposed to the project. If the project is considered in isolation, the impacts are negligible. However, the project does not happen in a vacuum, and the social environment is much wider than the footprint of the project. If the social risks and potential damage to cultural and indigenous rights are considered the impact on the social fabric of already vulnerable communities may be significant. At this stage communities feel that they cannot make informed decisions. Although all legal processes have been followed, the seismic survey industry is not moving at the pace of the community, and in the long run this will be detrimental to the industry. Potential future benefits and the economic development of the country should the surveys find any significant resources are not disputed. From a social perspective it is recommended that the project proceed subject to the mitigation measures (i.e. meaningful consultation, local research, education, and awareness raising in the project-affected communities) forming part of the conditions for authorisation and being implemented prior to the commencement of the actual survey.

IMPACT STATEMENT

The findings of the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Based on the nature and extent of the proposed project, the level of disturbance predicted as a result of the survey activities, the findings of the specialist studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team and the EAP that the significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures and the project should be authorised.

Some of the key critical mitigation measures are listed below (more detail is provided in Section 11 of this report):

- Plan seismic surveys to avoid sensitive areas and periods for some marine fauna: Movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (June/July and late October/November), and their aggregation on the summer feeding grounds between St Helena Bay and Dassen Island from late October to late December and ensure that

migration paths are not blocked by seismic operations. If possible, the survey should be undertaken from North to South to avoid these feeding aggregations;

- Although a seismic vessel and its gear may pass through a declared Marine Protected Area, acoustic sources must not be operational during this transit;
- Ensure the seismic vessel is fitted with Passive Acoustic Monitoring (PAM) technology, which detects some animals through their vocalisations;
- Define and enforce the use of the lowest practicable seismic source volume for production, and design arrays to maximise downward propagation, minimise horizontal propagation and minimise high frequencies in seismic source pulses;
- Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards';
- Ensure that solid streamers rather than field-filled streamers are used to avoid leaks;
- Make provision for the placing of qualified Marine Mammal Observers (MMOs) on board the seismic vessel;
- Maintain a pre-acquisition watch of 60-minutes before any instances of seismic source testing. If only a single lowest power seismic source is tested, the pre- acquisition watch period can be reduced to 30 minutes;
- Implement a "soft-start" procedure in certain identified scenarios or if testing multiple seismic sources;
- Implement a dedicated MMO and PAM pre- acquisition watch of at least 60 minutes (to accommodate deep-diving species in water depths greater than 200 m);
- Terminate seismic source on observation and/or detection of penguins or feeding aggregations of diving seabirds, turtles, slow swimming large pelagic fish (including whale sharks, basking sharks, manta rays) or cetaceans within the 500 m mitigation zone;
- Terminate seismic source on observation of any obvious mortality or injuries to cetaceans, turtles, seals or mass mortalities of squid and fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO to be as a direct result of the survey;
- Avoid operating during June and July, in order to avoid periods of peak fishing effort by the large pelagic longline sector;
- Prior to the commencement of seismic survey activities the key stakeholders should be consulted and informed of the proposed seismic survey programme;
- An experienced FLO should be placed on board the seismic or guard vessel to facilitate communications with fishing vessels in the vicinity of the seismic survey areas;
- Notify any fishing vessels at a radar range of 12 nm from the seismic vessel via radio regarding the safety requirements around the seismic vessel;
- Implement a grievance mechanism in case of disruption to fishing or navigation;
- Re-assess post project, the effects on the identified communities and their intangible cultural heritage as well as of related economic damage and losses, and human development impacts. Based on the outcomes, provide resources and support for communities to develop and undertake safeguarding measures or plans to enhance the mitigation capacity of their intangible cultural heritage by fostering dialogue, mutual understanding and reconciliation between and within communities. It is anticipated that this can be achieved through the implementation of the mitigation measures in the Social Impact Assessment.

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- TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism.
- TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. TGS will further contact relevant scientific research institutions to offer the potential of collaborating in independent on-water research during the survey.
- Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented that would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior to the commencement of the survey and then operational levels of noise during the survey.
- Consult with communities on potential ways in which to make a positive contribution to the communities.

1 INTRODUCTION

TGS Geophysical Company (UK) (hereafter TGS) has applied for Environmental Authorization for a 3D seismic survey off the West Coast of South Africa. Environmental Impact Management Services (Pty) Ltd (EIMS) has been appointed by TGS to prepare and submit an application for Environmental Authorisation (EA) as per the requirements of the Environmental Impact Assessment (EIA) Regulations, 2014, as amended, promulgated under the National Environmental Management Act (Act No. 107 of 1998- NEMA) and the requirements of the Minerals and Petroleum Resources Development Act (Act No. 28 of 2002 – MPRDA).

The proposed project area is located between approximately 120 km offshore of St Helena Bay (closest point), extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay over a number of petroleum licence blocks. The Application Area for the proposed 3D seismic survey is approximately 57 400 km^2 in extent. It is proposed that a single survey vessel equipped with seismic sources and streamers be used. The proposed 3D survey would be supported by up to two escort vessels. The 3D survey will take in the order of 70 days including downtime.

A Basic Assessment (BA) process is being undertaken to accompany the application for the EA Listing Notices listed activities applicable to the project namely:

- GN985, Listing Notice 1: Activity 21(b): Any activity including the operation of that activity which requires a reconnaissance permit in terms of section 74 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice or in Listing Notice 3 of 2014, required to exercise the reconnaissance permit, excluding –

  (a) any desktop study; and

  (b) any aeial survey.

The Application Area corner coordinate points are listed in Table 1 below. Close towns or points of interest include Cape Town, Hout Bay, Saldanha, Lamberts Bay, Hondeklip Bay and Port Nolloth.

Table 1: Application Area Corner Coordinate Points

Point	Latitude	Longitude	Point	Latitude	Longitude
1	32°59'53.46"S	16°35'02.75"E	6	30°40'16.36"S	13°20'38.26"E
2	32°59'57.95"S	13°55'17.25"E	7	30°32'53.92"S	13°35'15.39"E
3	32°39'06.49"S	13°53'26.20"E	8	30°15'21.82"S	14°04'05.31"E
4	32°09'29.22"S	13°58'04.38"E	9	30°15'27.76"S	14°52'28.65"E
5	31°32'44.64"S	13°29'01.12"E			

1.1 REPORT STRUCTURE

This report has been compiled in accordance with the NEMA EIA Regulations, 2014, as amended. A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in Table 2 below.

Table 2: Report structure

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 3(1)(a)	Details of – i. The Environmental Assessment Practitioner (EAP) who prepared the report; and ii. The expertise of the EAP, including a curriculum vitae;	1.2
Appendix 3(1)(b)	The location of the activity, including – i. The 21-digit Surveyor General code of each cadastral land parcel; ii. Where available, the physical address and farm name; iii. Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	2
Appendix 3(1)(f	A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is – i. A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or ii. On a land where the property has not been defined, the coordinates within which the activity is to be undertaken;	2
Appendix 3(1)(d)	A description of the scope of the proposed activity, including – i. All listed and specified activities triggered and being applied for; and ii. A description of the associated structures and infrastructure related to the development;	3
Appendix 3(1)(	A description of the policy and legislative context within which the development is proposed including:	4

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	i. an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and ii. how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments	
Appendix 3(1)(f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	5
Appendix 3(1)(g)	A motivation for the preferred site, activity and technology alternative	6, 8 and 9
Appendix 3(1)(h)	A full description of the process followed to reach the proposed preferred alternative within the site, including: – i. Details of the development footprint alternatives considered; ii. Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; iii. A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; iv. The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; v. The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – a. Can be reversed; b. May cause irreplaceable loss or resources; and c. Can be avoided, managed or mitigated; vi. The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	6, 7, 8 and 9

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	vii. Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; viii. The possible mitigation measures that could be applied and level of residual risk; ix. The outcome of the site selection matrix; x. If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and; xi. A concluding statement indicating the preferred alternatives, including preferred location of the activity.	
Appendix 3(1)(h)	A full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including – i. A description of all environmental issues and risks that were identified during the environmental impact assessment process; and ii. An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	6, 7, 8 and 9
Appendix 3(1)(i)	An assessment of each identified potentially significant impact and risk, including – i. Cumulative impacts; ii. The nature, significance and consequences of the impact and risk; iii. The extent and duration of the impact and risk; iv. The probability of the impact and risk occurring; v. The degree to which the impact and risk can be reversed; vi. The degree to which the impact and risk may cause irreplaceable loss of resources; and vii. The degree to which the impact and risk can be mitigated;	6, 7, 8 and 9

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 3(1)(k)	Where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report;	11
Appendix 3(1)(l)	An environmental impact statement which contains – I. A summary of the key findings of the environmental impact assessment; II. A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicting any areas that should be avoided, including buffers; and III. A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	11.1 11.2 11.3 11.4
Appendix 3(1)(m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr;	11.4
Appendix 3(1)(n)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	11.2
Appendix 3(1)(o)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	12
Appendix 3(1)(p)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	11
Appendix 3(1)(q)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	N/A
Appendix 3(1)I	An undertaking under oath or affirmation by the EAP in relation to – iv. The correctness of the information provided in the reports; v. The inclusion of comments and inputs from stakeholders and interested and affected parties;	13

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Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	vi. The inclusion of inputs and recommendations from the specialist reports where relevant; and vii. Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	
Appendix 3(1)(t)	Any specific information that may be required by the competent authority; and	None
Appendix 3(1)(u)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.	None

1.2 DETAILS OF THE EAP

EIMS has been appointed by TGS as the Independent Environmental Assessment Practitioner (EAP) to prepare and submit the EA application, Basic Assessment Report, and undertaking a Public Participation Process (PPP) to accompany the Reconnaissance Permit Application. The contact details of the EIMS consultant's and EAP's who compiled this Report are as follows:

- Name: GP Kriel (compiler)/ Liam Whitlow (Reviewer)
- Tel No: +27 11 789 7170
- Fax No: +27 86 571 9047
- E-mail address: tgs@eims.co.za

In terms of Regulation 13 of the EIA Regulations, 2014, as amended, an independent EAP, must be appointed by the applicant to manage the application. EIMS is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations, as well as Section 1 of the NEMA. This includes, inter alia, the requirement that EIMS is:

- Objective and independent;
- Has expertise in conducting EIA's;
- Comply with the NEMA, the environmental regulations and all other applicable legislation;
- Considers all relevant factors relating to the application; and
- Provides full disclosure to the applicant and the relevant environmental authority.

EIMS is a private and independent environmental management-consulting firm that was founded in 1993. EIMS has in excess of 29 years' experience in conducting EIA's. Please refer to the EIMS website (www.eims.co.za) for further details of expertise and experience.

GP holds an M.Env.Sci (Water Sciences) Cum Laude from the North-West University (Potchefstroom Campus) and has been employed as an Environmental Consultant since 2007. GP is a Registered Professional Natural Scientist (South African Council for Natural and Scientific Professions) and a Registered Environmental Assessment Practitioner (Environmental Assessment Practitioners Association of South Africa). He has delivered presentations locally and internationally concerning the use of bio-indicators for the determination of water quality, and has experience in a wide variety of environmental management projects including: Environmental Impact Assessments, Basic Assessments, Geographic Information Systems (GIS), Environmental Compliance Monitoring, Environmental Awareness Training, Aquatic Ecological Assessments, Drinking and Waste Water Treatment Process Audits, Wetland Delineation and Assessments, ISO 14001 Aspect Registers, Water Use Licence Applications, Waste Management Licence Applications, Integrated Waste and Water Management Plans (IWWMP) and Green House Gas Assessments.

Liam holds a B. Sc. Hons degree in Environmental Management and has completed an additional B. Sc. honours course in applied limnology. In addition, he has completed a higher certificate in Project Management with Damelin Business School and a course on ISO14001 Auditing Principles and Environmental Management Systems Auditor Training. Liam is a registered professional natural scientist with the South African Council for Natural Scientific Professions. Liam's professional experience, gained over more than 21 years, lies mainly with environmental impact assessments including project managing significantly large EIA's in the mining and infrastructure sectors. Liam's other experience includes ISO14001, Site Assessments, Water-use licensing, Environmental monitoring, and Environmental Management Plans. Liam's experience lies mainly within South Africa, but he has been involved in projects in both Lesotho and Botswana.

The Curriculum Vitae of the EAP responsible for the compilation of this Report is included in Appendix 1.

1.3 SPECIALIST CONSULTANTS

Specialist studies have been undertaken to address the key impacts that require further investigation, and these include:

- Acoustic Technical Report – SLR Consulting Australia (Pty) Ltd;
- Marine Ecological Assessment – Pisces Environmental Services (Pty) ltd;
- Fisheries Assessment – undertaken by CapMarine (Pty) Ltd;
- Heritage Assessment – PGS Heritage (Pty) Ltd; and
- Social Assessment – Equispectives Research and Consulting Services (Pty) Ltd.

The specialist studies involved the gathering of data relevant to identifying and assessing environmental impacts that may occur as a result of the proposed project. These impacts were assessed according to pre-defined impact rating methodology (Section 9.1). Mitigation / management measures to minimise potential negative impacts or enhance potential benefits are put forward in this BA Report. The specialist reports that informed this BA report are included in Appendix 3.

2 DESCRIPTION OF THE PROJECT AREA

Table 3 indicates the details of the project area for the proposed project including details on the project location as well as the distance from the proposed project area to the nearest towns.

Table 3: Locality details

Project Area	The proposed project area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay over a number of petroleum licence blocks.
Application Area	Proposed 3D Seismic Application Area: approximately 57 400 km^2 in extent.
Magisterial District	Adjacent to the Namakwaland and West Coast District Municipalities.
District Municipality	Adjacent to the Namakwaland and West Coast District Municipalities.
Local Municipalities	Adjacent to various local municipalities: • City of Cape Town; • Cederberg Local Municipality; • Saldanha Bay Local Municipality; • Bergrivier Local Municipality; • Swartland Local Municipality; • Nama Khoi Local Municipality; • Kamiesberg Local Municipality; • Richtersveld Local Municipality; and • Matzikama Local Municipality.
Petroleum License Blocks Covered by Application Area	The following license blocks are covered by the application area: • 12/3/274 ER; • 12/3/348 ER; • 12/3/939 ER; • 12/3/248 ER; and • Open area.

The locality of the proposed Application Area is shown in Figure 1. The proposed project area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay over a number of petroleum licence blocks. The Application Area for the proposed 3D seismic survey is approximately 57 400 km^2 in extent.

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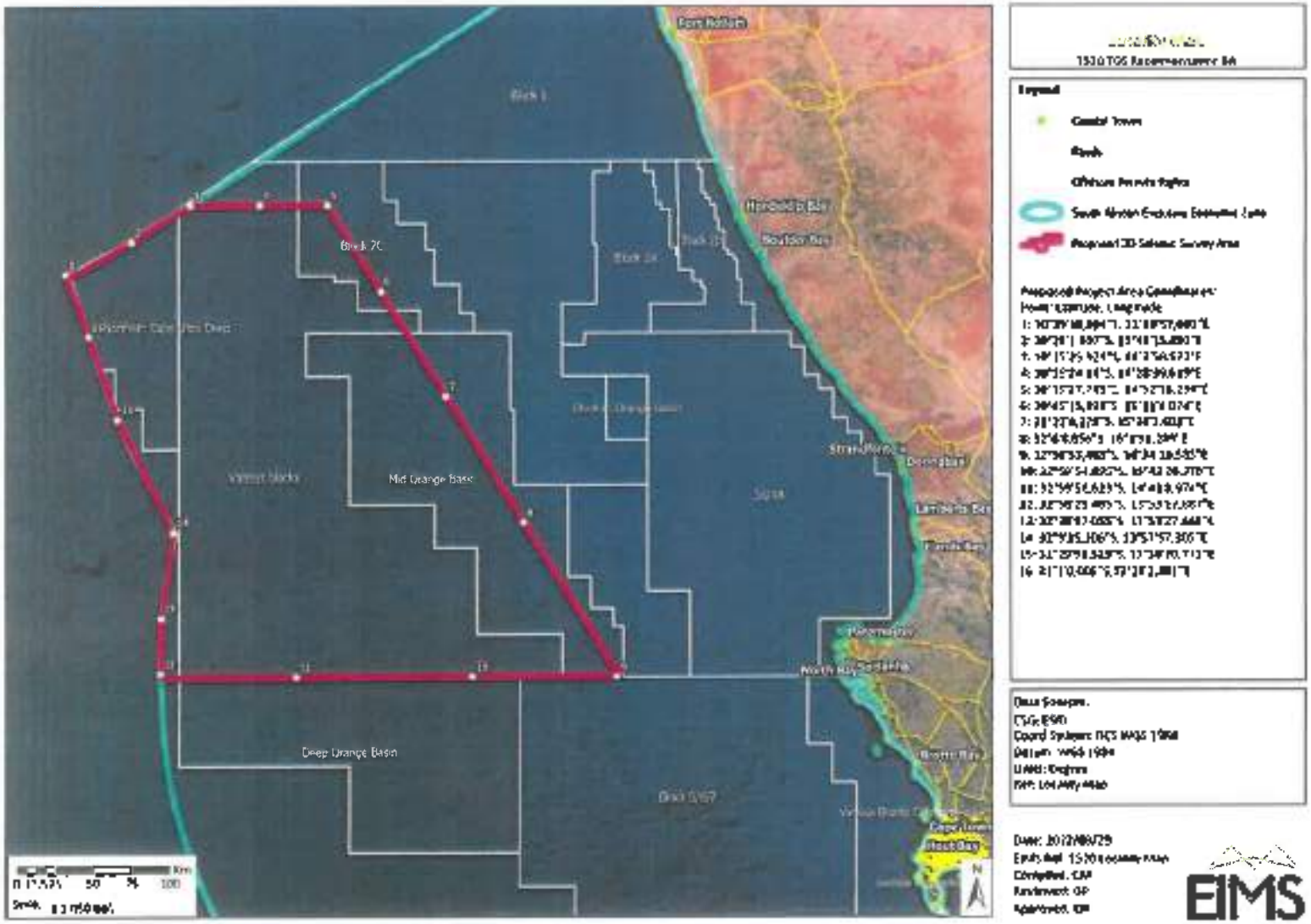

Figure 1: Locality map.

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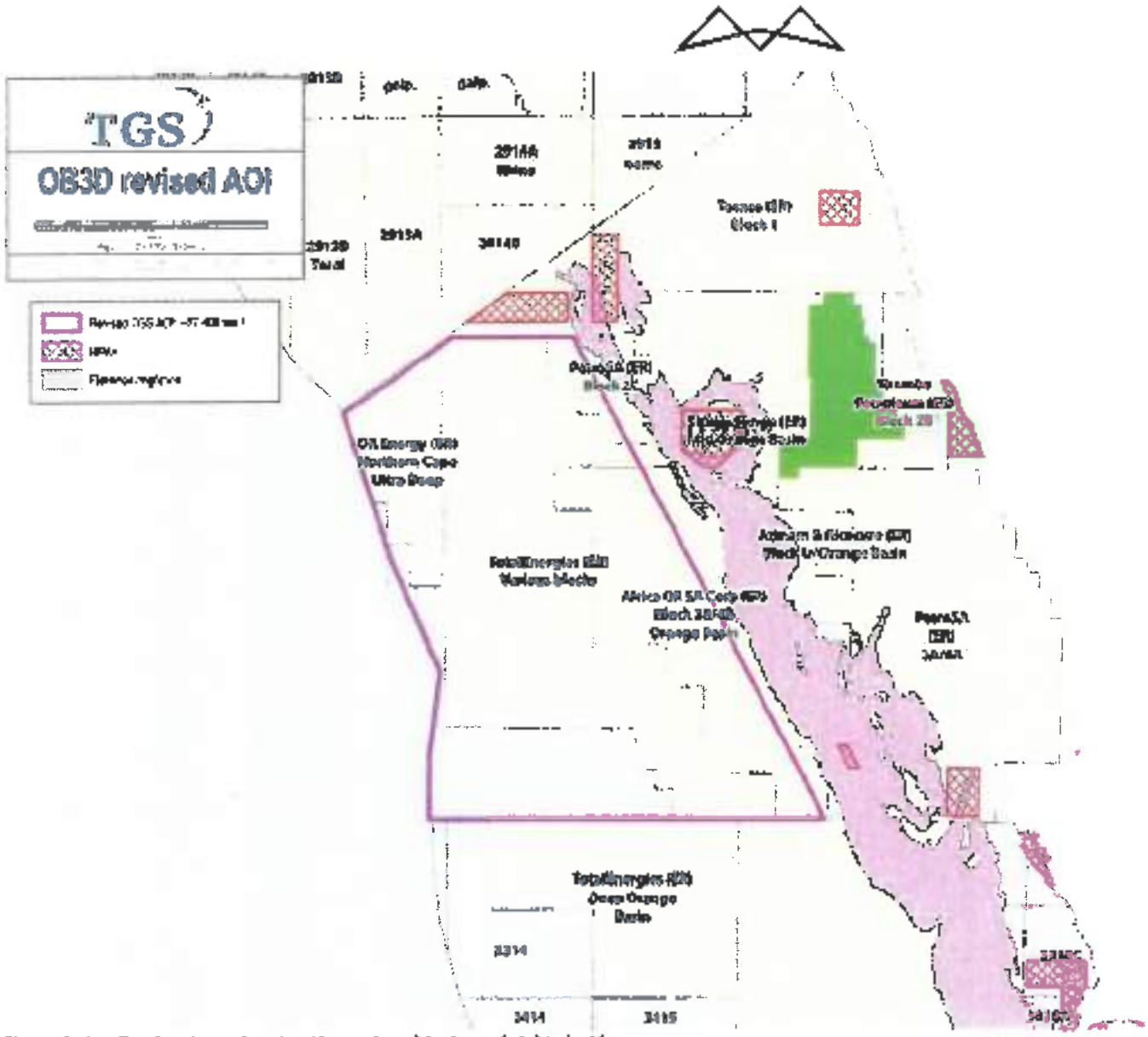
TGS
OB3D revised AOI
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Block 3
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3 DESCRIPTION OF THE PROPOSED ACTIVITY

Seismic survey programmes comprise of data acquisition in either two-dimensional (2D) and/or three-dimensional (3D) scales, depending on information requirements. 2D surveys are typically applied to obtain regional data from widely spaced survey grids and provide a vertical profile through the subsurface, highlighting geophysical, geological information and features along the seismic-line. Infill surveys on closer grids subsequently provide more detail over specific areas of interest. In contrast, 3D seismic surveys are conducted on a very tight survey grid spacing in specific target areas, often identified during 2D applications, providing a cube image of the subsurface geology within the survey volume. The current proposed seismic survey as discussed in this report is a 3D seismic survey and does not include any provision for exploration drilling.

During seismic surveys high-level, low frequency sound pulses are generated by an acoustic instrument towed behind a survey vessel, just below the sea surface. The sounds are directed towards the seabed and the seismic signal is reflected by the geological interfaces below the seafloor. The reflected signals are received by an array of receivers or sets of hydrophones towed behind the vessel in a single streamer (2D) or in multiple streamers (3D) and are fed back to the recording instruments on board. The spacing between the hydrophone groups is commonly 25 m or shorter, depending on the purpose of the seismic survey. Each group contains many hydrophones, spaced less than 1 m apart. The hydrophone streamers must be towed at constant depth (6 – 10 m), with flotation usually achieved by filling the cables with kerosene, gel or flexible polymer foam, so that they are neutrally buoyant. To compensate for minor adjustments, Automatic Cable Levellers, or "birds" are used. The ends of the hydrophone streamers are marked with tail buoys, to warn shipping about the presence of the cable in the water. The tail buoys also act as a platform for surface positioning systems so that the cable locations can be accurately monitored. Refer to Figure 3, Figure 4 and Figure 5 for illustrative examples of typical survey vessel, equipment and activities.

Figure 3: Example of seismic survey vessel and associated equipment (FishSAFE, 2021).

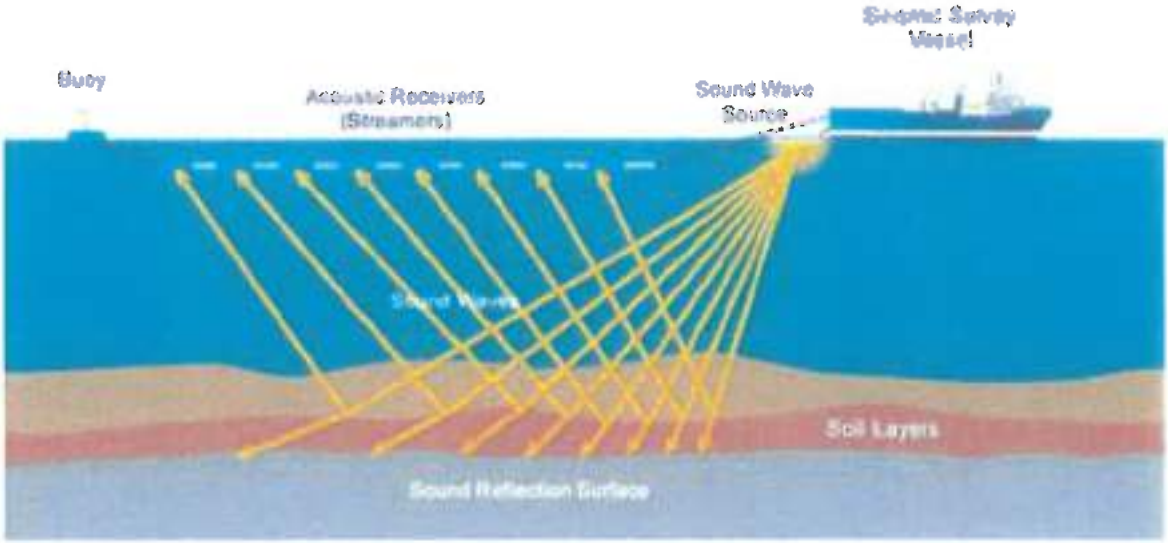

Figure 4: Example demonstration of seismic survey activities (Fish SAFE, 2021).

Figure 5: Schematic diagram showing side-view of the seismic source array and hydrophone cable ("streamer")

While acquiring the seismic data, the survey vessel would travel along transects of a prescribed grid within the Application Area that have been chosen to cross any known or suspected geological structure in the area. The vessel typically travels at a speed of between four and six knots (i.e. 2 to 3 meters per second / 7.2 to 10.8 kilometres per hour) while surveying. The survey vessel length is approximately 100 m.

The proposed survey would involve a seismic sound source and multiple hydrophone streamers, which would be approximately 8 000 m long and 2 000 m wide. The streamers would be towed at a depth of 8 m below the surface and would not be visible, except for the tail-buoy at the terminal end of the cable. The array has an operating pressure of 2 000 pounds per square inch. The sound source would be towed behind the vessel at a depth of between 5 – 25 m below the surface. As the survey vessel would be restricted in manoeuvrability, other vessels should remain clear of it and therefore a support vessel usually assists in the operation of keeping other vessels at a safe distance.

Each triggering of a sound source is termed a seismic pulse, and these are discharged at intervals of 6 – 20 seconds (depending on water depth and other environmental characteristics). Each seismic pulse is usually only between 5 and 30 milliseconds in duration, and despite peak levels within each pulse being high, the total energy delivered into the water is low. Seismic sources have most of their energy in the 5-300 Hz frequency range, with the optimal frequency required for deep penetration seismic work being 50-80 Hz.

Sound levels from individual sound sources used today in the seismic industry range from 200 to 255 dB re 1 µPa at 1 m, for small to large individual seismic sources, respectively. For sound source arrays, sound levels range from 235 dB re 1 µPa at 1 m for a small array (500 cubic inches) to 260 dB re 1 µPa at 1 m for large arrays (7 900 cubic inches). The majority of the produced energy is below 250 Hz, with 90% of the energy between 70 to 140 Hz, although pulses do contain some higher frequencies up to 16 kHz. It must be noted, however, that the sound level specifications for sound source arrays refer to sound levels in the vertical direction directly beneath the sound source array, generally near its centre, with nominal sound levels in the horizontal direction being ~10-20 dB lower.

4 POLICY AND LEGISLATIVE CONTEXT

This section provides an overview of the governing legislation identified which relates to the proposed project. Additional legislation and other guidelines and policies are discussed in Table 5 below.

4.1 CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA

The constitution of any country is the supreme law of that country. The Bill of Rights in chapter 2 section 24 of the Constitution of South Africa Act (Act No. 108 of 1996) makes provisions for environmental issues and declares that: *"Everyone has the right –*

a) to an environment that is not harmful to their health or well-being; and

b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

i. prevent pollution and ecological degradation;

ii. promote conservation; and

iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development"

The BA and associated impact mitigation actions are conducted to fulfil the requirement of the Bill of Rights.

4.2 THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT

The aim of the MPRDA is to *"make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources"*. The MPRDA outlines the procedural requirements that need to be met to acquire mining rights in South Africa. Further to an Acceptance Letter of Reconnaissance Permit (Ref: 12/1/040) dated 15 December 2021 from PASA (and the subsequent extension letters dated 10 February 2022 and 19 May 2022, TGS must apply for Environmental Authorisation in terms of NEMA for any activities requiring a reconnaissance permit as per Section 74 of the MPRDA.

Several amendments have been made to the MPRDA. These include, but are not limited to, the amendment of Section 102, concerning amendment of rights, permits, programmes and plans, to requiring the written permission of the Minister for any amendment or alteration; and the section 5A) requirement that landowners or land occupiers receive twenty-one (21) days' written notice prior to any activities taking place on their properties. One of the most recent amendments requires all mining related activities to follow the NEMA process as per the EIA Regulations, 2014, which came into effect on 4 December 2014.

4.3 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The main aim of the National Environmental Management Act, 1998 (Act 107 of 1998 – NEMA) is to provide for co-operative governance by establishing decision-making principles on matters affecting the environment. In terms of the NEMA EIA Regulations, the applicant is required to appoint an EAP to undertake the EIA process, as well as conduct the public participation process towards an application for EA. In South Africa, EIA's became a legal requirement in 1997 with the promulgation of regulations under the Environment Conservation Act (ECA). Subsequently, NEMA was passed in 1998. Section 24(2) of NEMA empowers the Minister and any MEC, with the concurrence of the Minister, to identify activities which must be considered, investigated, assessed and reported on to the competent authority responsible for granting the relevant EA. On 23 April 2006, the Minister of Environmental Affairs and Tourism (now Department of Environment, Forestry and Fisheries – DFFE) promulgated regulations in terms of Chapter 5 of the NEMA. These regulations, in terms of the NEMA, were amended in June 2010 and again in December 2014 as well as April 2017. The NEMA EIA Regulations, 2014, as amended, are applicable to this project. Exploration activities officially became governable under the NEMA EIA Regulations in December 2014 with the competent authority identified as the DMRE.

The objective of the EIA Regulations is to establish the procedures that must be followed in the consideration, investigation, assessment and reporting of the listed activities that are triggered by the proposed project. The

purpose of these procedures is to provide the competent authority with adequate information to make informed decisions which ensure that activities which may impact negatively on the environment to an unacceptable degree are not authorised, and that activities which are authorised are undertaken in such a manner that the environmental impacts are managed to acceptable levels.

In accordance with the provisions of Sections 24(5) and Section 44 of the NEMA the Minister has published Regulations (GN R. 982) pertaining to the required process for conducting EIA's in order to apply for, and be considered for, the issuing of an EA. These EIA Regulations provide a detailed description of the EIA process to be followed when applying for EA for any listed activity.

In terms of these regulations a Basic Assessment process is required for the proposed project. The Table 4 below identifies the listed activities the proposed project triggers and consequently requires authorisation prior to commencement.

Table 4: NEMA listed activities to be authorised

Activity	Activity Description	Applicability
Listing Notice 1 Activity 21(b)	Any activity including the operation of that activity which requires a reconnaissance permit in terms of section 74 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice or in Listing Notice 3 of 2014, required to exercise the reconnaissance permit, excluding- (a) any desktop study; and (b) any arial survey	The undertaking of 3D survey reconnaissance activities requires a reconnaissance permit in terms of section 74 of the Mineral and Petroleum Resources Development Act.

4.4 THE NATIONAL HERITAGE RESOURCES ACT

The National Heritage Resources Act (Act 25 of 1999 – NHRA) stipulates that cultural heritage resources may not be disturbed without authorisation from the relevant heritage authority. Section 34(1) of the NHRA states that, *"no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority..."* The NHRA is utilised as the basis for the identification, evaluation and management of heritage resources and in the case of Cultural Resource Management (CRM) those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through the NEMA, MPRDA and the Development Facilitation Act (DFA) legislation. In the latter cases the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorisations are granted for a development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impact Processes required by the NEMA and MPRDA. This change requires an evaluation of the Section of these Acts relevant to heritage.

The NHRA provides for the protection of South Africa's natural heritage, including wrecks or associated debris or artefacts that may be found or disturbed on the seabed. Section 13 states that the South African Heritage Resources Agency (SAHRA) is the statutory organisation responsible for the protection of South Africa's cultural heritage. SAHRA thus has jurisdiction over any shipwrecks that may occur within the territorial waters and the maritime cultural zone fall. According to Section 35 of the NHRA, any person who discovers archaeological objects or material (including wrecks) in the course of a development must immediately report the find to SAHRA. No person may, without a permit issued by SAHRA, destroy, damage, excavate, alter, deface or otherwise disturb any archaeological site.

Furthermore, Section 38 deals with matters of Heritage Resource Management. Section 38(8) states that *"(8) The provisions of this section do not apply to a development as described in subsection (1) if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989), or the integrated environmental management guidelines issued by the Department of Environment Affairs and Tourism, or the Minerals Act, 1991 (Act No. 50 of 1991), or any other legislation:*

Provided that the consenting authority must ensure that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of subsection (3), and any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent."

In terms of the above, in terms of this section, the South African Heritage Resources Agency (SAHRA) would need to be notified regarding the proposed development and would act as a key commenting authority.

4.5 NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT

The National Environmental Management Protected Areas Act (Act No. 57 of 2003 – NEMPAA) is intended to *"provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes"* and creating a *"national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity"*.

The NEMPAA defines various kinds of protected areas, namely: *"special nature reserves, national parks, nature reserves (including wilderness areas) and protected environments; world heritage sites; marine protected areas; specially protected forest areas, forest nature reserves and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act 84 of 1998); and mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act 63 of 1970)"*.

There are six offshore Marine Protected Areas (MPAs) in the general project area but none fall within the Application Area. The proposed 3D Application Area lies well offshore of these MPAs. Critical biodiversity areas (CBAs) within the Reconnaissance Permit and 3D Application Areas include both CBA1: natural and CBA2: natural areas.

4.6 ADDITIONAL SOUTH AFRICAN LEGISLATION

Additional legislation may be applicable to the proposed project. These are presented in Table 5 below.

Table 5: Applicable legislation and guidelines overview

Legislation / Guidelines	Description
Potentially Applicable Legislation	
Dumping at Sea Control Act (Act No. 73 of 1980)	This Act controls the dumping of substances at sea. The Act lists substances that are prohibited to be dumped at sea (Schedule 1) and substances that are restricted when dumping at sea (Schedule 2). The Director-General may on application grant a special permit authorising the dumping of substances listed in Schedule 1 or 2.
Environment Conservation Act (Act No. 73 of 1989)	The Environment Conservation Act (Act No. 73 of 1989 – ECA) was, prior to the promulgation of the NEMA, the backbone of environmental legislation in South Africa. To date the majority of the ECA has been repealed by various other Acts, however Section 25 of the Act and the Noise Regulations (GN R. 154 of 1992) promulgated under this section are still in effect. These Regulations serve to control noise and general prohibitions relating to noise impact and nuisance.
Hazardous Substances Act (Act No. 15 of 1973)	This Act provides for the control of substances which may cause injury or ill-health to or death of human. No person may, without a licence: (1) sell any Group I Hazardous Substance; (2) use, operate or apply any Group III Hazardous Substance (listed electronic products); and (3) install or keep any Group III Hazardous Substance.
Marine Living Resources Act (Act No. 18 of 1998)	This Act provides for the conservation of marine ecosystems, the long-term sustainable utilisation of marine living resources and the orderly access to exploitation, utilisation and protection of certain marine living resources.

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Legislation / Guideline	Description
	The Small Scale Fishers Policy was gazetted in May 2019 under the Marine Living Resources Act.
Marine Traffic Act (Act No. 2 of 1981)	This Act regulates marine traffic in South Africa's territorial waters. It regulates the entry and dropping of anchor within 500 m safety zone of installations.
Marine Pollution (Control and Civil Liability) Act (Act No. 6 of 1981)	The purpose of this Act is to provide protection of the marine environment from pollution by oil and other harmful substances, by giving power to South African Maritime Safety Authority (SAMSA) to take steps to prevent harmful substances being discharged from vessels. The applicant would have to disclose to SAMSA before the commencement of proposed activities the amounts and types of chemicals that would be used and disposed of during operations. No disposal of waste at sea is proposed.
Marine Pollution (Prevention of Pollution from Ships) Act (Act No. 2 of 1986)	This Act regulates pollution from ships, tankers and offshore installations, and for that purpose gives effect to MARPOL 73/78. In terms of the Act, it is an offence to discharge any oil from a ship, tanker or offshore installation within 12 miles (19 km) off the South African coast. The discharge of oily water or oil and any other substance which contains more than a hundred parts per million of oil is prohibited between 19 – 80 km offshore. No dumping at sea is proposed as part of this application.
Marine Pollution (Intervention) Act (Act No. 65 of 1987)	This Act gives effect to the international convention relating to the intervention of the High Seas in cases of oil pollution casualties, and to the Protocol relating to intervention of the High Seas in cases of Marine Pollution by substances other than Oil in South African Waters.
Maritime Safety Authority Act (Act No. 5 of 1998)	This Act provides for the establishment and functions of SAMSA. The objectives of the Act are to, inter alia: (1) ensure safety of life and property at sea; (2) prevent and combat pollution of the marine environment by ship; and (3) promote South Africa's maritime interests.
Maritime Safety Authority Levies Act (Act No. 6 of 1998)	This Act provides for the imposition of levies by SAMSA. SAMSA is permitted to raise and collect a levy on all vessels calling at South African ports and operating in South African waters.
Maritime Zones Act (Act No. 15 of 1994)	The Act defines the maritime zones, including territorial waters, contiguous zone, exclusive economic zone and continental shelf. Section 9(1) states that any law in force in South Africa shall also apply on and in respect of an installation.
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	This Act regulates the carrying out of restricted activities that may harm listed threatened or protected species or activities that encourage the spread of alien or invasive species subject to a permit.
Maritime Safety Authority Levies Act (Act No. 6 of 1998)	This Act provides for the imposition of levies by SAMSA. SAMSA is permitted to raise and collect a levy on all vessels calling at South African ports and operating in South African waters.
National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008)	This Act supports the authorisation requirements of NEMA but specifies additional criteria for regulating activities or developments (Section 63) and provides for pollution control within the coastal zone (Sections 69 to 73), where the coastal zone includes the Exclusive Economic Zone defined in the Maritime Zone Act.

Legislation / Guidelines	Description
National Ports Act (Act No. 12 of 2005)	This Act regulates and controls navigation within port limits and the approaches to ports, cargo handling, and the pollution and the protection of the environment within the port limits. The Act specifies a requirement for an agreement with or a licence from the National Ports Authority to operate a port facility or service.
Sea-Shore Act (Act No. 21 of 1935)	This Act declares the State President the owner of the seashore and the sea within the territorial waters of South Africa and provides for the grant of rights in respect of the seashore and the sea and for the alienation of portions of the seashore and the sea.
Applicable Guidelines	
Integrated Environmental Management Information Guidelines Series	The various guidelines will be considered throughout this environmental Scoping and Impact Assessment process. This series of guidelines was published by the Department of Environmental Affairs (DEA – now DFFE) and refers to various environmental aspects. Applicable guidelines in the series for the project include: Guideline 5: Companion to NEMA EIA Regulations (October 2012); Guideline 7: Public participation (October 2012); and Guideline 9: Need and desirability (October 2014). Additional guidelines published in terms of the NEMA EIA Regulations, 2014 (as amended), in particular: Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006; Guideline 4: Public Participation in support of the EIA Regulations, 2006; and Guideline 5: Assessment of alternatives and impacts in support of the EIA Regulations, 2006.

4.7 NATIONAL POLICY AND PLANNING CONTEXT

Various other national policy and planning may be of specific relevance to the needs and desirability of the project with respect to overarching energy and climate change policy and planning in South Africa. These are described below:

4.7.1 INTEGRATED RESOURCE PLAN 2019

The Minister of Mineral Resources and Energy (Minister) published the current Integrated Resource Plan (IRP 2019) as GN 1360 of 18 October 2019 in Government Gazette No. 4278. The Determination provides for various energy sources to be procured from Independent Power Producers (IPPs) through one or more IPP Procurement Programmes as contemplated in the Electricity Regulations on New Generation Capacity, 2011. The plan aimed to balance a number of objectives, namely to ensure security of supply, to minimize cost of electricity, to minimize negative environmental impact (emissions) and to minimize water usage. The IRP 2019 makes provision for gas from year 2024.

4.7.2 NATIONAL DEVELOPMENT PLAN 2030

The NDP aims to eliminate poverty and reduce inequality by 2030. According to the plan, South Africa can realise these goals by drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society. One of the

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key priorities is "faster and more inclusive economic growth". To transform the economy and create sustainable expansion for job creation, an average economic growth exceeding 5% per annum is required. The NDP makes numerous mentions of the need to act responsibly to mitigate the effects of climate change. Diversification of the energy mix away from fossil fuels will be key as energy generation makes up 48 percent of South Africa's GHG emissions. The NDP indicates that "the country will explore the use of natural gas as a less carbon intensive transitional fuel".

4.7.3 WHITE PAPER ON THE ENERGY POLICY OF THE REPUBLIC OF SOUTH AFRICA (1998)

- The White Paper on the Energy Policy (1998) is the overarching policy document which guides future policy and planning in the energy sector. The policy objectives include the stimulation of economic development, management of energy related environmental and health impacts and diversification of the country's energy supply to ensure energy security. The paper states that the government will, inter alia, "promote the development of South Africa's oil and gas resources..." and "ensure private sector investment and expertise in the exploitation and development of the country's oil and gas resources". The successful exploitation of these natural resources would contribute to the growth of the economy and relieve pressure on the balance of payments.

4.7.4 NATIONAL GAS INFRASTRUCTURE PLAN (2005)

- The gas infrastructure plan is intended to be a strategy for the development of the natural gas industry in South Africa. Government wishes to promote the gas industry based on its energy policy objectives as set out in the White Paper on Energy (1998). These include:

  - Increasing access to affordable energy services;
  - Improving energy governance;
  - Stimulating economic activity;
  - Managing energy-related environmental impacts;
  - Securing security of supply through diversity of supply;
  - Competition within and between energy carriers; and
  - Promoting New Partnership for African Development (NEPAD) cross-border type projects.

4.7.5 PARIS AGREEMENT – UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. The Paris Agreement aims to limit the global temperature increase to below 2 °C. Each individual country is responsible for determining their contribution (referred to as the "nationally determined contribution") in reaching this goal. As a signatory to the Agreement, South Africa will be required to adopt the agreement within its own legal systems, through ratification, acceptance, approval or accession. "As a signatory to the Paris Agreement, South Africa is required to investigate alternatives to existing industries which have high carbon emissions. A shift away from coal-based energy production within the energy sector and increased reliance on alternative energy sources is therefore anticipated."

4.7.6 NATIONAL CLIMATE CHANGE RESPONSE WHITE PAPER

The majority of South Africa's energy emissions arise from electricity generation. The Paper sets out South Africa's overall response strategy though strategic priorities, leading to a series of adaption, mitigation, response measures and priority flagship programmes. Policy decisions on new infrastructure investments must consider climate change impacts to avoid the lock-in of emissions intensive technologies into the future. In the medium-

term, the Paper indicates that a mitigation option with the biggest potential includes a shift to lower-carbon electricity generation options.

4.8 INTERNATIONAL LEGISLATION

4.8.1 UNITED NATIONS CONVENTION ON THE LAW OF THE SEA

The United Nations Convention on the Law of the Sea 1982 sets out the roles and responsibilities of the signatory nations in the use of the oceans. The convention establishes guidelines for governments, businesses, and other organisations for the management of marine natural resources. The fundamental principle established in the Convention is that States should cooperate to ensure conservation and promote the objective of the optimum utilization of fisheries resources both within and beyond the exclusive economic zone.

The Agreement attempts to achieve this objective by providing a framework for cooperation in the conservation and management of those resources. It promotes the effective management and conservation of international marine resources by establishing, among other things, detailed minimum international standards for the conservation and management of straddling fish stocks and highly migratory fish stocks; ensuring that measures taken for the conservation and management of those stocks in areas under national jurisdiction and in the adjacent international waters are compatible and coherent; ensuring that there are effective mechanisms for compliance and enforcement of those measures in international waters; and recognizing the special requirements of developing States in relation to conservation and management as well as the development and participation in fisheries of straddling and highly migratory fish stocks.

4.8.2 INTERNATIONAL REGULATIONS FOR PREVENTING COLLISIONS AT SEA

Under the convention on the International Regulations for Preventing Collisions at Sea, a seismic survey vessel that is engaged in surveying is defined as a "vessel restricted in its ability to manoeuvre" and power-driven and sailing vessels are therefore required to give way to it. Vessels engaged in fishing shall, in so far as possible, keep out of the way of the seismic survey operation. Furthermore, under the Marine Traffic Act, 1981 (No. 2 of 1981), a seismic survey vessel and its array of sound sources and hydrophones fall under the definition of an "offshore installation" and as such it is protected by a 500 m horizontal safety zone. It is an offence for an unauthorised vessel to enter the safety zone. In addition to a statutory 500 m safety zone, seismic contractors generally request a safe operational limit (that is greater than the 500 m safety zone) that they would like other vessels to stay beyond. Support vehicles are usually commissioned as 'chase' boats to ensure that other vessels adhere to the safe operational limits.

4.8.3 INTERNATIONAL MARINE CONVENTIONS

The following international marine conventions may be applicable to the proposed survey activities:

- International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL);
- Amendment of the International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL) (Bulletin 567 – 2/08);
- International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC Convention);
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (the London Convention) and the 1996 Protocol (the Protocol);
- International Convention relating to Intervention on the High Seas in case of Oil Pollution Casualties (1969) and Protocol on the Intervention on the High Seas in Cases of Marine Pollution by substances other than oil (1973);
- Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (1989);

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- Convention on Biological Diversity (1992); and
- Benguela Current Convention (2013).

5 NEED AND DESIRABILITY OF THE PROPOSED ACTIVITY

The area proposed for the seismic survey is a large under-explored area with potential for both oil and gas. Based on the initial information review undertaken, TGS has designed a 3D seismic survey to specifically target the area highlighted in Figure 1.

5.1 GUIDELINE ON NEED AND DESIRABILITY IN TERMS OF THE EIA REGULATIONS

The needs and desirability analysis component of the "Guideline on need and desirability in terms of the EIA Regulations (Notice 819 of 2014)" includes, but is not limited to, describing the linkages and dependencies between human well-being, livelihoods and ecosystem services applicable to the area in question, and how the proposed development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, opportunity costs, etc.). Table 6 present the needs and desirability analysis undertaken for the project.

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Table 6: Needs and desirability analysis for the proposed co-disposal facility.

Ref No.	Question	Answer
1	Securing ecological sustainable development and use of natural resources	
1.1	How were the ecological integrity considerations taken into account in terms of: Threatened Ecosystems, Sensitive and vulnerable ecosystems, Critical Biodiversity Areas, Ecological Support Systems, Conservation Targets, Ecological drivers of the ecosystem, Environmental Management Framework, Spatial Development Framework (SDF) and global and international responsibilities.	A number of specialist studies have informed this application and include: • Marine Ecological Impact Assessment; • Fisheries Impact Assessment; • Heritage Impact Assessment; • Social Impact Assessment; and • Acoustic (Noise) Technical Report The conclusions of these studies are included in this report.
1.2	How will this project disturb or enhance ecosystems and / or result in the loss or protection of biological diversity? What measures were explored to avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Refer to baseline marine ecological statement in Section 8, and the impact assessment in Section 9 of this report.
1.3	How will this development pollute and / or degrade the biophysical environment? What measures were explored to either avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	
1.4	What waste will be generated by this development? What measures were explored to avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and / or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	Waste will be generated during the operational phase. The types of waste generated include sewage waste, biodegradable galley wastes, and non-biodegradable solid waste. Waste has been identified as an impact and assessed in Section 9 below. However, it is anticipated that the following measures can be utilised to reduce the impact of the waste on the receiving environment: • Visual inspection that waste does not leave the vessel; • Waste must be securely stored.

Ref No.	Question	Answer
		• All hazardous waste such as oil must be stored seperately and disposed of at a registered facility. • Proof of disposal must be kept by the Applicant.
1.5	How will this project disturb or enhance landscapes and / or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	There are six offshore Marine Protected Areas (MPAs) in the general project area, but none fall within the Application Area. The proposed 3D Application Area lies well offshore of these MPAs. CBAs within the Application Area include both CBA1: natural and CBA2: natural areas. It is recommended that post project, the effects on the identified communities and their intangible cultural heritage as well as of related economic damage and losses, and human development impacts be assessed to verify the findings of the predictive impact assessment. Based on the outcomes resource provision and support for communities to develop and undertake safeguarding measures or plans to enhance the mitigation capacity of their intangible cultural heritage by fostering dialogue, mutual understanding and reconciliation between and within communities is recommended. It is anticipated that this can be achieved through the implementation of the mitigation measures in the Social Impact Assessment.
1.6	How will this project use and / or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Refer to the impact assessment in Section 9 of this report. As a result of the fact that this project entails a 3D seismic survey only it is anticipated that this project will not lead to a significant impact or depletion of non-renewable resources.
1.7	How will this project use and / or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and / or impacts on the ecosystem jeopardise the integrity of the resource and / or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	Refer to the impact assessment in Section 9 of this report. It is anticipated that the project will have a low impact on the localised marine ecology and fisheries.

Ref No.	Question	Answer
1.7.1	Does the proposed project exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)?	The proposed project aims to identify oil and gas resources to be used in the energy production and/ or processing or manufacturing of materials.
1.7.2	Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used?	The proposed project aims to identify oil and gas resources and will not, at this stage, involve the use of the natural resources identified as part of the proposed survey project.
1.7.3	Do the proposed location, type and scale of development promote a reduced dependency on resources?	The proposed project aims to identify oil and gas resources and will not, at this stage, involve the use of the natural resources identified as part of the proposed survey project.
1.8	How were a risk-averse and cautious approach applied in terms of ecological impacts:	
1.8.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	The limitations and/or gaps in knowledge are presented in Sections 11.4.5 and 12.
1.8.2	What is the level of risk associated with the limits of current knowledge?	The level of risk is considered low at this stage.
1.8.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	As a result of the fact that this project entails only survey activities, it is anticipated that this project will not lead to a significant impact on the receiving environment. Refer to the impact assessment in Section 9 of this report. There is a deficiency in terms of local research in SA waters, but that international research is, in the view of the specialists, adequate for predicting risk- result and risk has been identified as low. Recommendations have been included to take the opportunity presented by this project to enhance/ encourage site-specific local research.
1.9	How will the ecological impacts resulting from this development impact on people's environmental right in terms following?	
1.9.1	Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	The proposed activities are anticipated to have low negative ecological impacts. Refer to the impact assessment in Section 9 in this report.
1.9.2	Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	

Ref No.	Question	Answer
1.10	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	A medium to low impact on third party wellbeing, livelihoods and ecosystem services is foreseen. Refer to the impact assessment in Section 9 of this report.
1.11	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area?	The proposed survey activities are anticipated to have generally low negative marine ecological impacts. Refer to the impact assessment in Section 9 in this report.
1.12	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	Refer to Section 8, details of the alternatives considered.
1.13	Describe the positive and negative cumulative ecological / biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Refer to Section 9 of this report.
2	Promoting justifiable economic and social development	
2.1	What is the socio-economic context of the area, based on, amongst other considerations, the following:	
2.1.1	The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks or policies applicable to the area	The offshore area of activity, as well as the Exclusive Economic Zone (EEZ) as a whole, do not fall within the borders of any municipality or province of South Africa. Thus, the related planning documentation, especially at the District and Local Municipality level, typically don't directly address offshore areas and activities in a significant level of detail. The Application Area is located adjacent to the Namakwa District Municipality and the West Coast District Municipality. Refer to Section 8.7 of this report for a breakdown of the demographics and social environment in these areas. The Namakwa IDP (2022 – 2027) aligns with the Nine Point Plan identified by the National Government and identifies the Growing the Oceans Economy and Tourism – Small Harbour Development & Coastal and Marine Tourism. The IDP does not specifically mention offshore activities or exploration. The impact of the actual seismic survey activities on the local economy is anticipated to be limited. Spatial Development Goal 4 of the West Coast District Municipality IDP (2022 – 2027) states that the district should promote sustainable utilisation of the District's natural resource base

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Ref No.	Question	Answer
		to extract economic development opportunities. The impact of the seismic survey activities on the local economy is anticipated to be limited however it will potentially allow significant economic growth in the future. More detail is provided in the Social Assessment report included in Appendix 3.
2.1.2	Spatial priorities and desired spatial patterns (e.g. need for integration of segregated communities, need to upgrade informal settlements, need for densification, etc.).	Survey activities typically require highly skilled employment. However, where feasible, it is anticipated that the use of local labour could be utilised, but it is anticipated that this will be extremely limited, if at all.
2.1.3	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.); and	Refer to the baseline environment in Section 6 of this report.
2.1.4	Municipal Economic Development Strategy ("LED Strategy").	Considering the location of the activities, it is not anticipated to significantly promote or facilitate spatial transformation and sustainable urban development.
2.2	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	Refer to the impact assessment in Section 9 in this report."
2.2.1	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	Survey activities typically require highly skilled employment. However, where feasible, it is anticipated that the use of local labour could be utilised, but it is anticipated that this will be extremely limited, if at all. It is recommended that TGS consult with communities on potential ways in which to make a positive contribution to the communities.
2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	Refer to the public participation process and feedback contained in Appendix 2.
2.4	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-terms?	Refer to the impact assessment and mitigation measures in Section 9 of this report.
2.5	In terms of location, describe how the placement of the proposed development will:	

Ref No.	Question	Answer
2.5.1	Result in the creation of residential and employment opportunities in close proximity to or integrated with each other.	Survey activities typically require highly skilled employment. However, where feasible, it is anticipated that the use of local labour could be utilised, but it is anticipated that this will be extremely limited, if at all.
2.5.2	Reduce the need for transport of people and goods.	The activities are not anticipated to have an impact on the transportation of goods and people.
2.5.3	Result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms of public transport).	The activities are not anticipated to have an impact on the public transport.
2.5.4	Compliment other uses in the area.	The offshore area has been subjected to a number of previous exploration activities as well as previous 2D and 3D surveys.
2.5.5	Be in line with the planning for the area.	Refer to item 2.1.1 of this table (above).
2.5.6	For urban infill development, make use of underutilised land available with the urban edge.	Not applicable. The proposed project is not located in an urban area.
2.5.7	Optimise the use of existing resources and infrastructure.	Refer to Section 3 of this report.
2.5.8	Opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement).	
2.5.9	Discourage "urban sprawl" and contribute to compaction / densification.	Not applicable. The proposed project is not located in an urban area.
2.5.10	Contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs.	Refer to items 2.5.7 – 2.5.9 of this table (above).
2.5.11	Encourage environmentally sustainable land development practices and processes	As a result of the fact that this project does not directly entail the exploration for oil and gas, it is anticipated that this project will not lead to a highly significant impact on the receiving environment.

Ref No.	Question	Answer
2.5.12	Take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	The proposed project aims to identify potentially strategic oil and gas resources.
2.5.13	The investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential).	The proposed project aims to identify oil and gas resources. Given the location offshore, it is not anticipated that the survey activities will contribute to the significantly to settlements or areas in terms of socio-economic returns.
2.5.14	Impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	Refer to impact assessment in Section 9 of this report.
2.5.15	In terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	Given the location offshore, it is not anticipated that the activities will contribute to the significantly to settlements or areas in terms of socio-economic returns.
2.6	How was a risk-averse and cautious approach applied in terms of socio-economic impacts:	
2.6.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Refer to Sections 11.4.5 and 12 of this report.
2.6.2	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	The level of risk is low as the project is not expected to have far reaching negative impacts on socio-economic conditions.
2.6.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	The level of risk is low as the project is not expected to have far reaching highly negative impacts on socio-economic conditions. The survey area is located 120 km offshore, outside of the fisheries ringfence area. Since the survey activities will not include any drilling at this stage, a risk averse and cautious approach has been implemented to limit the impact on the surrounding environment.
2.7	How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:	
2.7.1	Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Refer to the impact assessment in Section 9 of this report.

Ref No.	Question	Answer
2.7.2	Positive impacts. What measures were taken to enhance positive impacts?	Refer to the impact assessment in Section 9 of this report.
2.8	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	Refer to the impact assessment in Section 9 of this report.
2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	Refer to the impact assessment in Section 9 of this report.
2.10	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be disributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	Refer to the impact assessment in Section 9 of this report. The survey activities typically require highly skilled employment. However, where feasible, it is anticipated that the use of local labour could be utilised, but it is anticipated that this will be extremely limited, if at all.
2.11	What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	By conducting a Basic Assessment Process, the applicant ensures that equitable access has been considered. Refer to the impact assessment in Section 9 of this report.
2.12	What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	Refer to the impact assessment in Section 9 of this report. The EMPr will specify timeframes within which mitigation measures must be implemented.
2.13	What measures were taken to:	
2.13.1	Ensure the participation of all interested and affected parties.	Refer to Section 7 of this report, describing the public participation process undertaken for the proposed project.
2.13.2	Provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation.	Refer to Section 7 of this report, describing the public participation process undertaken for the proposed project. The BID, advertisement, notification letter and site notice have been

Ref No.	Question	Answer
2.13.3	Ensure participation by vulnerable and disadvantaged persons,	made available in English, isiXhosa and Afrikaans to assist in understanding of the project. In addition, the BA report executive summary will be made available in all three of these languages. Further public consultation will be held during the review period of the BA report for the project.
2.13.4	Promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means;	
2.13.5	Ensure openness and transparency, and access to information in terms of the process,	
2.13.6	Ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge.	
2.13.7	Ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein will be promoted?	
2.14	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	Refer to Section 7 of this report, describing the public participation process undertaken for the proposed project.
2.15	What measures have been taken to ensure that current and / or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	Potential future workers will have to be educated on a regular basis as to the environmental and safety risks that may occur within their work environment. Furthermore, adequate measures will have to be taken to ensure that the appropriate personal protective equipment is issued to workers based on the conditions that they work in and the requirements of their job.
2.16	Describe how the development will impact on job creation in terms of, amongst other aspects:	
2.16.1	The number of temporary versus permanent jobs that will be created.	Reconnaissance and exploration activities typically require highly skilled employment. However, where feasible, it is anticipated that the use of local labour could be utilised, but it is anticipated that this will be extremely limited, if at all. The majority of the work will be done remotely through the acquisition and processing of existing information. However,
2.16.2	Whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area).	

Ref No.	Question	Answer
2.16.3	The distance from where labourers will have to travel.	should local labour be required during the possible 3D seismic survey, then travel will be from suitable ports.
2.16.4	The location of jobs opportunities versus the location of impacts.	
2.16.5	The opportunity costs in terms of job creation.	
2.17	What measures were taken to ensure:	
2.17.1	That there were intergovernmental coordination and harmonization of policies, legislation and actions relating to the environment.	The EIA Process requires governmental departments to communicate regarding any application. In addition, all relevant departments are notified at various phases of the project by the EAP.
2.17.2	That actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures.	
2.18	What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	Refer to Section 7 of this report, describing the public participation process implemented for the application, as well as Section 8, the impact on any national estate.
2.19	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	Refer to the impact assessment and mitigation measures in Section 9 of the report.
2.20	What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	The proposed survey activities are not anticipated to produce significant pollution, environmental damage or adverse health effects in the long term.
2.21	Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	Refer to Section 6, description of the process followed to reach the proposed preferred site.

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Ref No.	Question	Answer
2.22	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	Refer to the impact assessment and mitigation measures in Section 9 of the BA Report.

5.2 NEED FOR SEISMIC DATA

In addition to the information presented in Table 6 above, a discussion of the needs and desirability of the project would not be complete without understanding the need for acquisition of the seismic data and possible oil and gas exploration and production that could potentially take place in the future as a result of the survey. It cannot be said with absolute certainty that exploration drilling, let alone production activities, will be undertaken in the future. As such, it is not currently possible to accurately assess the risks associated with these activities, given that the specific details of these potential future activities are not known. While it is acknowledged that the risks mentioned would need assessment, such assessment falls outside of the scope of the current application and would need to be assessed in detail during subsequent Scoping and EIA processes, should exploration drilling or production be proposed. The environmental consequences applicable to the planned survey activities have been identified and assessed in this BA Report.

The fastest growing sector for the use of natural gas is for the generation of electric power. Natural gas power plants usually generate electricity in gas turbines, directly using the hot exhaust gases from the combustion of the gas (USCUSA, 2015). Of the three fossil fuels used for electric power generation (coal, oil and natural gas), natural gas emits the least carbon dioxide per unit of energy produced. Natural gas emits 30% and 45% less carbon dioxide than burning oil and coal, respectively. Burning natural gas also releases lower amounts of nitrogen oxides, sulphur dioxide, particulates and mercury when compared to coal and oil.

The increased use of natural gas can, in the short term, serve as a transition fuel on the path to the carbon-neutral goal of the Paris Agreement. In addition to gas as a key transitional fuel reducing reliance on coal, the benefits of oil and gas could include significant amount of job creation, especially if local beneficiation takes place. An increase in domestic natural gas reserves would enable South Africa to take steps to secure the countries' energy supply (through diversification), assist in reducing the emissions of greenhouse gases (by reducing the country's reliance on coal for electricity generation) and reduce the need for the importation of gas. As such, exploration for additional domestic hydrocarbon reserves is considered important and supported by national policy, and any discoveries would be well received by the local market and are consistent with the objectives stated in the 2019 IRP. Natural gas emits 30% and 45% less carbon dioxide than burning oil and coal, respectively, and 65% less carbon dioxide than coal when the increased efficiency of Combined Cycle Gas Turbines versus coal fired power stations is considered. Eskom produces over 200MtCO2/yr, over 40% of South Africa's total. South Africa also has SASOL's Secunda coal to liquids plant, the biggest single source of CO_2 in the world at 57MtCO2/yr (~12.5% of South Africa's total) to produce 160k barrels of products per day. Supplying these products from conventional oil production and refining would generate approximately 10% of those emissions, 5 to 6MtCO2/yr.

According to the 2019 IRP the availability of gas in the short to medium term is a risk as South Africa does not currently have gas resources. There is also a supply and foreign exchange risk associated with likely increase in gas volumes depending on the energy mix adopted post 2030 when a large number of coal fired power stations are decommissioned. South Africa's economic growth is dependent on the availability of energy, ensuring a sustainable and reliable supply of electricity with sufficient capacity is a key aspect to growing the economy of South Africa in the future. The electricity shortages experienced in South Africa over the past decade are a contributing factor to the significant slowdown in economic growth rate. To enable economic growth within the target rate of between 5% and 8% to be achieved, it will be necessary for Government to continue increasing electricity generating capacity in the country. The use of natural gas for electricity generation is identified in national policy, together with renewable energy technologies, as an alternative in diversifying the domestic energy supply away from its current reliance on coal. Gas is identified in the draft Integrated Resources Plan as significant contributor to South Africa's energy mix in the period up to 2030. Availability of gas also provides an opportunity to convert to Combined Cycle Gas Turbine and run open-cycle gas turbine plants at Ankerlig (Saldanha Bay), Gourikwa (Mossel Bay), Avon (Outside Durban) and Dedisa (Coega IDZ) on gas (IRP 2019).

From a climate change perspective, it is not currently possible to accurately assess the risks associated with oil and gas activities, given that the specific details of these potential future activities are not known and therefore climate change impacts would need to be assessed in detail during any subsequent Scoping and EIA processes for any potential subsequent oil and gas production projects.

The feasibility of using natural gas for domestic power generation is considered to be dependent on the extent of available domestic reserves of natural gas, as well as the financial cost of importing natural gas should those reserves be insufficient. The acquisition of seismic survey data is therefore considered important with respect

to understanding the potential for future oil and gas production as part of the energy mix of the country going forward and the need and desirability of the project is therefore supported from an energy security perspective.

In addition to the above, seismic surveying is not only used for petroleum and natural gas exploration and development, it can in certain instances also be used for development of offshore wind, geothermal energy, and low-carbon solutions such as carbon capture and storage and also more generally for providing more insight and understanding into the regional geology of the area for scientific purposes.

This project can also provide an opportunity to conduct independent research on how fish species on the West Coast such as snoek respond to seismic surveying. Bearing in mind that the location of this particular survey is far offshore and impacts on the biophysical environment are expected to be relatively low this project is seen as a good opportunity to obtain local data and conduct local research which could be useful for similar projects and applications that may take place in the future.

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6 PROJECT ALTERNATIVES

This section provides a description of the alternatives considered as part of this BA process.

6.1 LOCATION ALTERNATIVES

The application area has been selected by TGS due to the high likelihood of containing significant hydrocarbon reserves. The application area is considered as the optimal area for such a survey due to its location well offshore and well outside of the fisheries ring-fence area. As such no location alternatives are considered feasible for the project.

6.2 LAYOUT ALTERNATIVES

Most of the ecosystem types in the Reconnaissance Permit Area are either poorly protected or not protected. CBAs within the Application Areas include both CBA1: natural and CBA2: natural areas (see Figure 91). CBA 1 indicates irreplaceable or near-irreplaceable sites that are required to meet biodiversity targets with limited, if any, option to meet targets elsewhere, whereas CBA 2 are "best design sites" and there are often alternative areas where feature targets can be met; however, these will be of higher cost to other sectors and / or will be larger areas. Activities within these management zones are classified into those that are "compatible", those that are "not compatible", and those that have "restricted compatibility". Non-invasive (e.g. seismic surveys) and invasive (e.g. exploration wells) exploration activities are classified as having "restricted compatibility". Activities with restricted compatibility require a detailed assessment to determine whether the recommendation is that they should be permitted (general – as is the case for this assessment), permitted subject to additional regulations (consent), or prohibited, depending on a variety of factors. Petroleum production is, however, classified as "not compatible" in CBAs, but may be compatible, subject to certain conditions, in Ecological Support Areas (ESAs). The CBA areas are not considered no-go areas for the purposes of seismic survey activities and TGS would still want to survey these areas. Seismic surveying is not only used for petroleum and natural gas exploration and development. It is also used for development of offshore wind, geothermal energy, and low-carbon solutions such as carbon capture and storage and also more generally for providing more insight and understanding into the regional geology of the area for scientific purposes therefore the CBA areas are not considered no-go areas for the purpose of the seismic survey. In addition, according to the National Coastal and Marine Spatial Biodiversity Plan for the coast and ocean around the South African mainland states that petroleum production may be possible in CBAs using lateral drilling or other techniques that do not result in biodiversity impacts. According to the plan, if significant petroleum resources are identified in these areas, the selection of the site as a CBA could be re-evaluated, although this would require alternative CBAs to be identified to meet biodiversity targets.

No Marine Protected Areas (MPAs) are located within the Application Area. No no-go areas within the Application Area have been identified in any of the specialist studies conducted. As such no layout alternatives or exclusion areas are considered applicable – refer to sensitivity map included as Figure 124 below.

6.3 TECHNOLOGY ALTERNATIVES

The activities proposed in this application require specialised technology and skills. The available technology alternatives are limited by most suitable technology for conducting seismic surveys. To this end, it was concluded by Weilgart (2010) that seismic source design can be optimized to reduce unwanted energy. Imaging deep geological targets requires an acoustic source outputting relatively low frequency content (200Hz) and in directions (both inline and horizontal to the plane of interest) that are not of use. During collection of seismic data for deep imaging purposes one should strive to reduce unnecessary acoustic energy (noise) through array, source, and receiver design optimization. Weilgart (2013) further concluded that that regardless of the imaging target, anyone collecting seismic data should strive to reduce unwanted energy or noise. It should be noted that even if unwanted frequencies (> 200 Hz) are removed, there will still be frequency overlap with several marine animals (including most baleen whales) that can and should be minimized. It was further concluded that, lower source levels could be achieved through better system optimization, i.e. a better pairing of source and receiver characteristics, and better system gain(s). For example, new receiver technologies, such as fibre optic receivers, may allow the use of lower amplitude sources through a higher receiver density and/or a lower system noise

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floor. Some evidence exists which indicates that re-engineered seismic sources with "mufflers" can be used to attenuate unwanted high frequency energy without affecting frequencies of interest. TGS must define and enforce the use of the lowest practicable seismic source volume for production, and design arrays to maximise downward propagation, minimise horizontal propagation and minimise high frequencies in seismic source pulses.

Refer to the detailed mitigation measures included in the EMPr (Appendix 5) for recommendations regarding source design. The above optimisation techniques should be implemented including better seismic source design and system optimisation with the selected survey contractor. In addition, kerosene free hydro-streamers should be used. It is also important to ensure that 'turtle-friendly' tail buoys are used or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'.

6.4 SCHEDULING ALTERNATIVES

Based on the findings of the Acoustics, Marine Ecology and Fisheries recommendations, it is recommended that the survey window of January – May be utilised in order to:

- Avoid sensitive areas and periods for some marine fauna: Movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (June/July and late October/November), and their aggregation on the summer feeding grounds between St Helena Bay and Dassen Island from late October to late December and ensure that migration paths are not blocked by seismic operations;
- Avoid periods of peak fishing activity during June and July in order to reduce the probability of disruption to the large pelagic longline fishing sector and tuna pole line fishing sector.

6.5 NO GO ALTERNATIVE

The no go alternative would imply that no seismic survey activities are undertaken. As a result, the opportunity to identify potential oil and gas resources within the Application Area would not exist. This will negate the potential negative and positive impacts associated with the proposed survey activities.

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7 STAKEHOLDER ENGAGEMENT

The Public Participation Process (PPP) is a requirement of several pieces of South African legislation and aims to ensure that all relevant interested and Affected Parties (I&APs) are consulted, involved and their comments are considered, and a record included in the reports submitted to the Authorities. The process ensures that all stakeholders are provided this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study. The PPP for the proposed project needs to be managed sensitively and according to best practises to ensure and promote:

- Compliance with international best practice options;
- Compliance with national legislation;
- Establishment and management of relationships with key stakeholder groups; and
- Involvement and participation in the environmental study and authorisation/approval process.

As such, the purpose of the PPP and stakeholder engagement process is to:

- Introduce the proposed project;
- Explain the authorisations required;
- Explain the environmental studies already completed and yet to be undertaken (where applicable);
- Solicit and record any issues, concerns, suggestions, and objections to the project;
- Provide opportunity for input and gathering of local knowledge;
- Establish and formalise lines of communication between the I&APs and the project team;
- Identify all significant issues for the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent negative environmental impacts and maximize and/or promote positive environmental impacts associated with the project.

7.1 GENERAL APPROACH TO PUBLIC PARTICIPATION

The PPP for the proposed project has been undertaken in accordance with the requirements of the NEMA EIA Regulations (2014), and in line with the principles of Integrated Environmental Management (IEM). IEM implies an open and transparent participatory process, whereby stakeholders and other I&APs are afforded an opportunity to comment on the project and have their views considered and included as part of project planning.

An initial I&AP database has been compiled based on known key I&AP's and stakeholder databases available from existing sources. The I&AP database includes amongst others, adjacent landowners, rights holders, communities, regulatory authorities and other special interest groups.

7.1.1 LIST OF PRE-IDENTIFIED ORGANS OF STATE/ KEY STAKEHOLDERS IDENTIFIED AND NOTIFIED

Pre-identified Key Stakeholders were notified of the proposed project and include:

- Abalobi
- Africa Conservation Trust
- Afriforum
- Agri Westcape
- Anglo American
- Aukotowa Fishing Co-Op
- Iziko Museums of South Africa
- Japan Marine Supplies & Services
- Jayfish cc
- Kernel Marine (Pty) Ltd
- Khulani Fishing (Pty) Ltd
- Kobush

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- Birdlife
- Centre for Environmental Rights
- Chapmans Peak Fisheries
- Cochoqua Tribal Authority
- Combined Fishing Enterprise cc
- Community Processors and Distributors (Pty) Ltd
- Conservation South Africa
- Council for Geoscience
- CSIR
- Dangle Conservancy
- De Beers Group of Companies
- EarthLife Africa
- Endangered Wildlife Trust
- Eskom Holdings SOC Ltd
- Federation for a Sustainable Environment
- Fisherman Development Organisation
- FishSA
- Frackfree SA
- Fresh Tuna Exporters Association
- Gansbaai Marine (Pty) Ltd
- Green Connection
- GroundWork SA
- Hickisons Fishing Company Ltd
- Hondeklip Bay Women's Group
- Hondeklipbaai Visserye Bpk.
- iAfrica
- iGas
- Ikamva Lethu Fishing Company (Pty) Ltd
- Imbize
- Impact Oil and Gas
- Impala Fishing (Pty) Ltd
- Inert Fas Industries
- Ingwe Emnyama Fishing Enterprises (Pty) Ltd
- IRASA Kholsan
- Irvin & Johnson Limited
- Local Ward Councillors
- Lucky Star
- Masifundise Development Trust
- NamaquaRIGHTS
- Natural Justice
- Namibian Government
- North Western Cape Mining Forum
- Observatory Civic Organisation
- Oceana Group Limited
- Oceans Not Oil
- Pescalura
- PetroSA
- Port Nolloth Abalone
- Port Nolloth Fish Factory
- Port Nolloth Fisheries
- Port Nolloth Sea Farm Ranching
- Premier Fishing
- Premier Fishing (SA) (Pty) Ltd
- Protect the West Coast
- Quayside Fish Suppliers Cape (Pty) Ltd
- Reiga Visserye cc
- Risar Fishing
- SA Foundation for the Conservation of Coastal Bird
- SA Tuna Association
- SA Tuna Longline Association
- South African Navy Hydrographic Office
- South African National Biodiversity Institute
- South African Maritime Safety Association
- South African Pelagic Fishing Industry Association
- South African United Fishing Front
- Sunbird Energy
- Sungu Sungu Petroleum
- Thombo Petroleum/Africa Energy corp
- Transnet SOC Ltd
- West Coast National Park

- Isinde Tlent (Pty) Ltd
- World Wildlife Fund

Pre-identified authorities were notified of the proposed project and include:

- Bergrivier Local Municipality
- Cape Nature
- Cederberg Local Municipality
- City of Cape Town Metropolitan
- Eskom SOC ltd
- Heritage Western Cape
- Kamiesberg Local Municipality
- Matzikama Local Municipality
- Nama Khoi Local Municipality
- Namakwa District Municipality
- National Department of Agriculture, Land Reform and Rural Development
- National Department of Forestry, Fisheries and the Environment
- National Department of Mineral Resources
- National Department of Public Works
- National Department of Social Development
- National Department of Transport
- National Department of Water and Sanitation; and
- National Energy Regulator of South Africa
- Northern Cape Department of Nature and Conservation
- Northern Cape Provincial Heritage Resource Agency
- Petroleum Agency of South Africa
- Ritchersveld Local Municipality
- Saldanha Bay Local Municipality
- SANPARKS
- South African Heritage Resources
- Swartland Local Municipality
- West Coast District Municipality
- West Coast Marine Conservation Society
- Western Cape Department of Environmental Affairs and Development Planning

7.1.2 INITIAL NOTIFICATION

The PPP commenced on 16 August 2022 with an initial notification and call to register for a period of 30 days. The initial notification was given in the following manner:

7.1.2.1 REGISTERED LETTERS, FAXES AND EMAILS

Notification letters (English, isiXhosa and Afrikaans), faxes, and emails were distributed to all pre-identified key I&APs including government organisations, NGOs, relevant municipalities, ward councillors, landowners and other organisations that might be affected.

The notification letters included the following information to I&APs:

- List of anticipated activities to be authorised;
- Scale and extent of activities to be authorised;
- Information on the intended reconnaissance operation to enable I&APs to assess/surmise what impact the activities will have on them or on the use of their land;
- The purpose of the proposed project;
- Details of the affected properties (including details of where a locality map could be obtained);
- Details of the relevant regulations;

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- Initial registration period timeframes; and
- Contact details of the EAP.

7.1.2.2 NEWSPAPER ADVERTISEMENTS / GOVERNMENT GAZETTE

Advertisements describing the proposed project and EIA process were placed in newspapers with circulation in the vicinity of the study area. The initial advertisements were placed in Cape Times (English and isiXhosa), Sentinel News (English and Afrikaans), Weslander (English and Afrikaans), Ons Kontrei (English and Afrikaans), and Die Plattelander (English and Afrikaans) as well as in the National Gazette. The newspaper adverts included the following information:

- Project name;
- Applicant name;
- Project location;
- Nature of the activity and application;
- Details of initial round of public meetings; and
- Relevant EIMS contact person for the project.

7.1.2.3 SITE NOTICE PLACEMENT

A1 Correx site notices in English, Afrikaans and isiXhosa were placed at 100 onshore locations adjacent to the application area during the week of 16-20 August 2022. The on-site notices included the following information:

- Project name;
- Applicant name;
- Project location;
- Map of proposed project area;
- Project description;
- Legislative requirements;
- Details of initial round of public meetings; and
- Relevant EIMS contact person for the project.

7.1.2.4 POSTER PLACEMENT

A3 posters in English, Afrikaans and isiXhosa were placed at local public gathering places at various onshore locations. The notices and written notification afforded all pre-identified I&APs the opportunity to register for the project as well as to submit their issues/queries/concerns and indicate the contact details of any other potential I&APs that should be contacted. The contact person at EIMS, contact number, email and faxes were stated on the posters. Comments/concerns and queries were encouraged to be submitted in either of the following manners:

- Electronically (fax, email);
- Telephonically; and/or
- Written letters.

7.1.2.5 RADIO ADVERTS

Radio adverts were aired notifying I&APs of the project on the following radio stations:

- KFM (English);
- Radio NFM (English and Afrikaans);

- Radio Namakwaland (English and Afrikaans); and
- Radio West Coast (English and isiXhosa).

7.1.3 AVAILABILITY OF BA REPORT

Notification regarding the availability of this BA Report for public review will be given in the following manner to all registered I&APs (which includes key stakeholders and landowners):

- Registered letters with details on where the report can be obtained and/or reviewed, public meeting date and time, EIMS contact details as well as the public review comment period;
- Facsimile notifications with information similar to that in the registered letter described above; and/or
- Email notifications with a letter attachment containing the information described above.

This BA report is being made available for public review from 21 October 2022 to 21 November 2022. Hard copies of the report are available at the following venues:

- The Hout Bay Public Library (Melkhout Crescent, Hout Bay, Cape Town, Western Cape)
- The Sea Point Public Library (Civic Centre, Cor Three Anchor Bay and Main roads, Sea Point, Cape Town, Western Cape)
- The Vredenburg Public Library (2 Academy Street,(close to West Coast College), Vredenburg, West Coast, Western Cape)
- The Lamberts Bay Public Library (Church Street, Lamberts Bay, Western Cape)
- Kamiesburg Local Municipality in Hondeklip Bay (Wag Wey street)
- J Bekeur Library (Robson St, Port Nolloth, Richtersveld, Northern Cape)

The report is also available for review and download at www.eims.co.za. Data free access to the report download was also available to those I&APs who required such. The executive summary has also been made available in English, Afrikaans and isiXhosa.

7.1.4 PUBLIC MEETINGS

A series of initial public meetings were held between from 29 August 2022 to 5 September 2022 at the following venues:

- Hout Bay: Hout Bay Public Library (Monday, 29 August 2022 at 16:00 – 18:00);
- Cape Town: Life Church (Tuesday, 30 August 2022 at 16:00 – 18:00);
- Saldanha: Hoedjies Bay Hotel (Wednesday, 31 August 2022 at 16:00 – 18:00);
- Lamberts Bay: Community Hall (Thursday, 1 September 2022 at 16:00 – 18:00);
- Hondeklip Bay: Eric Baker Hall (Friday, 2 September 2022 at 16:00 – 18:00); and
- Port Nolloth: Port Nolloth Country Club (Saturday, 3 September 2022 at 10:00 – 12:00).

The aim of the first round of public meetings was to ensure as many concerns and issues were captured prior to release of the draft BA report. This was done in order to ensure that the BA report addresses as many of the potential concerns from the public and affected stakeholders as possible. A second round of public meetings is scheduled for during the review period of this draft BA report.

Figure 6: Protest held outside the venue of the Initial Port Nolloth Public Meeting on 3 September 2022.

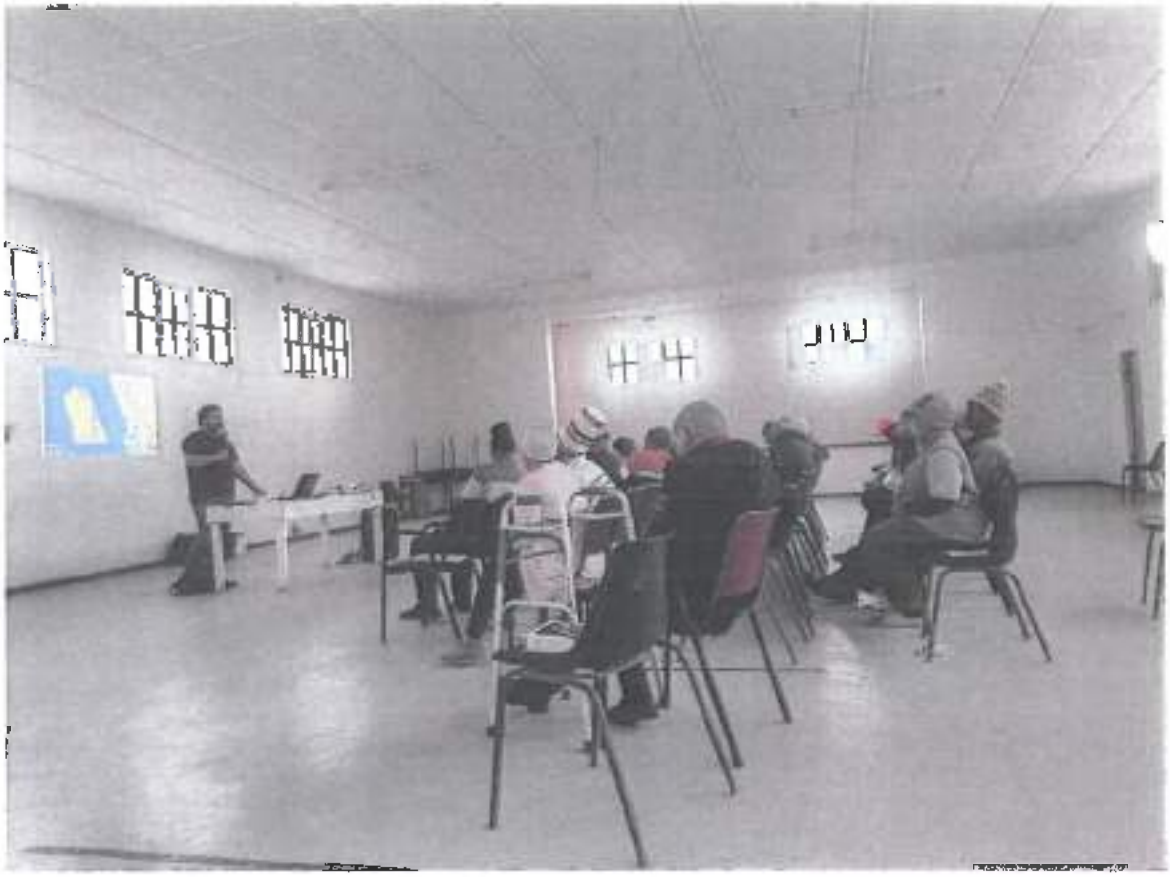

Figure 7: Public Meeting held in Hondeklip Bay on 1 September 2022.

Figure 8: Public Meeting held in Lamberts Bay on 1 September 2022.

7.1.5 FOCUS GROUP MEETINGS

In addition to the above, a number of focus group meetings and other interviews were undertaken by the Social and Heritage Specialists as part of their assessments. Please refer to the Social and Heritage Specialist Reports in Appendix B for further details.

7.2 PUBLIC PARTICIPATION PROGRESS

Comments raised to date have been addressed in a transparent manner and included in the Public Participation Report (Appendix 2). A high-level summary of the key comments and concerns raised to date are presented below.

- I&AP registrations and deregistration;
- Notification/information document requests;
- Notification of I&APs registered on the previous Searcher application database;
- Effects on migratory patterns along the West Coast;
- Long term marine life impact if the survey finds exploitable resources;
- Impacts on marine life between the survey site and the coast and how this will impact the future of tourism and agriculture;
- Climate change impacts associated with oil and gas;
- Effects on fisheries and catch rates;
- Food security;
- Free Prior and Informed Consent in public participation processes;

- Public Consultation Process as a "tick box exercise";
- Impact on indigenous cultural heritage, historical connection to the sea;
- Overlap between the Searcher and TGS application areas;
- Lessons learnt from the Searcher and Shell court cases;
- EIMS' independence if the applicant pays for the services rendered;
- Free Prior and Informed Consent in public participation processes;
- Alternative technologies to seismic surveys;
- Requests for mapping data;
- Objections to the proposed TGS Seismic Survey;
- Cumulative impacts;
- Need and desirability of seismic surveys;
- EIA process related comments;
- A lot of the communities are very poor. Concern that there will be no economic benefits for the communities as a direct result of the survey;
- Impact on livelihoods of the coastal communities; and
- The need for an Strategic Environmental Assessment (SEA).

Seismic reconnaissance projects are controversial in South Africa and has been in the news frequently in the last year. For many stakeholders it is an emotional matter, for others the potential of impacting their livelihoods is the biggest fear. There are also stakeholders that feel that the exploration for fossil fuels is not in line with sustainable development and the fight against climate change. Other stakeholders feel that it is imperative for the growth and development of the South African economy to engage in these investigations.

8 ENVIRONMENTAL BASELINE ASSESSMENT

8.1 LOCATION

The Application Area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay over a number of petroleum licence blocks. The locality of the proposed Application Area is shown in Figure 1.

8.2 GEOPHYSICAL CHARACTERISTICS

This section provides a description of the geophysical characteristics of the application area. The information has been sourced from the Marine Ecological Study undertaken by Pisces Environmental Services (Pty) Ltd included in Appendix 3.

8.2.1 BATHYMETRY

The continental shelf along the West Coast is generally wide and deep, although large variations in both depth and width occur. The shelf maintains a general NNW trend, widening north of Cape Columbine and reaching its widest off the Orange River (180 km) (Figure 9). The nature of the shelf break varies off the South African West Coast. Between Cape Columbine and the Orange River, there is usually a double shelf break, with the distinct inner and outer slopes, separated by a gently sloping ledge. The immediate inshore[1] area consists mainly of a narrow (about 8 km wide) rugged rocky zone and slopes steeply seawards to a depth of around 80 m. The middle (-80 to -150 m) and outer shelf (-150 to -350 m) normally lacks relief and slopes gently seawards reaching the shelf edge at a depth of between -350 to -500 m (Sink *et al.* 2019). The three shelf zones characterising the West Coast are recognised following both abiotic (de Wet 2013) and biotic (Karenyi *et al.* 2016) patterns.

Banks on the continental shelf include the Orange Bank (Shelf or Cone), a shallow (180 - 190 m) zone that reaches maximal widths (180 km) offshore of the Orange River, and Child's Bank, situated ~150 km offshore at about 31°S, and within the northern portion of the project target area. Child's Bank is a major feature on the West Coast margin and is the only known submarine bank within South Africa's Exclusive Economic Zone (EEZ), rising from a depth of 350 - 400 m water to less than -200 m at its shallowest point. It is a rounded, flat topped, sandy plateau, which lies at the edge of the continental shelf. The bank has a gentle northern, eastern and southern margin but a steep, slump-generated outer face (Birch & Rogers 1973; Dingle *et al.* 1989; de Wet 2013). At its southwestern edge, the continental slope drops down steeply from -350 to -1 500 m over a distance of less than 60 km (de Wet 2013) creating precipitous cliffs at least 150 m high (Birch & Rogers 1973). The bank consists of resistant, horizontal beds of Pliocene sediments, similar to that of the Orange Banks, and represents another perched erosional outlier formed by post-Pliocene erosion (Dingle 1973; Siesser *et al.* 1974). The top of this feature has been estimated to cover some 1 450 km² (Sink *et al.* 2012).

Tripp Seamount, a geological feature ~25 km to the north of the Reconnaissance Permit area, rises from the seabed at ~1 000 m to a depth of 150 m. It is a roughly circular feature with a flat apex that drops steeply on all sides.

Further underwater features in the vicinity of the Reconnaissance Permit Area include the Cape Canyon and Cape Point Valley, which lie ~95 km and ~250 km to the southeast of the southern boundary of the Reconnaissance Permit Area (Simpson & Forder 1968; Dingle 1986; Wigley 2004; Wigley & Compton 2006). The Cape Canyon was discovered in the 1960s. The canyon head forms a well-developed trench on the continental shelf, 100 m deep and 4 km wide (Wigley 2004; Wigley & Compton 2006). South of Cape Columbine the canyon becomes progressively narrower and deeper. Adjacent to Cape Town in a water depth of 1 500 m, the canyon has a local relief in the order of 500–800 m (Simpson & Forder 1968; Dingle *et al.* 1987). The Cape Canyon has a longitudinal extent of at least 200 km and can be traced to a water depth of at least 3 600 m (Dingle 1970), where the topography of the distal end is rugged and complex (Dingle *et al.* 1987). Sediments in the canyon are predominately unconsolidated sands and muds. The canyon serves as an upwelling feature funnelling cold, nutrient-rich South Atlantic Central Water up the canyon slope providing highly productive surface waters which

[1] As per the 2019 National Biodiversity Assessment inshore is defined as the area influenced by wave energy and light, with the fair-weather wave base at a depth ranging between -30 to -50 m used to determine the outer limits of the zone in South Africa. Offshore areas are those that extend beyond this zone.

in turn power feeding grounds for cetaceans and seabirds (Pilander et al 2018; www.environment.gov.za/deareseachteamreturnfromdeepseaexpedition).

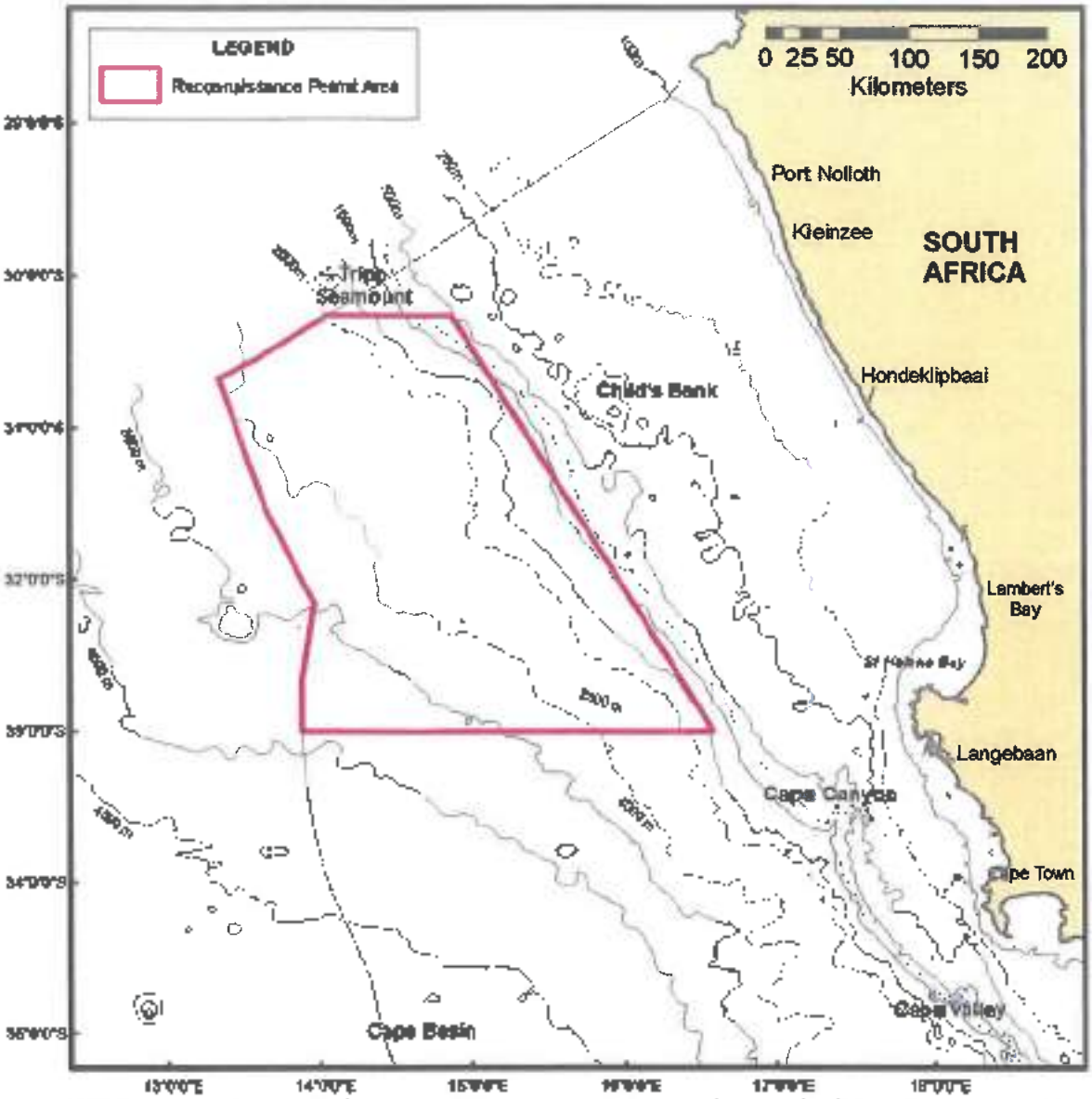

Figure 9: Map indicating location of the Reconnaissance Permit Area in relation to bathymetric features off the West Coast.

The Cape Point Valley, which lies about 70 km south of the Cape Peninsula, is another large canyon breaching the shelf. This canyon has sustained the highest fishing effort and catches in the South African demersal trawl fishery for almost a century (www.marineprotectedareas.org.za/canyons).

Using high-resolution bathymetry collected between 315 – 3 125 m depth, Polan (2017) identified numerous new and previously undocumented submarine canyon systems, most of which are less extensive than the Cape Canyon and Cape Point Valley and do not incise the shelf (Figure 10). Canyon morphology was highly variable and included linear, sinuous, hooked and shelf-indenting types. Large fluid seep/pockmark fields of varying morphologies were similarly revealed situated in close proximity to the sinuous, hooked and shelf-indenting canyon types thereby providing the first evidence of seafloor fluid venting and escape features from the South African margin. These pockmarks represent the terminus of stratigraphic fluid migration from an Aptian gas reservoir, evidenced in the form of blowout pipes and brightened reflectors. This area lies well to the southeast of the Reconnaissance Permit Area.

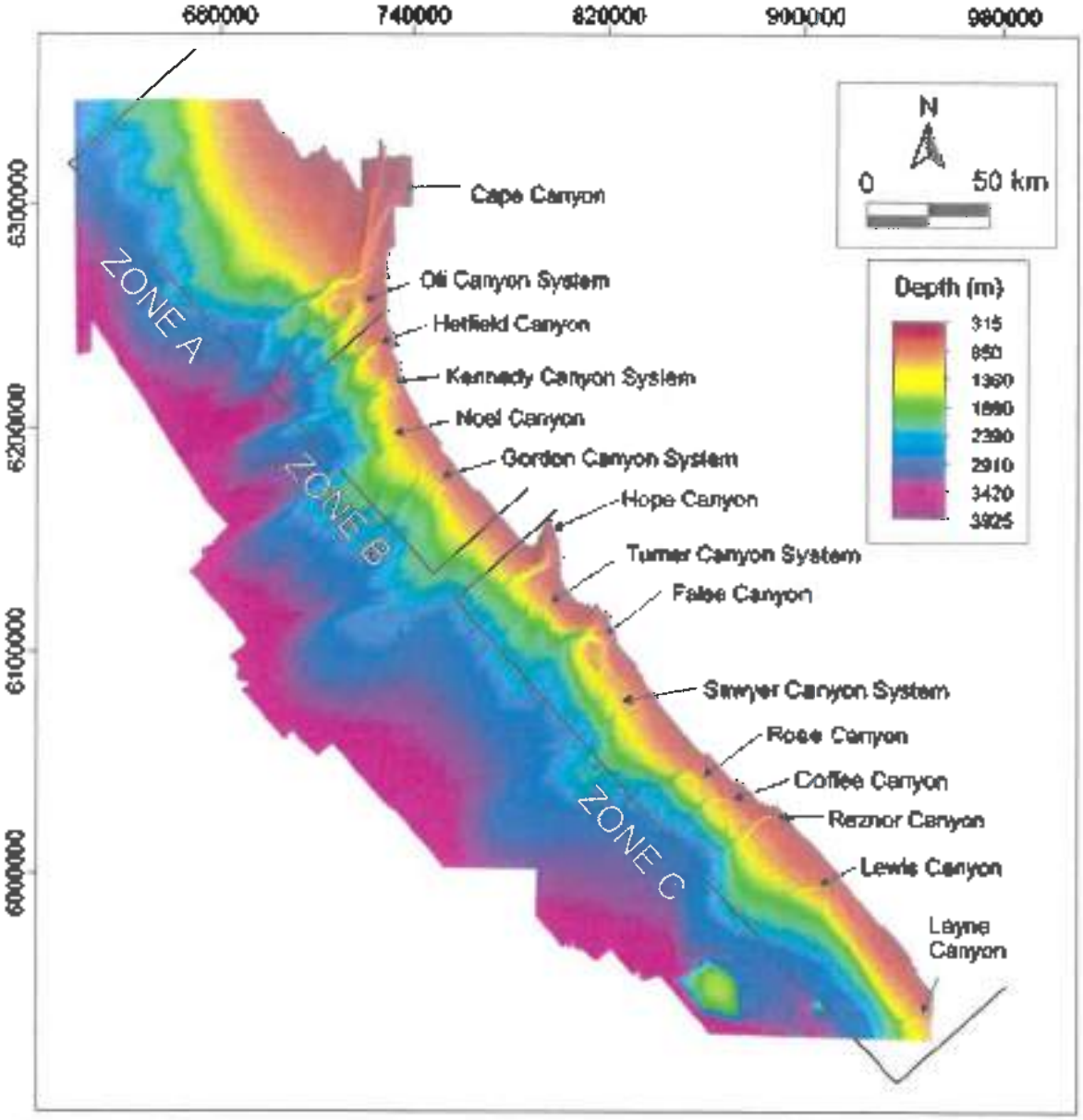

Figure 10: Submarine canyon domains of the southwestern Cape continental margin identified by Palan (2017).

8.2.2 COASTAL AND INNER-SHELF GEOLOGY AND SEABED GEOMORPHOLOGY

Figure 11 below illustrates the distribution of seabed surface sediment types off the South African north-western coast. The inner shelf is underlain by Precambrian bedrock (Pre-Mesozoic basement), whilst the middle and outer shelf areas are composed of Cretaceous and Tertiary sediments (Dingle 1973; Dingle *et al.* 1987; Birch et *al.* 1976; Rogers 1977; Rogers & Bremner 1991). As a result of erosion on the continental shelf, the unconsolidated sediment cover is generally thin, often less than 1 m. Sediments are finer seawards, changing from sand on the inner and outer shelves to muddy sand and sandy mud in deeper water. However, this general pattern has been modified considerably by biological deposition (large areas of shelf sediments contain high levels of calcium carbonate) and localised river input. An ~500-km long mud belt (up to 40 km wide, and of 15 m average thickness) is situated over the inner shelf between the Orange River and St Helena Bay (Birch *et al.* 1976). Further offshore and within the Reconnaissance Permit Area, sediment is dominated by muds and sandy muds. The continental slope, seaward of the shelf break, has a smooth seafloor, underlain by calcareous ooze.

Present day sedimentation is limited to input from the Orange River. This sediment is generally transported northward. Most of the sediment in the area is therefore considered to be relict deposits by now ephemeral rivers active during wetter climates in the past. The Orange River, when in flood, still contributes largely to the

mud belt as suspended sediment is carried southward by poleward flow. In this context, the absence of large sediment bodies on the inner shelf reflects on the paucity of terrigenous sediment being introduced by the few rivers that presently drain the South African West Coast coastal plain.

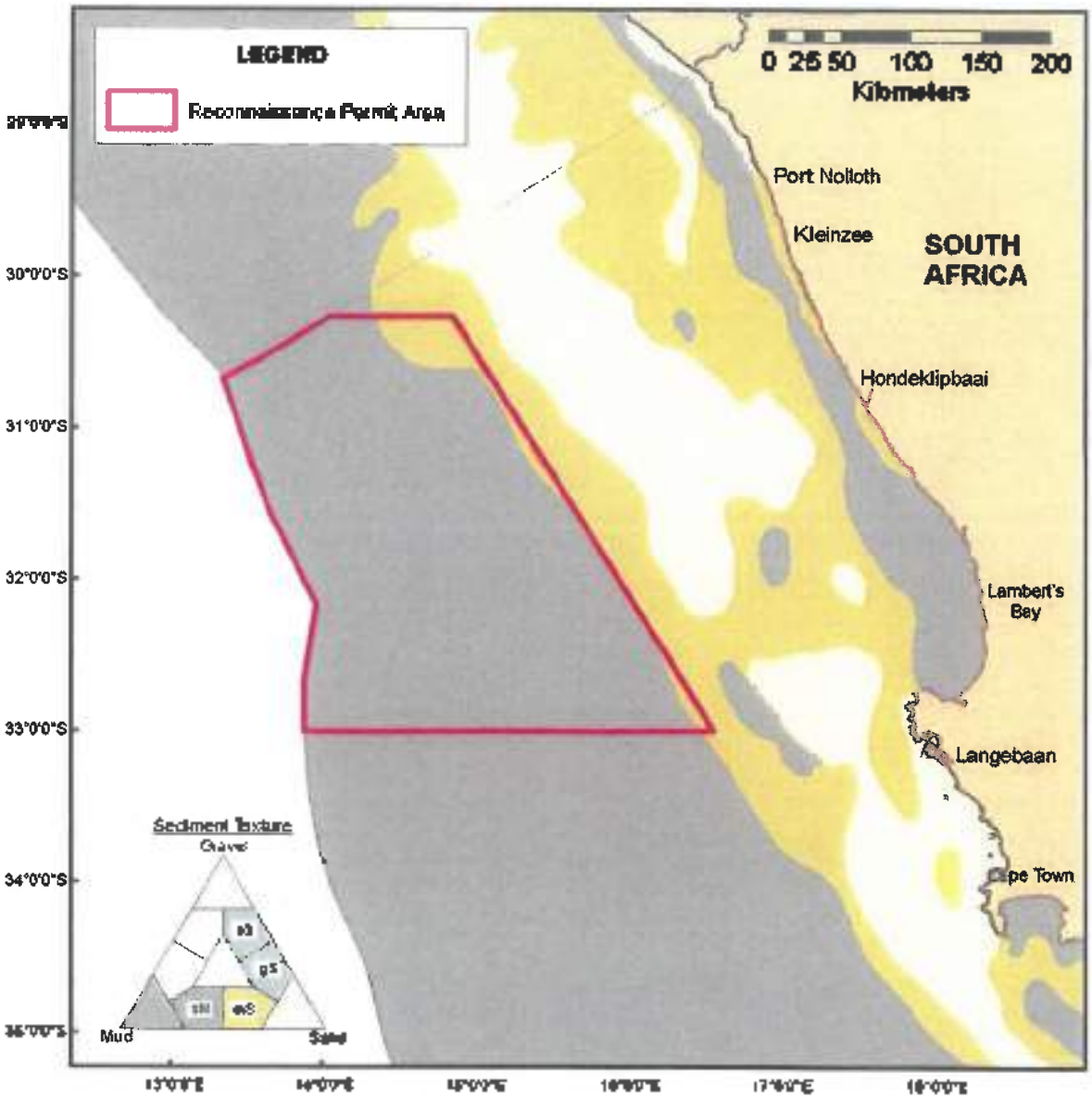

Figure 11: The Reconnaissance Permit Area in relation to sediment distribution on the continental shelf of the South African West Coast (Adapted from Rogers 1977). Based on information in Holness *et al.* (2014) and Sink *et al.* [2019], the mud/sandy mud sediments have been extended to the edge of the EEZ beyond that shown in Rogers (1977).

The benthic habitat types of the West Coast were classified and mapped in detail through the 2011 National Biodiversity Assessment (NBA) (Sink *et al.* 2012a). These were refined in the 2018 NBA (Sink *et al.* 2019) to provide substratum types (Figure 12 below).

In the Reconnaissance Permit Area the water depth ranges from ~500 m to nearly 4 000 m. The Southeast Atlantic Unclassified Slopes and Southeast Atlantic Unclassified Abyss substrata dominate across the area. The shelf inshore of the Reconnaissance Permit Area boasts a diversity of substrata (Sink *et al.* 2019).

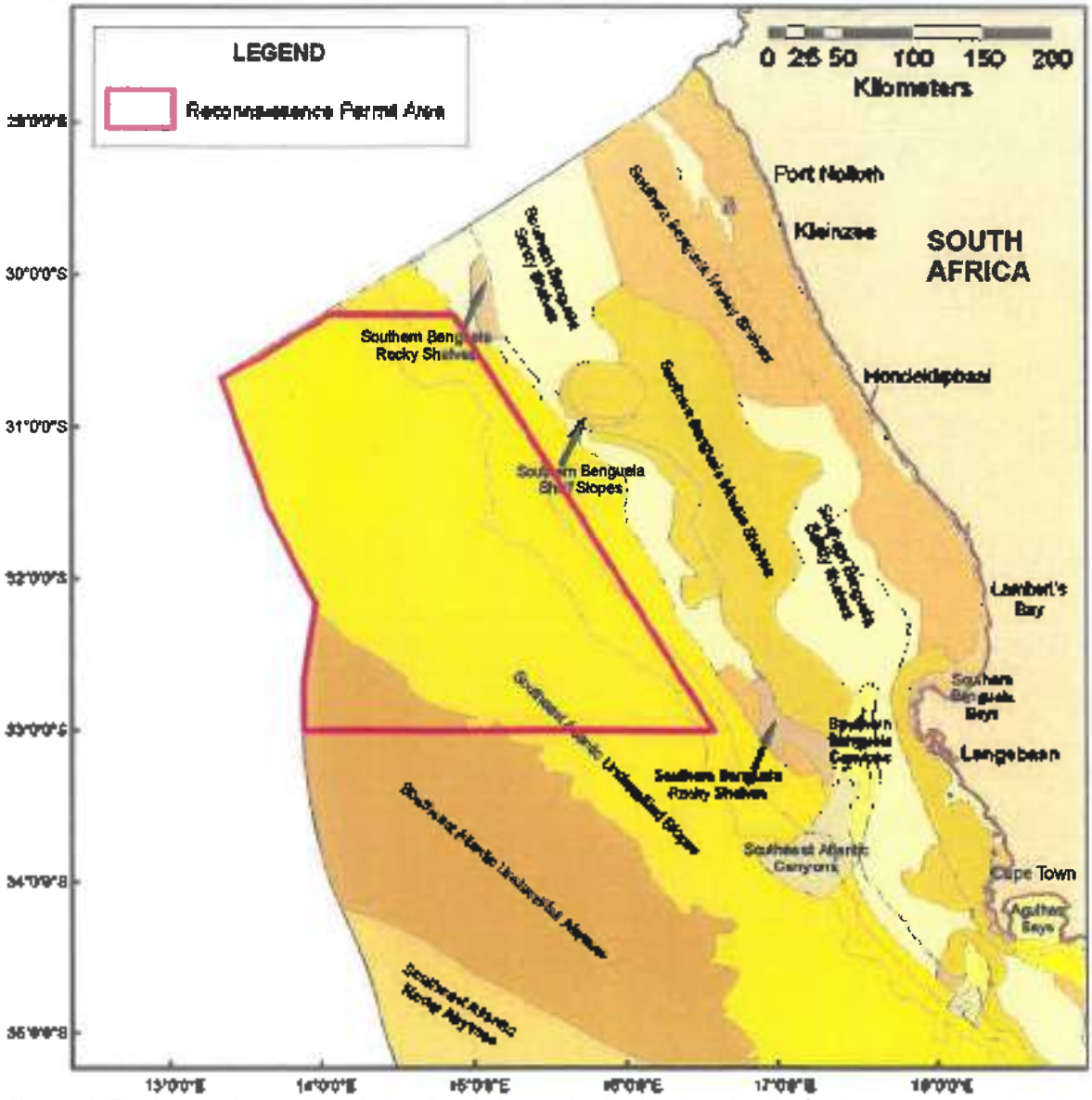

Figure 12: The Reconnaissance Permit Area in relation to the distribution of seabed substratum types along the West Coast (adapted from Sink *et al.* 2019).

8.3 BIOPHYSICAL CHARACTERISTICS

This section provides a description of the biophysical characteristics of the application area. The information has been sourced from the Marine Ecological Study undertaken by Pisces Environmental Services (Pty) Ltd included in Appendix 3.

8.3.1 WIND PATTERNS

Winds are one of the main physical drivers of the nearshore Benguela region, both on an oceanic scale, generating the heavy and consistent south-westerly swells that impact this coast, and locally, contributing to the northward-flowing longshore currents, and being the prime mover of sediments in the terrestrial environment. Consequently, physical processes are characterised by the average seasonal wind patterns, and substantial episodic changes in these wind patterns have strong effects on the entire Benguela region.

The prevailing winds in the Benguela region are controlled by the South Atlantic subtropical anticyclone, the eastward moving mid-latitude cyclones south of southern Africa, and the seasonal atmospheric pressure field over the subcontinent. The south Atlantic anticyclone is a perennial feature that forms part of a discontinuous belt of high-pressure systems which encircle the subtropical southern hemisphere. This undergoes seasonal

variations, being strongest in the austral summer, when it also attains its southernmost extension, lying southwest and south of the subcontinent. In winter, the south Atlantic anticyclone weakens and migrates north-westwards.

These seasonal changes result in substantial differences between the typical summer and winter wind patterns in the region, as the southern hemisphere anti-cyclonic high-pressures system, and the associated series of cold fronts, moves northwards in winter, and southwards in summer. The strongest winds occur in summer (October to March), during which winds blow 98% of the time (PRDW 2013), with a total of 226 gales (winds exceeding 18 m/s or 35 kts) being recorded over the period (CSIR 2006). Virtually all winds in summer come from the south to south-southeast (Figure 13). These southerlies occur over 40% of the time, averaging 20 – 30 kts and reaching speeds in excess of 60 kts, bringing cool, moist air into the coastal region and driving the massive offshore movements of surface water, and the resultant strong upwelling of nutrient-rich bottom waters, which characterise this region in summer. The winds also play an important role in the loss of sediment from beaches. These strong equator-wards winds are interrupted by the passing of coastal lows with which are associated periods of calm or north or northwest wind conditions. These northerlies occur throughout the year, but are more frequent in winter.

Winter remains dominated by southerly to south-easterly winds, but the closer proximity of the winter cold-front systems results in a significant south-westerly to north-westerly component (Figure 13). This 'reversal' from the summer condition results in cessation of upwelling, movement of warmer mid-Atlantic water shore-wards and breakdown of the strong thermoclines which typically develop in summer. There are also more calms in winter, occurring about 3% of the time, and wind speeds generally do not reach the maximum speeds of summer. However, the westerly winds blow in synchrony with the prevailing south-westerly swell direction, resulting in heavier swell conditions in winter.

During autumn and winter, catabatic, or easterly 'berg' winds can also occur. These powerful offshore winds can exceed 50 km/h, producing sandstorms that considerably reduce visibility at sea and on land. Although they occur intermittently for about a week at a time, they have a strong effect on the coastal temperatures, which often exceed 30°C during 'berg' wind periods (Shannon & O'Toole 1998). The winds also play a significant role in sediment input into the coastal marine environment with transport of the sediments up to 150 km offshore.

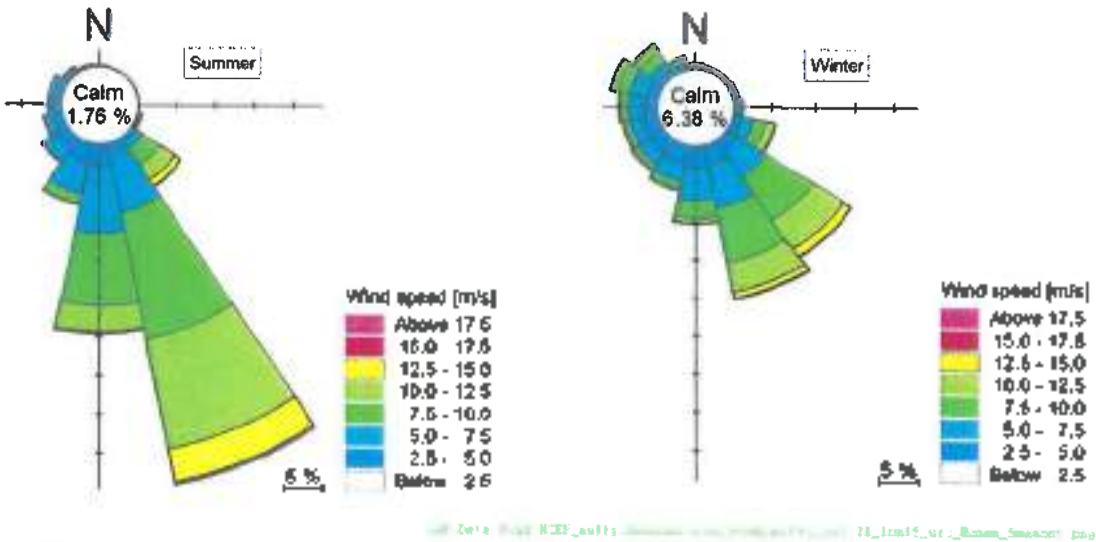

Figure 13: Wind Speed vs. Wind Direction for NCEP hind cast data at location 15°E, 31°S (From PRDW 2013).

8.3.2 LARGE-SCALE CIRCULATION AND COASTAL CURRENTS

The southern African West Coast is strongly influenced by the Benguela Current. Current velocities in continental shelf areas generally range between 10–30 cm/s (Boyd & Oberholster 1994), although localised flows in excess of 50 cm/s occur associated with eddies (PRDW 2013). On its western side, flow is more transient and characterised by large eddies shed from the retroflection of the Agulhas Current. This results in considerable variation in current speed and direction over the domain (PRDW 2013). In the south the Benguela current has a width of 200 km, widening rapidly northwards to 750 km. The surface flows are predominantly wind-forced, barotropic and fluctuate between poleward and equatorward flow (Shillington *et al*. 1990; Nelson & Hutchings

1983) (Figure 14b). Fluctuation periods of these flows are 3 - 10 days, although the long-term mean current residual is in an approximate northwest (alongshore) direction. Current speeds decrease with depth, while directions rotate from predominantly north-westerly at the surface to south-easterly near the seabed. Near bottom shelf flow is mainly poleward with low velocities of typically <5 cm/s (Nelson 1989; PRDW 2013). The poleward flow becomes more consistent in the southern Benguela.

The major feature of the Benguela Current is coastal upwelling and the consequent high nutrient supply to surface waters leads to high biological production and large fish stocks. The prevailing longshore, equatorward winds move nearshore surface water northwards and offshore. To balance the displaced water, cold, deeper water wells up inshore. Although the rate and intensity of upwelling fluctuates with seasonal variations in wind patterns, the most intense upwelling tends to occur where the shelf is narrowest and the wind strongest. There are three upwelling centres in the southern Benguela, namely the Namaqua (30°S), Cape Columbine (33°S) and Cape Point (34°S) upwelling cells (Taunton-Clark 1985) (Figure 14a). Upwelling in these cells is seasonal, with maximum upwelling occurring between September and March. Both the Reconnaissance Permit area and the 3D Application Area are located offshore of these upwelling events.

Where the Agulhas Current passes the southern tip of the Agulhas Bank (Agulhas Retroflection area), it may shed a filament of warm surface water that moves north-westward along the shelf edge towards Cape Point, and Agulhas Rings, which similarly move north-westwards into the South Atlantic Ocean (Figure 14). These rings may extend to the seafloor and west of Cape Town may split, disperse or join with other rings. During the process of ring formation, intrusions of cold subantarctic water moves into the South Atlantic. The contrast in warm (nutrient-poor) and cold (nutrient-rich) water is thought to be reflected in the presence of cetaceans and large migratory pelagic fish species (Best 2007). The Reconnaissance Permit Area lies offshore of 15°E on the outer edge of these features.

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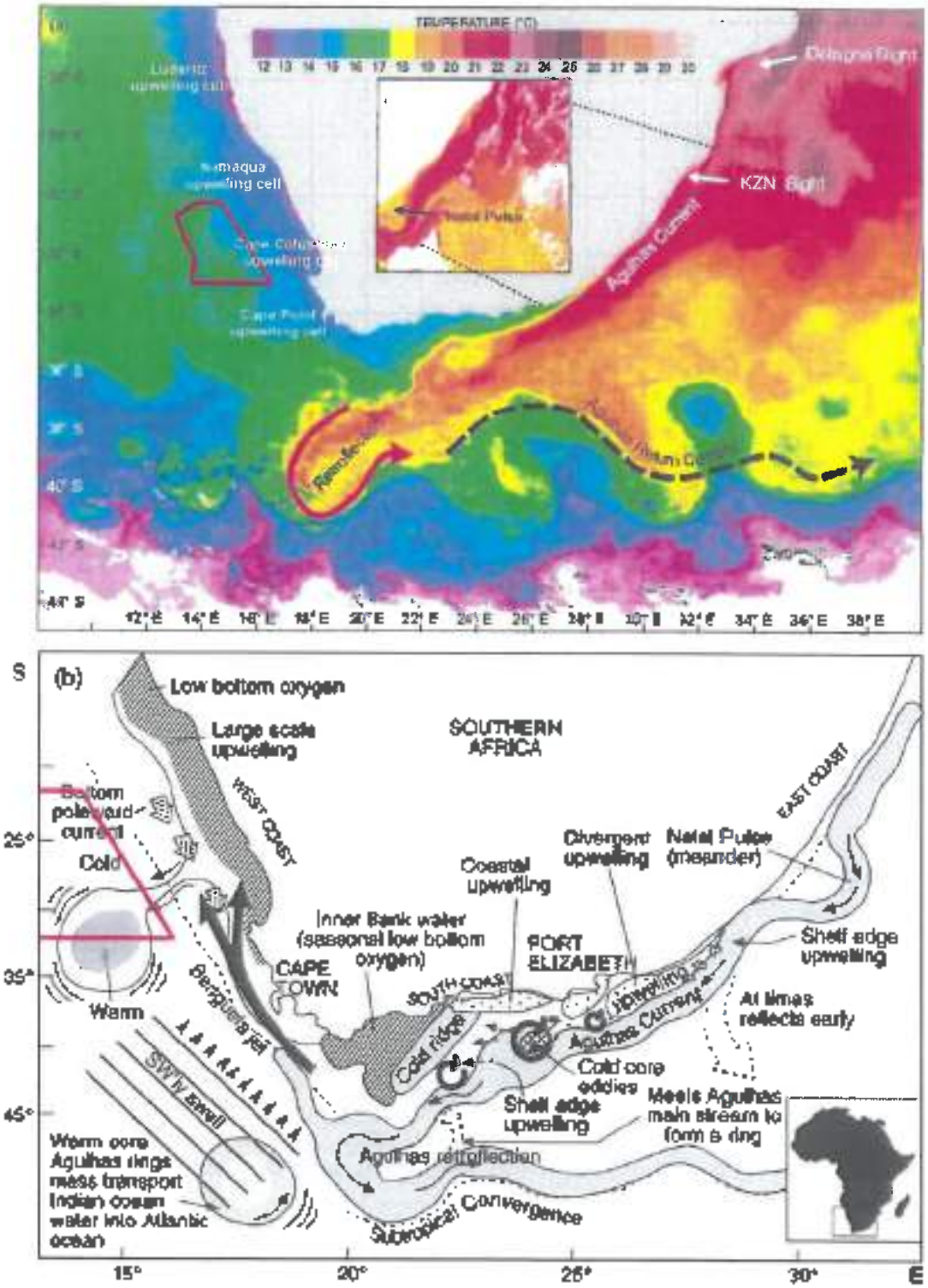

Figure 14: (a) Satellite sea-surface temperature image showing the predominance of the warm Agulhas Current along the South African south coast and the colder upwelled water on the west coast (adapted from Roberts *et al.* 2010), and (b) physical processes and features associated with the Southwest Coast (adapted from Roberts 2005) in relation to the Reconnaissance Permit Area (red polygon).

8.3.3 WAVES AND TIDES

Most of the west coast of southern Africa is classified as exposed, experiencing strong wave action, rating between 13-17 on the 20 point exposure scale (McLachlan 1980). Much of the coastline is therefore impacted

by heavy south-westerly swells generated in the roaring forties, as well as significant sea waves generated locally by the prevailing moderate to strong southerly winds characteristic of the region (Figure 15). The peak wave energy periods fall in the range 9.7 – 15.5 seconds.

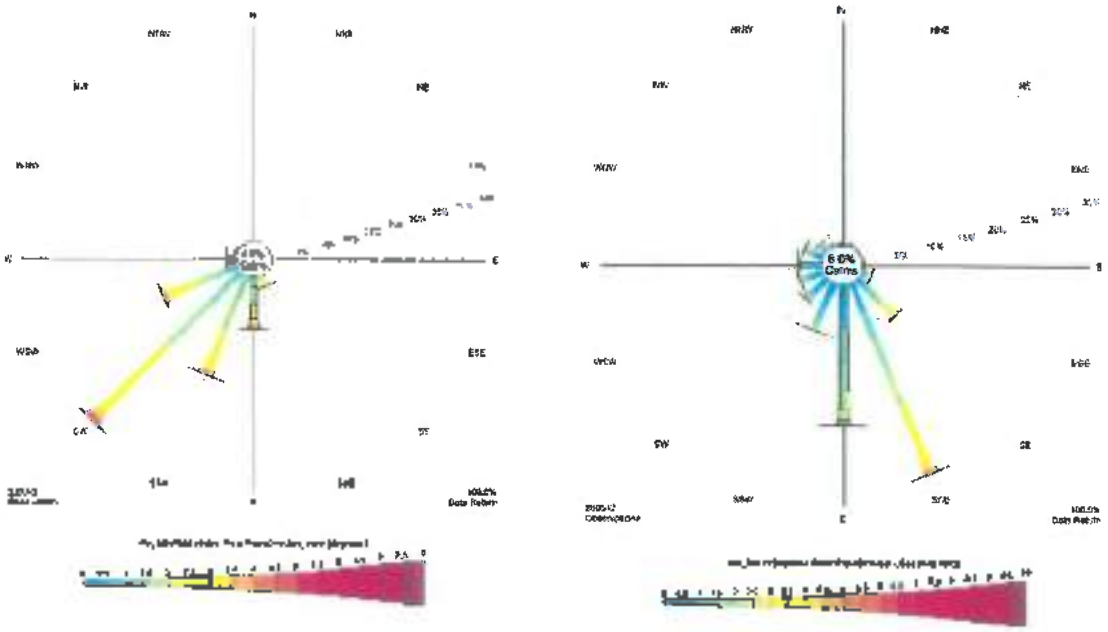

Figure 15: Annual rose plots of significant wave height partitions of swell (left) and wind-sea (right) for GROW1012 hind cast data at location 15°E, 31°S.

The wave regime along the southern African west coast shows only moderate seasonal variation in direction, with virtually all swells throughout the year coming from the S and SSW direction. Winter swells are strongly dominated by those from the S and SSW, which occur almost 80% of the time, and typically exceed 2 m in height, averaging about 3 m, and often attaining over 5 m. With wind speeds capable of reaching 100 km/h during heavy winter south-westerly storms, winter swell heights can exceed 10 m.

In comparison, summer swells tend to be smaller on average, typically around 2 m, not reaching the maximum swell heights of winter. There is also a slightly more pronounced southerly swell component in summer. These southerly swells tend to be wind-induced, with shorter wave periods (~8 seconds), and are generally steeper than swell waves (CSIR 1996). These wind-induced southerly waves are relatively local and, although less powerful, tend to work together with the strong southerly winds of summer to cause the northward-flowing nearshore surface currents, and result in substantial nearshore sediment mobilisation, and northwards transport, by the combined action of currents, wind and waves.

In common with the rest of the southern African coast, tides are semi-diurnal, with a total range of some 1.5 m at spring tide, but only 0.6 m during neap tide periods.

8.3.4 WATER

South Atlantic Central Water (SACW) comprises the bulk of the seawater in the study area, either in its pure form in the deeper regions, or mixed with previously upwelled water of the same origin on the continental shelf (Nelson & Hutchings 1983). Salinities range between 34.5‰ and 35.5‰ (Shannon 1985).

Seawater temperatures on the continental shelf of the southern Benguela typically vary between 6°C and 16°C. Well-developed thermal fronts exist, demarcating the seaward boundary of the upwelled water. Upwelling filaments are characteristic of these offshore thermal fronts, occurring as surface streamers of cold water, typically 50 km wide and extending beyond the normal offshore extent of the upwelling cell. Such fronts typically have a lifespan of a few days to a few weeks, with the filamentous mixing area extending up to 625 km offshore. South and east of Cape Agulhas, the Agulhas retroflection area is a global "hot spot" in terms of temperature variability and water movements.

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations, especially on the bottom. SACW itself has depressed oxygen concentrations (~80% saturation value), but lower oxygen concentrations (<40% saturation) frequently occur (Bailey *et al.* 1985; Chapman & Shannon 1985).

Nutrient concentrations of upwelled water of the Benguela system attain 20 µM nitrate-nitrogen, 1.5 µM phosphate and 15-20 µM silicate, indicating nutrient enrichment (Chapman & Shannon 1985). This is mediated by nutrient regeneration from biogenic material in the sediments (Bailey *et al.* 1985). Modification of these peak concentrations depends upon phytoplankton uptake, which varies according to phytoplankton biomass and production rate. The range of nutrient concentrations can thus be large but, in general, concentrations are high.

8.3.5 UPWELLING AND PLANKTON PRODUCTION

The cold, upwelled water is rich in inorganic nutrients, the major contributors being various forms of nitrates, phosphates and silicates (Chapman & Shannon 1985). During upwelling the comparatively nutrient-poor surface waters are displaced by enriched deep water, supporting substantial seasonal primary phytoplankton production. This, in turn, serves as the basis for a rich food chain up through zooplankton, pelagic baitfish (anchovy, pilchard, round-herring and others), to predatory fish (hake and snoek), mammals (primarily seals and dolphins) and seabirds (jackass penguins, cormorants, pelicans, terns and others). High phytoplankton productivity in the upper layers again depletes the nutrients in these surface waters. This results in a wind-related cycle of plankton production, mortality, sinking of plankton detritus and eventual nutrient re-enrichment occurring below the thermocline as the phytoplankton decays. The eastern boundary of the Reconnaissance Permit Area is located on the western edge of these upwelling events and although waters are expected to be comparatively warm and nutrient poor, seasonal upwelling inshore of the Reconnaissance Permit Area can be expected (see Figure 14). The Application Area is located well offshore of these upwelling events.

8.3.6 ORGANIC INPUTS

The Benguela upwelling region is an area of particularly high natural productivity, with extremely high seasonal production of phytoplankton and zooplankton. These plankton blooms in turn serve as the basis for a rich food chain up through pelagic baitfish (anchovy, pilchard, round-herring and others), to predatory fish (snoek), mammals (primarily seals and dolphins) and seabirds (jackass penguins, cormorants, pelicans, terns and others). All of these species are subject to natural mortality, and a proportion of the annual production of all these trophic levels, particularly the plankton communities, die naturally and sink to the seabed.

Balanced multispecies ecosystem models have estimated that during the 1990s the Benguela region supported biomasses of 76.9 tons/km^2 of phytoplankton and 31.5 tons/km^2 of zooplankton alone (Shannon *et al.* 2003). Thirty six percent of the phytoplankton and 5% of the zooplankton are estimated to be lost to the seabed annually. This natural annual input of millions of tons of organic material onto the seabed off the southern African West Coast has a substantial effect on the ecosystems of the Benguela region. It provides most of the food requirements of the particulate and filter-feeding benthic communities that inhabit the sandy-muds of this area, and results in the high organic content of the muds in the region. As most of the organic detritus is not directly consumed, it enters the seabed decomposition cycle, resulting in subsequent depletion of oxygen in deeper waters.

An associated phenomenon ubiquitous to the Benguela system are red tides (dinoflagellate and/or ciliate blooms) (see Shannon & Pillar 1985; Pitcher 1998). Also referred to as Harmful Algal Blooms (HABs), these red tides can reach very large proportions, extending over several square kilometres of ocean. Toxic dinoflagellate species can cause extensive mortalities of fish and shellfish through direct poisoning, while degradation of organic-rich material derived from both toxic and non-toxic blooms results in oxygen depletion of subsurface water. Being associated primarily with upwelling cells, HABs may occur in inshore of the Reconnaissance Permit Area, but would not be expected in the Application Area.

8.3.7 LOW OXYGEN EVENTS

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations with <40% saturation occurring frequently (e.g. Visser 1969; Bailey *et al.* 1985). The low oxygen concentrations are attributed to nutrient remineralisation in the bottom waters of the system (Chapman & Shannon 1985). The absolute rate of this is dependent upon the net organic material build-up in the sediments, with the carbon rich mud deposits playing an important role. As the mud on the shelf is distributed in discrete patches (see Figure 12), there are corresponding preferential areas for the formation of oxygen-poor water. The two main areas of

low-oxygen water formation in the southern Benguela region are in the Orange River Bight and St Helena Bay (Chapman & Shannon 1985; Bailey 1991; Shannon & O'Toole 1998; Bailey 1999; Fossing *et al.* 2000). The spatial distribution of oxygen-poor water in each of the areas is subject to short- and medium-term variability in the volume of hypoxic water that develops. De Decker (1970) showed that the occurrence of low oxygen water off Lambert's Bay is seasonal, with highest development in summer/autumn. Bailey & Chapman (1991), on the other hand, demonstrated that in the St Helena Bay area daily variability exists as a result of downward flux of oxygen through thermoclines and short-term variations in upwelling intensity. Subsequent upwelling processes can move this low-oxygen water up onto the inner shelf, and into nearshore waters, often with devastating effects on marine communities.

Periodic low oxygen events in the nearshore region can have catastrophic effects on the marine communities leading to large-scale stranding of rock lobsters, and mass mortalities of marine biota and fish (Newman & Pollock 1974; Matthews & Pitcher 1996; Pitcher 1998; Cockcroft *et al.* 2000). The development of anoxic conditions as a result of the decomposition of huge amounts of organic matter generated by phytoplankton blooms is the main cause for these mortalities and walkouts. The most recent walkout occurred in early March 2022 at Elands Bay, when some 500 tons of rocklobster were reported stranded on the beach. The blooms develop over a period of unusually calm wind conditions when sea surface temperatures where high. Algal blooms usually occur during summer-autumn (February to April) but can also develop in winter during the 'berg' wind periods, when similar warm windless conditions occur for extended periods.

8.3.8 TURBIDITY

Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulate matter. Total Suspended Particulate Matter (TSPM) can be divided into Particulate Organic Matter (POM) and Particulate Inorganic Matter (PIM), the ratios between them varying considerably. The POM usually consists of detritus, bacteria, phytoplankton and zooplankton, and serves as a source of food for filter-feeders. Seasonal microphyte production associated with upwelling events will play an important role in determining the concentrations of POM in coastal waters. PIM, on the other hand, is primarily of geological origin consisting of fine sands, silts and clays. Off Namaqualand, the PIM loading in nearshore waters is strongly related to natural inputs from the Orange River or from 'berg' wind events. Although highly variable, annual discharge rates of sediments by the Orange River is estimated to vary from 8 - 26 million tons/yr (Rogers 1979). 'Berg' wind events can potentially contribute the same order of magnitude of sediment input as the annual estimated input of sediment by the Orange River (Shannon & Anderson 1982; Zoutendyk 1992, 1995; Shannon & O'Toole 1998; Lane & Carter 1999). For example, a 'berg' wind event in May 1979 described by Shannon and Anderson (1982) was estimated to have transported in the order of 50 million tons of sand out to sea, affecting an area of 20 000 km^2.

Concentrations of suspended particulate matter in shallow coastal waters can vary both spatially and temporally, typically ranging from a few mg/ℓ to several tens of mg/ℓ (Bricelj & Malouf 1984; Berg & Newell 1986; Fegley *et al.* 1992). Field measurements of TSPM and PIM concentrations in the Benguela current system have indicated that outside of major flood events, background concentrations of coastal and continental shelf suspended sediments are generally <12 mg/ℓ, showing significant long-shore variation (Zoutendyk 1995). Considerably higher concentrations of PIM have, however, been reported from southern African West Coast waters under stronger wave conditions associated with high tides and storms, or under flood conditions. In the vicinity of the Orange River mouth, where river outflow strongly influences the turbidity of coastal waters, measured concentrations ranged from 14.3 mg/ℓ at Alexander Bay just south of the mouth (Zoutendyk 1995) to peak values of 7 400 mg/ℓ immediately upstream of the river mouth during the 1988 Orange River flood (Bremner *et al.* 1990).

The major source of turbidity in the swell-influenced nearshore areas off the West Coast is the redistribution of fine inner shelf sediments by long-period Southern Ocean swells. The current velocities typical of the Benguela (10-30 cm/s) are capable of resuspending and transporting considerable quantities of sediment equator-wards. Under relatively calm wind conditions, however, much of the suspended fraction (silt and clay) that remains in suspension for longer periods becomes entrained in the slow poleward undercurrent (Shillington *et al.* 1990; Rogers & Bremner 1991).

Superimposed on the suspended fine fraction, is the northward littoral drift of coarser bedload sediments, parallel to the coastline. This northward, nearshore transport is generated by the predominantly south-westerly swell and wind-induced waves. Longshore sediment transport varies considerably in the shore-perpendicular

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dimension, being substantially higher in the surf-zone than at depth, due to high turbulence and convective flows associated with breaking waves, which suspend and mobilise sediment (Smith & Mocke 2002).

On the inner and middle continental shelf, the ambient currents are insufficient to transport coarse sediments typical of those depths, and re-suspension and shoreward movement of these by wave-induced currents occur primarily under storm conditions (see also Drake *et al.* 1985; Ward 1985). Data from a Waverider buoy at Port Nolloth have indicated that 2-m waves are capable of re-suspending medium sands (200 µm diameter) at ~10 m depth, whilst 6-m waves achieve this at ~42 m depth. Low-amplitude, long-period waves will, however, penetrate even deeper. Most of the sediment shallower than 90 m can therefore be subject to re-suspension and transport by heavy swells (Lane & Carter 1999).

Offshore of the continental shelf, the oceanic waters are typically clear as they are beyond the influence of aeolian and riverine inputs. The waters in the Reconnaissance Permit Area are thus expected to be comparatively clear.

8.4 BIOLOGICAL ENVIRONMENT

This section provides a description of the biological characteristics of the application area. The information has been sourced from the Marine Ecological Study undertaken by Pisces Environmental Services (Pty) Ltd included in Appendix 3.

Biogeographically, the study area falls into the cold temperate Namaqua Bioregion, which extends from Sylvia Hill, north of Lüderitz in Namibia to Cape Columbine (Emanuel *et al.* 1992; Lombard *et al.* 2004). The Reconnaissance Permit Area falls into the Southeast Atlantic Deep Ocean Ecoregion (Sink *et al.* 2019) (Figure 16). The coastal, wind-induced upwelling characterising the western Cape coastline, is the principle physical process which shapes the marine ecology of the southern Benguela region. The Benguela system is characterised by the presence of cold surface water, high biological productivity, and highly variable physical, chemical and biological conditions.

The Southeast Atlantic Oceanic Ecoregion extends from the shelf edge of the Southern Benguela onto the slope and into the abyssal plain of the Cape Basin, which comprises a relatively monotonous plain, interrupted by sporadic seamounts. This deep ocean region extends into Namibia and is bounded in the north by the prominent Walvis Ridge. In the south it is separated from the Southwest Indian Deep Ocean by the Agulhas Ridge, a transverse ridge that forms part of the Agulhas Falklands Fracture Zone and acts as a divide between the Cape Basin and the Agulhas Basin. The biodiversity patterns in the deep ocean ecosystems are not well understood (Sink *et al.* 2019).

Communities within marine habitats are largely ubiquitous throughout the southern African West Coast region, being particular only to substrate type or depth zone. These biological communities consist of many hundreds of species, often displaying considerable temporal and spatial variability (even at small scales). The offshore marine ecosystems comprise a limited range of habitats, namely unconsolidated seabed sediments, deepwater reefs and the water column. The biological communities 'typical' of these habitats are described briefly below, focusing both on dominant, commercially important and conspicuous species, as well as potentially threatened or sensitive species, which may be affected by the proposed exploration activities.

8.4.1 DEMERSAL COMMUNITIES

8.4.1.1 BENTHIC INVERTEBRATE MACROFAUNA

The seabed communities in the Reconnaissance Permit Area lie within the Namaqua sub-photic and continental slope biozones, which extend from a 50 m depth to the shelf edge, and beyond to the lower deep-sea slope, respectively. The benthic habitats of South Africa were mapped as part of the 2018 National Biodiversity Assessment (Sink *et al.* 2019) to develop assessments of the ecosystem threat status and ecosystem protection level. The benthic ecosystem types were subsequently mapped (Figure 17) and assigned an ecosystem threat status based on their level of protection (Figure 18). The Reconnaissance Permit Area is characterised by a limited variety of ecosystem types covering the mid- and lower shelves, the Southeast Atlantic continental slope and the Cape Basin Abyss.

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Figure 16: The Reconnaissance Permit Area (red polygon) in relation to the inshore and offshore ecoregions of the South African coast (adapted from Sink *et al.* 2019).

The benthic biota of unconsolidated marine sediments constitutes invertebrates that live on (epifauna) or burrow within (infauna) the sediments and are generally divided into macrofauna (animals >1 mm) and meiofauna (<1 mm). Numerous studies have been conducted on southern African West Coast continental shelf benthos, mostly focused on mining, pollution or demersal trawling impacts (Christie & Moldan 1977; Moldan 1978; Jackson & McGibbon 1991; Field *et al.* 1996; Field & Parkins 1997; Parkins & Field 1998; Pulfrich & Penney 1999; Goosen *et al.* 2000; Savage *et al.* 2001; Steffani & Pulfrich 2004; 2007; Steffani 2007a; 2007b; Atkinson 2009; Steffani 2009a, 2009b, 2010a, 2010b, 2010c; Atkinson *et al.* 2011; Steffani 2012a, 2012b, 2014; Karenyi 2014; Steffani *et al.* 2015; Biccard & Clark 2016; Biccard *et al.* 2016; Duna *et al.* 2016; Karenyi *et al.* 2016; Biccard *et al.* 2017, 2018; Gihwala *et al.* 2018; Biccard *et al.*2019; Gihwala *et al.* 2019). These studies, however, concentrated on the continental shelf and nearshore regions, and consequently the benthic fauna of the outer shelf and continental slope (beyond ~450 m depth) are very poorly known. This is primarily due to limited opportunities for sampling as well as the lack of access to Remote Operated Vehicles (ROVs) for visual sampling of hard substrata.

To date very few areas on the continental slope off the West Coast have been biologically surveyed (Sink *et al.* 2019; Harris *et al.* 2022). Although sediment distribution studies (Rogers & Bremner 1991) suggest that the outer shelf is characterised by unconsolidated sediments (see Figure 11), recent surveys conducted between 180 m and 480 m depth offshore of the Northern Cape coast revealed high proportions of hard ground rather than unconsolidated sediment, although this requires further verification (Karenyi unpublished data).

To date there have been no studies examining connectivity between slope, plateau or abyssal ecosystems in South Africa and there is thus limited knowledge on the benthic biodiversity of all three of these broad ecosystem groups in South African waters (Sink *et al.* 2019). There is no quantitative data describing bathyal ecosystems in South Africa and hence limited understanding of ecosystem functioning and sensitivity (Anderson & Hulley 2000; Harris *et al.* 2022). Due to the lack of information on benthic macrofaunal communities beyond the shelf break, no description can be provided for the offshore portions of the Reconnaissance Permit Area. However, as these communities would receive the sound in the far field only, no detrimental effects to the communities or to individual benthic species are expected. The description below for areas on the continental shelf, offshore of the Northern Cape coast is drawn from recent surveys by Karenyi (2014), Duna *et al.* (2016), Mostert *et al.* (2016), and Gihwala *et al.* (2018, 2019).

Three macro-infauna communities have been identified on the inner- (0-30 m depth) and mid-shelf (30-150 m depth, Karenyi *et al.* 2016). Polychaetes, crustaceans and molluscs make up the largest proportion of individuals, biomass and species on the west coast. The inner-shelf community, which is affected by wave action, is characterised by various mobile gastropod and polychaete predators and sedentary polychaetes and isopods. The mid-shelf community inhabits the mudbelt and is characterised by mud prawns. A second mid-shelf community occurring in sandy sediments, is characterised by various deposit-feeding polychaetes. The distribution of species within these communities are inherently patchy reflecting the high natural spatial and

temporal variability associated with macro-infauna of unconsolidated sediments (e.g. Kenny *et al.* 1998; Kendall & Widdicombe 1999; van Dalfsen *et al.* 2000; Zajac *et al.* 2000; Parry *et al.* 2003), with evidence of mass mortalities and substantial recruitments recorded on the South African West Coast (Steffani & Pulfrich 2004).

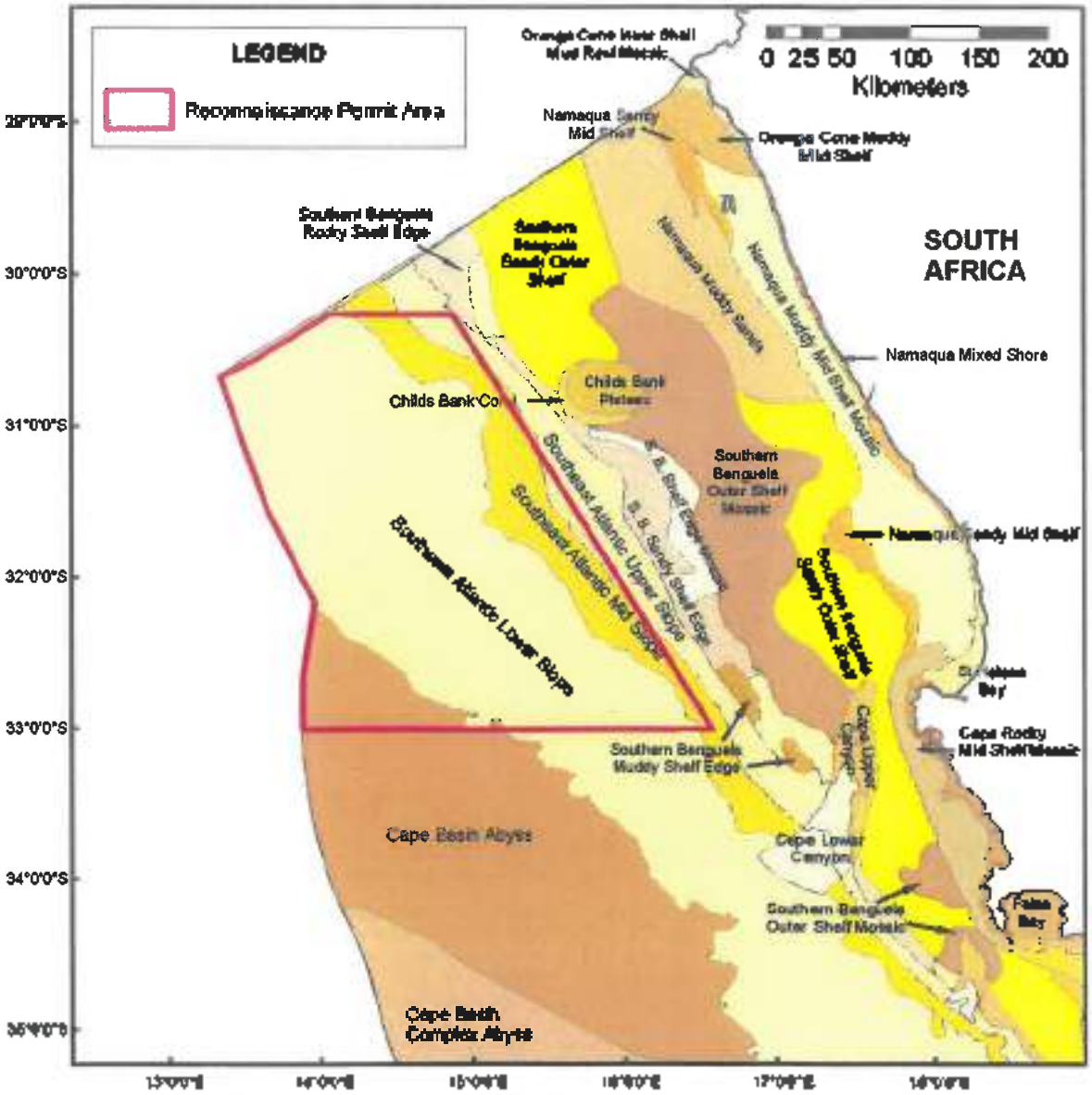

Figure 17: The Reconnaissance Permit Area (red polygon) in relation to the distribution of ecosystem types along the West Coast (adapted from Sink *et al.* 2019). Only those ecosystem types within the immediate vicinity of the Reconnaissance Permit Area are labelled.

Despite the current lack of knowledge of the community structure and endemicity of South African macro-infauna off the edge of the continental shelf, the marine component of the 2018 National Biodiversity Assessment (Sink *et al.* 2019), rated the South Atlantic bathyal and abyssal unconsolidated habitat types that characterise depths beyond 500 m, as being of 'Least concern' (Figure 18), with only those communities occurring along the shelf edge (~500 m) being considered 'Vulnerable'. This primarily reflects the great extent of these habitats in the South African Exclusive Economic Zone (EEZ).

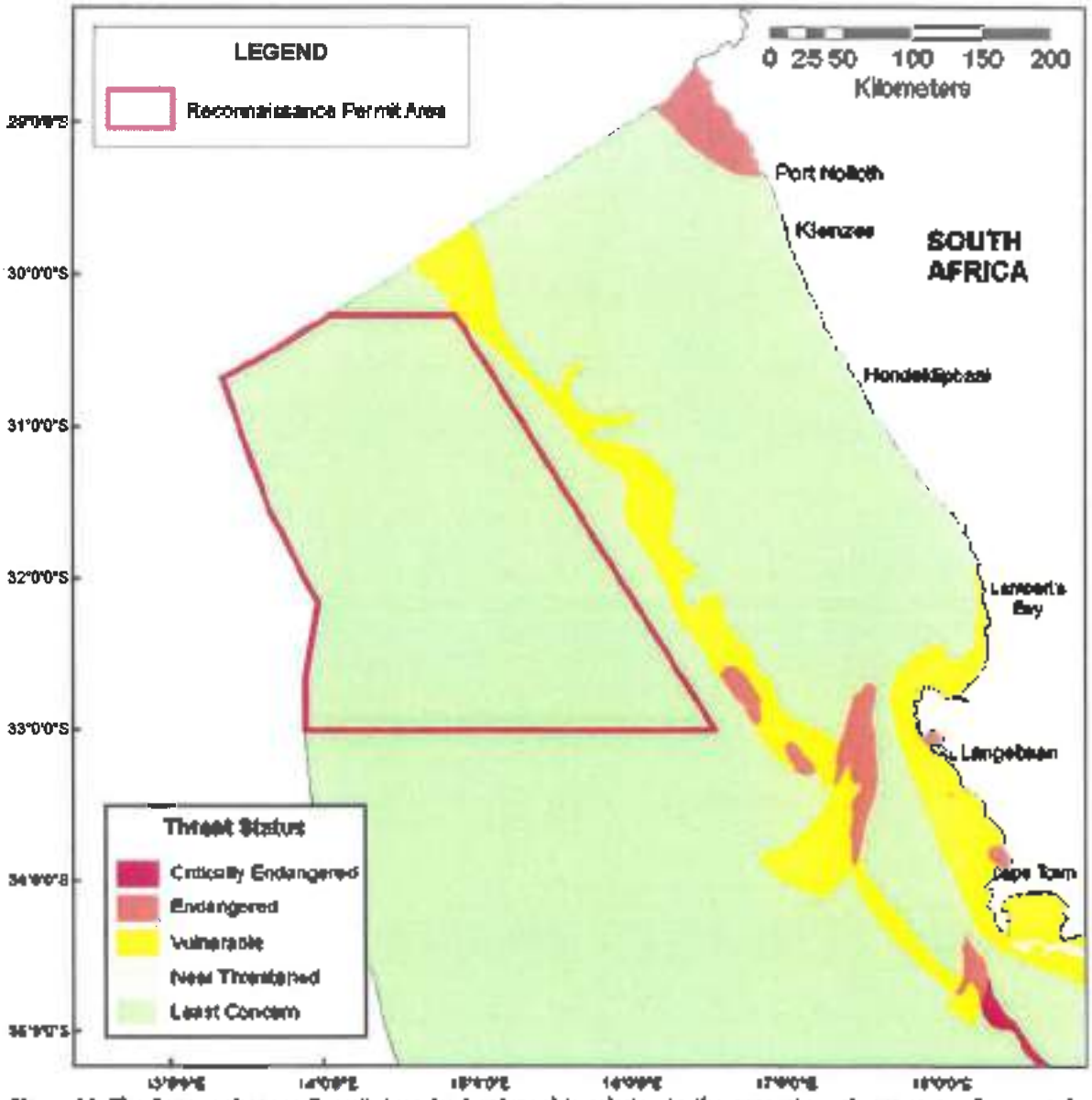

Figure 18: The Reconnaissance Permit Area (red polygon) in relation to the ecosystem threat status for coastal and offshore benthic and pelagic habitat types on the South African West Coast (adapted from Sink *et al.* 2019).

Karenyi *et al.* (2016) found that off Namaqualand, species richness generally increased from the inner-shelf across the mid-shelf and is influenced by sediment type. The highest total abundance and species diversity was measured in sandy sediments of the mid-shelf. Biomass is highest in the inshore (± 50 g/m^2 wet weight) and decreases across the mid-shelf averaging around 30 g/m^2 wet weight. This is contrary to Christie (1974) who found that biomass was greatest in the mudbelt at 80 m depth off Lamberts Bay, where the sediment characteristics and the impact of environmental stressors (such as low oxygen events) are likely to differ from those off the northern Namaqualand coast.

Benthic communities are structured by the complex interplay of a large array of environmental factors. Water depth and sediment grain size are considered the two major factors that determine benthic community structure and distribution on the South African west coast (Christie 1974, 1976; Steffani & Pulfrich 2004a, 2004b; 2007; Steffani 2007a; 2007b) and elsewhere in the world (e.g. Gray 1981; Ellingsen 2002; Bergen *et al.* 2001; Post *et al.* 2006). However, studies have shown that shear bed stress - a measure of the impact of current velocity on sediment – oxygen concentration (Post *et al.* 2006; Currie *et al.* 2009; Zettler *et al.* 2009, 2013), productivity (Escaravage *et al.* 2009), organic carbon and seafloor temperature (Day *et al.* 1971) may also strongly influence the structure of benthic communities. There are clearly other natural processes operating in the deep water shelf areas of the West Coast that can over-ride the suitability of sediments in determining benthic community

structure, and it is likely that periodic intrusion of low oxygen water masses is a major cause of this variability (Monteiro & van der Plas 2006; Pulfrich *et al.* 2006). In areas of frequent oxygen deficiency, benthic communities will be characterised either by species able to survive chronic low oxygen conditions, or colonising and fast-growing species able to rapidly recruit into areas that have suffered oxygen depletion. The combination of local, episodic hydrodynamic conditions and patchy settlement of larvae will tend to generate the observed small-scale variability in benthic community structure.

The invertebrate macrofauna are important in the marine benthic environment as they influence major ecological processes (e.g. remineralisation and flux of organic matter deposited on the sea floor, pollutant metabolism, sediment stability) and serve as important food source for commercially valuable fish species and other higher order consumers. As a result of their comparatively limited mobility and permanence over seasons, these animals provide an indication of historical environmental conditions and provide useful indices with which to measure environmental impacts (Gray 1974; Warwick 1993; Salas *et al.* 2006).

Also associated with soft-bottom substrates are demersal communities that comprise epifauna and bottom-dwelling vertebrate species, many of which are dependent on the invertebrate benthic macrofauna as a food source. According to Lange (2012) the continental shelf on the West Coast between depths of 100 m and 250 m, contained a single epifaunal community characterised by the hermit crabs *Sympagurus dimorphus* and *Parapagurfs pilosimanus*, the prawn *Funchalia woodwardi* and the sea urchin *Brissopsis capensis*. Atkinson (2009) also reported numerous species of urchins and burrowing anemones beyond 300 m depth off the West Coast.

Information on the benthic fauna of the lower continental slope and abyss (beyond 1 800 m depth) is largely lacking due to limited opportunities for sampling. However, deep water benthic sampling was undertaken (Benthic Solutions Ltd 2019) as part of the Environmental Baseline Survey for Total E&P Namibia's Block 2913B just to the north of the Reconnaissance Permit Area. This provided valuable information on the benthic infaunal communities of the lower continental slope. As conditions in such deep water habitats tend to be more uniform (low temperatures and low oxygen concentrations characterising the SACW that comprises the bulk of the water in the area), similar communities may be expected in the Reconnaissance Permit Area.

The macrofauna in Block 2913B were generally impoverished but fairly consistent, which is typical for deep water sediments. The 105 species recorded, were dominated by polychaetes, which accounted for 64.1% of the total individuals. Molluscs were represented by 11 species (19.6% of total individuals), whilst 10 species of crustaceans were recorded (contributing to only 9.8% of total individuals). Echinoderms were represented by only 3 species (5.8% of total individuals), whilst all other groups (Actiniaria, Nemertea, Nematoda, Asoidiacea and Priapulida) accounted for the remaining 5.9% of individuals. The deposit-feeding polychaete *Spiophanes sp.* was the most abundant species recorded. This small bristleworm can either be a passive suspension feeder or a surface deposit feeder, living off sediment particles, planktonic organisms and meiobenthic organisms. The bivalve mollusc *Microgloma mirmidina* was the second most common species, with the polychaete tentatively identified as a *Leiocapitellide* being the third most abundant. With the exception of the carnivorous polychaete *Glycera capitata*, most species were suspension or deposit feeders typical of soft unconsolidated sediments.

Examples of the macroinvertebrate infauna of the Block 2913B area are illustrated in Figure 19. A wide diversity of macroinvertebrates has been recorded inshore of the 1 000 m depth contour, and the reader is referred to the comprehensive field guide compiled by Atkinson & Sink (2018).

The 2018 National Biodiversity Assessment for the marine environment (Sink *et al.* 2019) points out that very few national IUCN Red List assessments have been conducted for marine invertebrate species to date owing to inadequate taxonomic knowledge, limited distribution data, a lack of systematic surveys and limited capacity to advance species red listing for these groups.

8.4.1.2 DEEP-WATER CORAL COMMUNITIES

There has been increasing interest in deep-water corals in recent years because of their likely sensitivity to disturbance and their long generation times. These benthic filter-feeders generally occur at depths in below 150 m with some species being recorded from as deep as 3 000 m. Some species form reefs while others are smaller and remain solitary. Corals add structural complexity to otherwise uniform seabed habitats thereby creating areas of high biological diversity (Breeze *et al.* 1997; Macissac *et al.* 2001). Deep water corals establish themselves below the thermocline where there is a continuous and regular supply of concentrated particulate organic matter, caused by the flow of a relatively strong current over special topographical formations which cause eddies to form. Nutrient seepage from the substratum might also promote a location for settlement (Hovland *et al.* 2002). In the productive Benguela region, substantial areas on and off the edge of the shelf should

thus potentially be capable of supporting rich, cold water, benthic, filter-feeding communities, and various species of scleractine and stylasterine corals have been reported from depths beyond -200 m in the Orange Basin.

Such communities would also be expected with topographic features such as seamounts located adjacent to the northern and western boundary of the Reconnaissance Permit Area (see Figure 9). Nonetheless, our understanding of the invertebrate fauna of the sub-photic zone is relatively poor (Gibbons *et al.* 1999) and the conservation status of the majority of invertebrates in this bioregion is not known.

8.4.1.3 DEMERSAL FISH SPECIES

Demersal fish are those species that live and feed on or near the seabed. As many as 110 species of bony and cartilaginous fish have been identified in the demersal communities on the continental shelf of the West Coast (Roel 1987). Details on demersal fish communities beyond the shelf break and in the Reconnaissance Permit Area are, however, lacking (see Harris *et al.* 2012). Changes in fish communities occur both latitudinally (Shine 2006, 2008; Yemane *et al.* 2015) and with increasing depth (Roel 1987; Smale *et al.* 1993; Macpherson & Gordon 1992; Bianchi *et al.* 2001; Atkinson 2009; Yemane *et al.* 2015), with the most substantial change in species composition occurring in the shelf break region between 300 m and 400 m depth (Roel 1987; Atkinson 2009). The shelf community (<380 m) is dominated by the Cape hake *M. capensis*, and includes jacopever (*Helicolenus dactylopterus*), kusk catshark (*Holohalaelurus regani*), soupfin shark (*Galeorhinus galeus*) and whitespotted houndshark (*Mustelus palumbes*). The more diverse deeper water community is dominated by the deepwater hake (*Merluccius paradoxus*), monkfish (*Lophius vomerinus*), kingklip (*Genypterus capensis*), bronze whiptail (*Lucigadus ori*) and hairy conger (*Bassanago albescens*) and various squalid shark species. There is some degree of species overlap between the depth zones.

Roel (1987) showed seasonal variations in the distribution ranges shelf communities, with species such as the pelagic goby (*Sufflogobius bibarbatus*), and West Coast sole (*Austroglossus microlepis*) occurring in shallow water north of Cape Point during summer only. The deep-sea community was found to be homogenous both spatially and temporally. In a more recent study, however, Atkinson (2009) identified two long-term community shifts in demersal fish communities; the first (early to mid-1990s) being associated with an overall increase in density of many species, whilst many species decreased in density during the second shift (mid-2000s). These community shifts correspond temporally with regime shifts detected in environmental forcing variables (Sea Surface Temperatures and upwelling anomalies) (Howard *et al.* 2007) and with the eastward shifts observed in small pelagic fish species and rock lobster populations (Coetzee *et al.* 2008, Cockcroft *et al.* 2008).

The diversity and distribution of demersal cartilaginous fishes on the West Coast is discussed by Compagno *et al.* (1991). The species that may occur in the general project area and on the continental shelf inshore thereof, and their approximate depth range, are listed in Table 7. Details on demersal cartilaginous species beyond the shelf break and in the Reconnaissance Permit Area are lacking, however.

There is limited information about bathyal fish communities in South Africa. South Africa defines its bathyal zone as extending from 500 m to 3 500 m, recognising an upper slope (500-1 000 m), mid slope (1 000-1 800 m) and lower slope (1 800-3 500 m). Typical upper slope fishes (200-2 000 m) include rattails (Macrouridae), greeneyes (*Chlorophthalmus* species), notacanthids, halosaurs, chimaeras, skates, bythitids such as *Cataetyx* spp. and moriids (deepsea cods) (Smith & Heemstra 2003). Rattails, bythitids, liparidids (snail fishes) and notacanthids (*Polyacanthonotus* species and halosaurs) are characteristic of the lower bathyal (see also Iwamoto & Anderson 1994; Jones 2014).

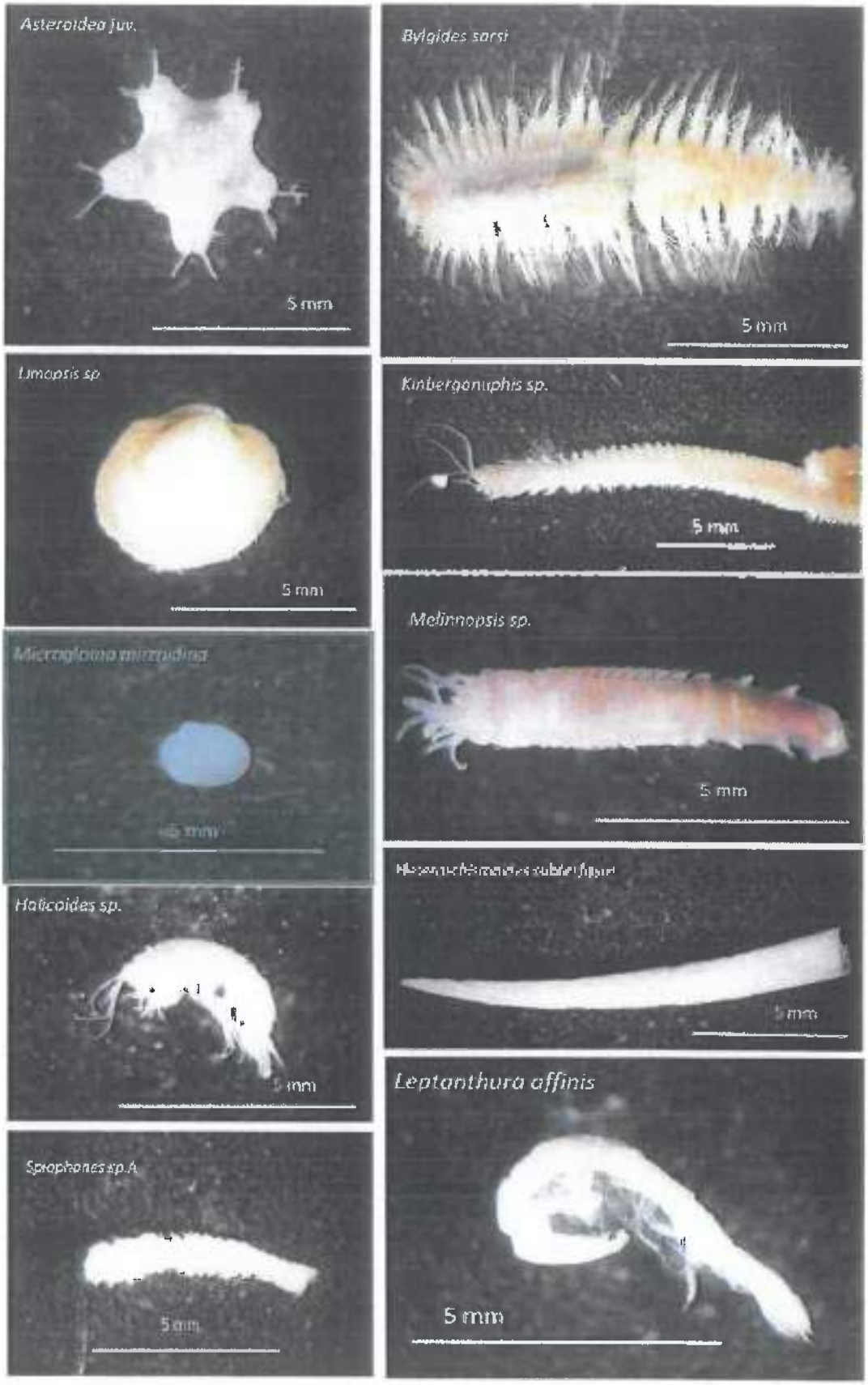

Figure 19: Examples of macroinvertebrates recorded in Block 2913B to the north of the Reconnaissance Permit Area (Source Benthic Solutions Ltd 2019).

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Table 7: Demersal cartilaginous species found on the continental shelf along the West Coast, with approximate depth range at which the species occurs (Compagno *et al.* 1991) and their IUCN conservation status. The National Assessment is provided in parentheses where available.

Common Name	Scientific name	Depth Range (m)	IUCN Conservation Status
Frilled shark	*Chlamydoselachus anguineus*	200-1 000	LC
Six gill cowshark	*Hexanchus griseus*	150-600	NT
Gulper shark	*Centrophorus granulosus*	480	EN
Leafscale gulper shark	*Centrophorus squamosus*	370-800	EN
Bramble shark	*Echinorhinus brucus*	55-285	EN
Black dogfish	*Centroscyllium fabricii*	>700	LC
Portuguese shark	*Centroscymnus coelolepis*	>700	NT
Longnose velvet dogfish	*Centroscymnus crepidater*	400-700	NT
Birdbeak dogfish	*Deania calcea*	400-800	NT
Arrowhead dogfish	*Deania profundorum*	200-500	NT
Longsnout dogfish	*Deania quadrispinosa*	200-650	VU
Sculpted lanternshark	*Etmopterus brachyurus*	450-900	DD
Brown lanternshark	*Etmopterus compagnoi*	450-925	LC
Giant lanternshark	*Etmopterus granulosus*	>700	LC
Smooth lanternshark	*Etmopterus pusillus*	400-500	LC
Spotted spiny dogfish	*Squalus acanthias*	100-400	VU
Shortnose spiny dogfish	*Squalus megalops*	75-460	LC
Shortspine spiny dogfish	*Squalus mitsukurii*	150-600	EN
Sixgill sawshark	*Pliotrema warreni*	60-500	LC
Goblin shark	*Mitsukurina owstoni*	270-960	LC
Smalleye catshark	*Apristurus microps*	700-1 000	LC
Saldanha catshark	*Apristurus saldanha*	450-765	LC
"grey/black wonder" catsharks	*Apristurus spp.*	670-1 005	LC
Tiger catshark	*Halaelurus natalensis*	50-100	VU

Common Name	Scientific name	Depth Range (m)	IUCN Conservation Status
Izak catshark	*Holohalaelurus regani*	100-500	LC
Yellowspotted catshark	*Scyliorhinus capensis*	150-500	NT
Soupfin shark/Vaalhaai	*Galeorhinus galeus*	<10-300	[illegible]
Houndshark	*Mustelus mustelus*	<100	EN (DD)
Whitespotted houndshark	*Mustelus palumbes*	>350	LC
Little guitarfish	*Rhinobatos annulatus*	>200	VU (LC)
Atlantic electric ray	*Torpedo nobiliana*	120-450	LC
African softnose skate	*Bathyraja smithii*	400-1 020	LC
Smoothnose legskate	*Crurirajа durbanensis*	>1 000	DD
Roughnose legskate	*Crurirajа parcomaculata*	150-620	LC
African dwarf skate	*Neoraja stehmanni*	290-1 025	LC
Thorny skate	*Raja radiata*	50-600	VU
Bigmouth skate	*Raja robertsi*	>1 000	LC
Slime skate	*Dipturus pullopunctatus*	15-460	LC
Rough-belly skate	*Raja springeri*	85-500	LC
Yellowspot skate	*Raja wallacei*	70-500	VU
Roughskin skate	*Dipturus spinacidermis*	1 000-1 350	EN
Biscuit skate	*Raja clavata*	25-500	NT
Munchkin skate	*Rajella caudaspinosa*	300-520	LC
Bigthorn skate	*Raja confundens*	100-800	LC
Ghost skate	*Rajella dissimilis*	420-1 005	LC
Leopard skate	*Rajella leopardus*	300-1 000	LC
Smoothback skate	*Rajella ravidula*	500-1 000	LC
Spearnose skate	*Rostroraja alba*	75-260	EN
St Joseph	*Callorhinchus capensis*	30-380	LC (LC)
Cape chimaera	*Chimaera notafricana*	680-1 000	LC

5020

Common Name	Scientific name	Depth Range (m)	IUCN Conservation Status
Brown chimaera	*Chimaera coraphila*	420-850	LC
Spearnose chimaera	*Rhinochimaera atlantica*	650-960	LC

LC – Least Concern, VU – Vulnerable, NT – Near Threatened, EN – Endangered, CR – Critically Endangered, DD – Data Deficient

8.4.2 SEAMOUNT AND SUBMARINE CANYON COMMUNITIES

Features such as banks, knolls and seamounts (referred to collectively here as "seamounts"), which protrude into the water column, are subject to, and interact with, the water currents surrounding them. The effects of such seabed features on the surrounding water masses can include the up-welling of relatively cool, nutrient-rich water into nutrient-poor surface water thereby resulting in higher productivity (Clark *et al.* 1999), which can in turn strongly influences the distribution of organisms on and around seamounts. Evidence of enrichment of bottom-associated communities and high abundances of demersal fishes has been regularly reported over such seabed features.

The enhanced fluxes of detritus and plankton that develop in response to the complex current regimes lead to the development of detritivore-based food-webs, which in turn lead to the presence of seamount scavengers and predators. Seamounts provide an important habitat for commercial deepwater fish stocks such as orange roughy, oreos, alfonsino and Patagonian toothfish, which aggregate around these features for either spawning or feeding (Koslow 1996).

Such complex benthic ecosystems in turn enhance foraging opportunities for many other predators, serving as mid-ocean focal points for a variety of pelagic species with large ranges (turtles, tunas and billfish, pelagic sharks, cetaceans and pelagic seabirds) that may migrate large distances in search of food or may only congregate on seamounts at certain times (Hui 1985; Harley *et al.* 1995). Seamounts thus serve as feeding grounds, spawning and nursery grounds and possibly navigational markers for a large number of species (SPRFMA 2007; Derville *et al.* 2020).

Enhanced currents, steep slopes and volcanic rocky substrata, in combination with locally generated detritus, favour the development of suspension feeders in the benthic communities characterising seamounts (Rogers 1994). Deep- and cold-water corals (including stony corals, black corals and soft corals) are a prominent component of the suspension-feeding fauna of many seamounts, accompanied by barnacles, bryozoans, polychaetes, molluscs, sponges, sea squirts, basket stars, brittle stars and crinoids (reviewed in Rogers 2004). There is also associated mobile benthic fauna that includes echinoderms (sea urchins and sea cucumbers) and crustaceans (crabs and lobsters) (reviewed by Rogers 1994; Kenyon *et al.* 2003). Some of the smaller cnidarians species remain solitary while others form reefs thereby adding structural complexity to otherwise uniform seabed habitats.

Consequently, the fauna of seamounts is usually highly unique and may have a limited distribution restricted to a single geographic region, a seamount chain or even a single seamount location (Rogers *et al.* 2008). As a result of conservative life histories (i.e. very slow growing, slow to mature, high longevity, low fecundity and unpredictable recruitment) and sensitivity to changes in environmental conditions, such biological communities have been identified as Vulnerable Marine Ecosystems (VMEs). They are recognised as being particularly sensitive to anthropogenic disturbance (primarily deep-water trawl fisheries and mining), and once damaged are very slow to recover, or may never recover (FAO 2008).

Geological features of note within the broader project area are Child's Bank and Tripp Seamount, with an unnamed seamount located in ~3 500 m at ~32°20'S; 13°30'E, as well as the Cape Canyon and Cape Point Valley. Child's Bank, which is situated at about 31°S, was described by Dingle *et al.* (1987) to be a carbonate mound (bioherm). The top of this feature is a sandy plateau with dense aggregations of brittle stars, while the steeper slopes have dense invertebrate assemblages including unidentified cold-water corals/rugged limestone feature, bounded at outer edges by precipitous cliffs at least 150 m high (Birch & Rogers 1973). Composed of sediments and the calcareous deposits from an accumulation of carbonate skeletons of sessile organisms (e.g. cold-water coral, foraminifera or marl), such features typically have topographic relief, forming isolated seabed knolls in otherwise low profile homogenous seabed habitats (Kopaska-Merkel & Haywick 2001; Kenyon *et al.* 2003,

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Wheeler *et al.* 2005, Colman *et al.* 2005). Tripp Seamount situated at about 29°40'S, lies ~30 km north of the northern boundary of the Application Area. It rises from the seabed at ~1 000 m to a depth of 150 m and roughly circular with a flat apex that drops steeply on all sides. There is reference to decapods crustaceans from Tripp Seamount (Kensley 1980, 1981) and exploratory deepwater trawl fishing (Hampton 2003), but otherwise knowledge of benthic communities characterising this seamount is lacking.

The Cape Rise comprises a group of NE-SW trending seamounts – the Southeast Atlantic Seamounts - which include Argentina and Protea Seamounts and the recently discovered Mount Marek. These rise up from over ~2 500 m depth in the Cape Basin abyss to 700 m deep. Other than a geoscience survey conducted in 1986 using a deep water camera to sample the lower bathyal and abyssal zones, including the seamount flanks, of the Cape Basin (Rogers 1986) no biodiversity surveys are known to have been conducted at Protea and Argentina seamounts. Southern Africa's seamounts and their associated benthic communities have not been sampled by either geologists or biologists (Sink & Samaai, 2009) and little is known about the benthic and neritic communities associated with them.

A recent study reporting on the megabenthos and benthopelagic fish on the Southeast Atlantic Seamounts (Bergstad *et al.* 2019), provides descriptions of the Erica and Schmitt-Ott Seamounts that lie approximately 450 – 500 km southwest of the Argentina Seamount and rise from the surrounding abyss to depths of 770 m and 920 m, respectively. Corals were the most frequent and widespread sessile invertebrate recorded on video transects, dominated by gorgonians whose abundance increased towards the seamount summits. Scleractinian and hydrocorals were also observed as was a diversity of sponges, echinoderms and crustaceans. Fish associated with the seamount included oreo dories, grenadiers and lanternshark. Similar communities might therefore be expected from the Protea and Argentina Seamounts.

During 2016-2018 the Department of Environmental Affairs: Oceans and Coast Branch (DEA: O&C) undertook research cruises to explore some of the undocumented areas of seabed off the West Coast, among them the Cape Canyon. Using tow-cameras, benthic grabs and dredges, the biota of the canyon head to ~500 m depth were sampled (Figure 20). A diversity of echinoderms, molluscs, and crustaceans were reported to dominate the canyon head, while scavengers such as ophuiroides and decapods were prevalent within habitats ranging from sandy areas, to patches of inshore and offshore mud belts. At depths of <100 m inshore of the canyon head, boulder beds hosted gorgonian and stylasterine corals.

The concept of a 'Vulnerable Marine Ecosystem' (VME) centres upon the presence of distinct, diverse benthic assemblages that are limited and fragmented in their spatial extent, and dominated (in terms of biomass and/or spatial cover) by rare, endangered or endemic component species that are physically fragile and vulnerable to damage (or structural/biological alteration) by human activities (Parker *et al.* 2009; Auster *et al.* 2011; Hansen *et al.* 2013).

VMEs are known to be associated with higher biodiversity levels and indicator species that add structural complexity, resulting in greater species abundance, richness, biomass and diversity compared to surrounding uniform seabed habitats (Buhl-Mortensen *et al.* 2010; Hogg *et al.* 2010; Barrio Froján *et al.* 2012; Beazley *et al.* 2013, 2015). Compared to the surrounding deep-sea environment, VMEs typically form biological hotspots with a distinct, abundant and diverse fauna, many species of which remain unidentified. Levels of endemism on VMEs are also relatively high compared to the deep sea. The coral frameworks offer refugia for a great variety of invertebrates and fish (including commercially important species) within, or in association with, the living and dead coral framework thereby creating spatially fragmented areas of high biological diversity. The skeletal remains of Scleractinia coral rubble and Hexactinellid poriferans can also represent another important deep-sea habitat, acting to stabilise seafloor sediments allowing for colonisation by distinct infaunal taxa that show elevated abundance and biomass in such localised habitats (Bett & Rice 1992; Faws & Vanreusel 2005; Beazley *et al.* 2013; Ashford *et al.* 2019).

VMEs are also thought to contribute toward the long-term viability of a stock through providing an important source of habitat for commercial species (Pham *et al.* 2015; Ashford *et al.* 2019). They can provide a wide range of ecosystem services ranging from provision of aggregation- and spawning sites to providing shelter from predation and adverse hydrological conditions (Husebø & Nøttestad *et al.* 2002; Krieger & Wing, 2002; Tissot *et al.*, 2006; Baillon *et al.* 2012; Pham *et al.* 2015). Indicator taxa for VMEs are also known to provide increased access to food sources, both directly to associated benthic fauna, and indirectly to other pelagic species such as fish and other predators due to the high abundance and biomass of associated fauna (Krieger & Wing, 2002; Husebø & Nøttestad *et al.* 2002; Buhl-Mortensen *et al.*, 2010; Hogg *et al.*, 2010; Auster *et al.* 2011).

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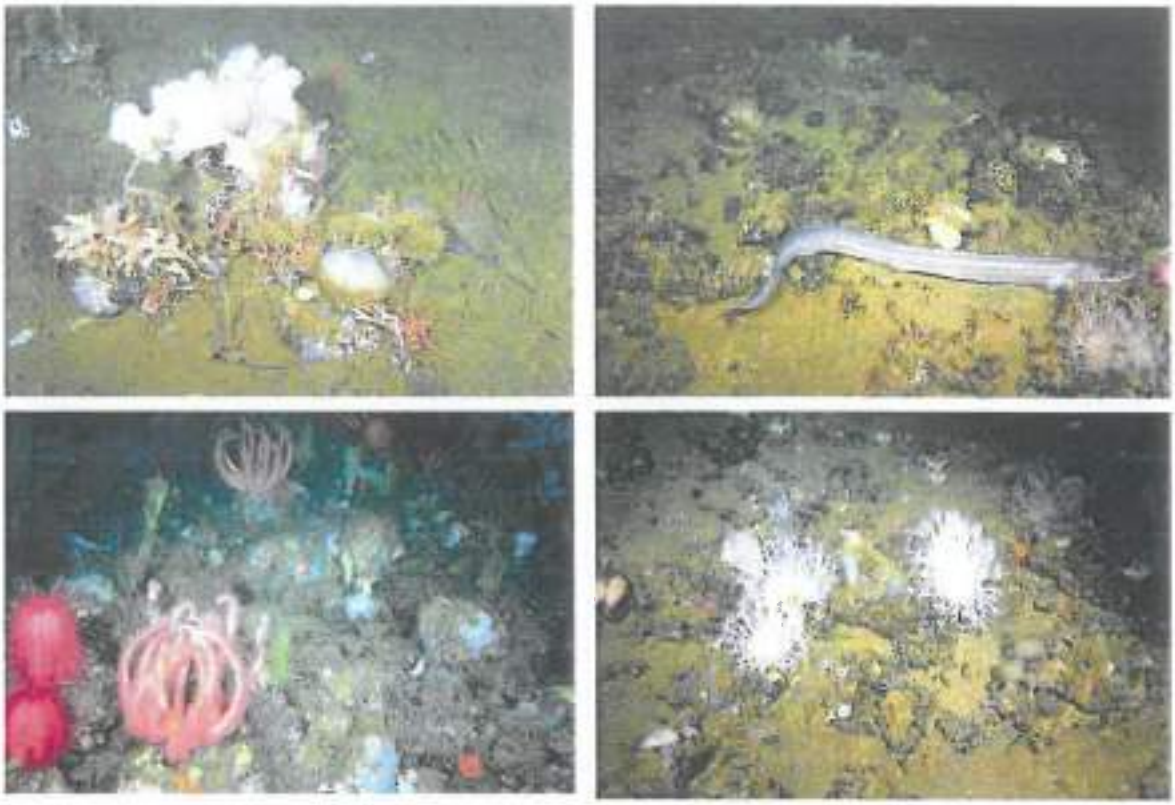

Figure 20: Deep water benthic macrofauna from various depths in the Cape Canyon (Source: www.environment.gov.za/dearesearchteamreturnfromdeepseaexpedition).

VME frameworks are typically elevated from the seabed, increasing turbulence and raising supply of suspended particles to suspension feeders (Krieger & Wing 2002; Buhl-Mortensen & Mortensen 2005; Buhl-Mortensen *et al.* 2010). Porifierans and cold-water corals have further been shown to provide a strong link between pelagic and benthic food webs (Pile & Young 2006; Cathalot *et al.* 2015). VMEs are increasingly being recognised as providers of important ecosystem services due to associated increased biodiversity and levels of ecosystem functioning (Ashford *et al.* 2019).

It is not always the case that seamount habitats are VMEs, as some seamounts may not host communities of fragile animals or be associated with high levels of endemism. Evidence from video footage taken on hard-substrate habitats in 100 - 120 m depth off southern Namibia and to the south-east of Child's Bank (De Beers Marine, unpublished data) (Figure 21), and in 190-527 m depth on Child's Bank (Sink *et al.* 2019) suggest that vulnerable communities including gorgonians, octocorals and reef-building sponges and hard-corals do occur on the continental shelf, some of which are thought to be Vulnerable Marine Ecosystem (VME) indicator species (Table 8). The distribution of 22 potential VME indicator taxa for the South African EEZ was recently mapped, with those from the West Coast listed in Table 8 (Atkinson & Sink 2018; Sink *et al.* 2019).

As sampling beyond 1 000 m depth has not taken place (Atkinson & Sink 2018) it is not known whether similar communities may be expected in the Reconnaissance Permit Area. Should they occur, however, they would receive the sound in the far field only and no detrimental effects to the communities or to individual benthic species are expected. The distribution of known and potential Vulnerable Marine Ecosystem habitat based on potential VME features, DFFE and SAEON trawl survey data, and many visual surveys indicating the presence of indicator taxa were mapped by Harris *et al.* 2022 (Figure 22). Some sites need more research to determine their status. The location of the Reconnaissance Permit Area is well offshore of these known and potential VMEs emphasising the gaps in our knowledge specific to the vulnerability of marine communities of abyssal habitats.

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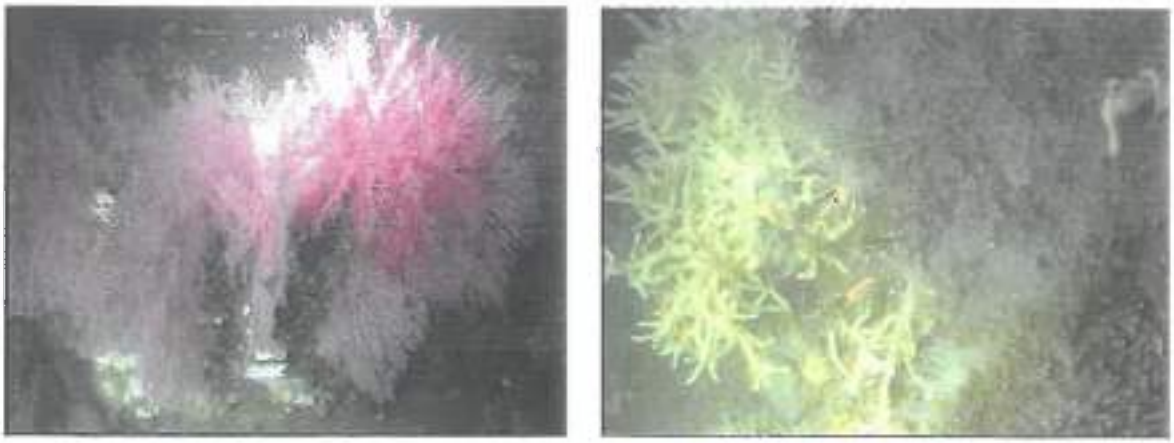

Figure 21: Gorgonians and bryozoans communities recorded on deep-water reefs (100-120 m) off the southern African West Coast (Photos: De Beers Marine).

Table 8: Table of Potential VME species from the continental shelf and shelf edge on the West Coast (Atkinson & Sink 2018)

Phylum	Name	Common Name
Porifera	*Suberites dendelenae*	Amorphous solid sponge
	Rossella cf. antarctica	Glass sponge
Cnidaria	*Melithaea* spp.	Colourful sea fan
	Thouarella spp.	Bottlebrush sea fan
Family: Isididae	?	Bamboo coral
	Anthoptilum grandiflorum	Large sea pen*
	Lophelia pertusa	Reef-building cold water coral
	Stylaster spp.	Fine-branching hydrocoral
Bryozoa	*Adeonella* spp.	Sabre bryozoan
	Phidoloporidae spp.	Honeycomb false lace coral
Hemichordata	*Cephalodiscus gilchristi*	Acorn animal

Sediment samples collected at the base of Norwegian cold-water coral reefs revealed high interstitial concentrations of light hydrocarbons (methane, propane, ethane and higher hydrocarbons C4+) (Hovland & Thomsen 1997), which are typically considered indicative of localised light hydrocarbon micro-seepage through the seabed. Bacteria and other micro-organisms thrive on such hydrocarbon pore-water seepages, thereby providing suspension-feeders, including corals and gorgonians, with a substantial nutrient source. Some scientists believe there is a strong correlation between the occurrence of deep-water coral reefs and the relatively high values of light hydrocarbons (methane, ethane, propane and n-butane) in near-surface sediments (Hovland *et al.* 1998, Duncan & Roberts 2001, Hall-Spencer *et al.* 2002, Roberts & Gage 2003). A recent study by January (2018) identified that hydrocarbon seeps and gas escape structures have been identified in the Orange Basin area. Large fluid seep/pockmark fields of varying morphologies were also reported to the south of the Reconnaissance Permit Area by Palan (2017).

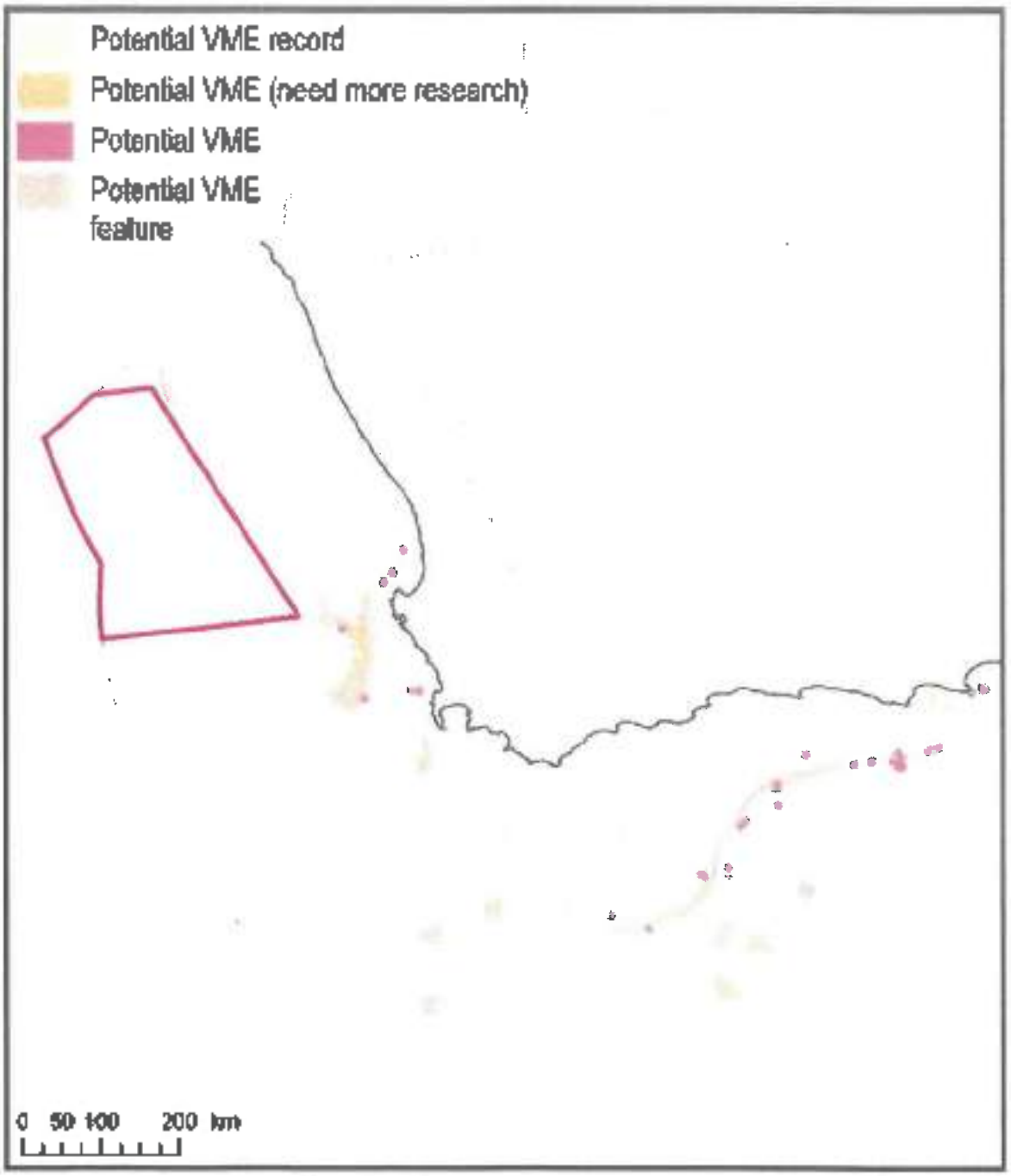

Figure 22: The Reconnaissance Permit Area (red polygon) in relation to the distribution of known and potential Vulnerable Marine Ecosystem habitat (adapted from Harris *et al.* 2022).

8.4.3 PELAGIC COMMUNITIES

In contrast to demersal and benthic biota associated with the seabed, pelagic species live and feed in the open water column. The pelagic communities are typically divided into plankton and fish, and their main predators, marine mammals (seals, dolphins and whales), seabirds and turtles. These are discussed separately below.

8.4.3.1 PLANKTON

Plankton is particularly abundant in the shelf waters off the West Coast, being associated with the upwelling characteristic of the area. Plankton range from single-celled bacteria to jellyfish of 2-m diameter, and include bacterio-plankton, phytoplankton, zooplankton, and ichthyoplankton (Figure 23).

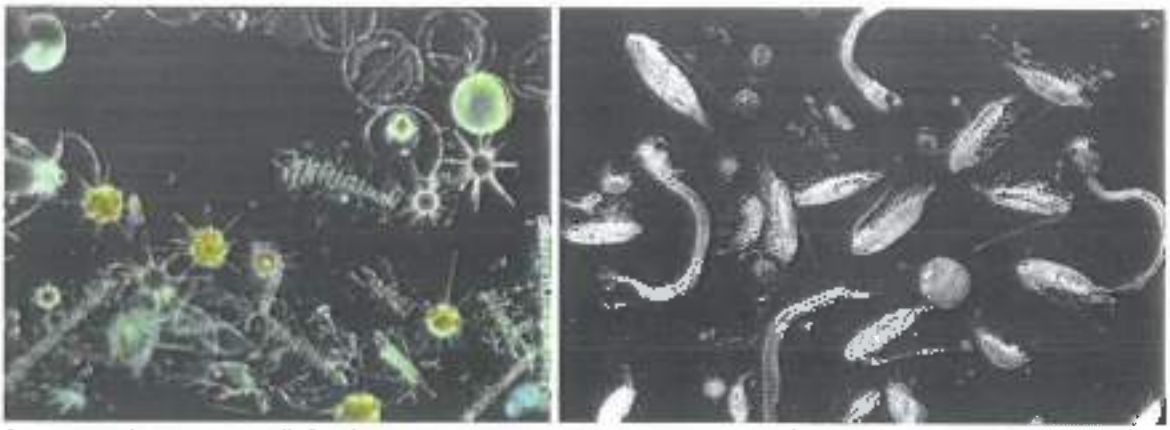

Figure 23: Phytoplankton (left, photo: hymagazine.com) and zooplankton (right, photo: mysciencebox.org) is associated with upwelling cells.

Phytoplankton are the principle primary producers with mean productivity ranging from 2.5 - 3.5 g C/m²/day for the midshelf region and decreasing to 1 g C/m²/day inshore of 130 m (Shannon & Field 1985; Mitchell-Innes & Walker 1991; Walker & Peterson 1991). The phytoplankton is dominated by large-celled organisms, which are adapted to the turbulent sea conditions. The most common diatom genera are *Chaetoceros*, *Nitzschia*, *Thalassiosira*, *Skeletonema*, *Rhizosolenia*, *Coscinodiscus* and *Asterionella* (Shannon & Pillar 1985). Diatom blooms occur after upwelling events, whereas dinoflagellates (e.g. *Prorocentrum*, *Ceratium* and *Peridinium*) are more common in blooms that occur during quiescent periods, since they can grow rapidly at low nutrient concentrations. In the surf zone, diatoms and dinoflagellates are nearly equally important members of the phytoplankton, and some silicoflagellates are also present.

Red-tides are ubiquitous features of the Benguela system (see Shannon & Pillar, 1986). The most common species associated with red tides (dinoflagellate and/or ciliate blooms) are *Noctiluca scintillans*, *Gonyaulax catenorensis*, *G. polygramma* and the ciliate *Mesodinium rubrum*. *Gonyaulax* and *Mesodinium* have been linked with toxic red tides. Most of these red-tide events occur quite close inshore although Hutchings *et al.* (1985) have recorded red-tides 30 km offshore. They are unlikely to occur in the offshore regions of the Application Area.

The mesozooplankton (≥200 µm) is dominated by copepods, which are overall the most dominant and diverse group in southern African zooplankton. Important species are *Centropages brachiatus*, *Calanoides carinatus*, *Metridia lucens*, *Nannocalanus minor*, *Clausocalanus arcuicornis*, *Paracalanus parvus*, *P. crassirostris* and *Ctenocalanus vanus*. All of the above species typically occur in the phytoplankton rich upper mixed layer of the water column, with the exception of *M. lucens* which undertakes considerable vertical migration.

The macrozooplankton (≥1 600 µm) are dominated by euphausiids of which 18 species occur in the area. The dominant species occurring in the nearshore are *Euphausia lucens* and *Nyctiphanes capensis*, although neither species appears to survive well in waters seaward of oceanic fronts over the continental shelf (Pillar *et al.* 1991).

Standing stock estimates of mesozooplankton for the southern Benguela area range from 0.2 - 2.0 g C/m², with maximum values recorded during upwelling periods. Macrozooplankton biomass ranges from 0.1-1.0 g C/m², with production increasing north of Cape Columbine (Pillar 1986). Although it shows no appreciable onshore-offshore gradients, standing stock is highest over the shelf, with accumulation of some mobile zooplanktors (euphausiids) known to occur at oceanographic fronts. Beyond the continental slope biomass decreases markedly. Localised peaks in biomass may, however, occur in the vicinity of Child's Bank and Tripp Seamount in response to topographically steered upwelling around such seabed features.

Zooplankton biomass varies with phytoplankton abundance and, accordingly, seasonal minima will exist during non-upwelling periods when primary production is lower (Brown 1984; Brown & Henry 1985), and during winter when predation by recruiting anchovy is high. More intense variation will occur in relation to the upwelling cycle; newly upwelled water supporting low zooplankton biomass due to paucity of food, whilst high biomasses develop in aged upwelled water subsequent to significant development of phytoplankton. Irregular pulsing of the upwelling system, combined with seasonal recruitment of pelagic fish species into West Coast shelf waters during winter, thus results in a highly variable and dynamic balance between plankton replenishment and food availability for pelagic fish species.

Although ichthyoplankton (fish eggs and larvae) comprise a minor component of the overall plankton, it remains significant due to the commercial importance of the overall fishery in the region. Various pelagic and demersal fish species are known to spawn in the inshore regions of the southern benguela, (including pilchard, round herring, chub mackerel lanternfish and hakes (Crawford *et al.* 1987; Hutchings 1994; Hutchings *et al.* 2002) (see Figure 24, Figure 25, Figure 26, and Figure 27), and their eggs and larvae form an important contribution to the ichthyoplankton in the region. Spawning of key species is presented below.

- Hake, snoek and round herring move to the western Agulhas Bank and southern west coast to spawn in late winter and early spring (key period), when offshore Ekman losses are at a minimum and their eggs and larvae drift northwards and inshore to the west coast nursery grounds. Figure 25 and Figure 26 highlight the temporal variation in hake eggs and larvae with there being a greater concentration of eggs and larvae between September - October compared to March - April. However, hake are reported to spawn throughout the year (Stramma *et al.* 2015). Snoek spawn along the shelf break (150-400 m) of the western Agulhas Bank and the West Coast between June and October (Griffiths 2002).
- Horse mackerel spawn over the east/central Agulhas Bank during winter months.
- Sardines spawn on the whole Agulhas Bank during November, but generally have two spawning peaks, in early spring and autumn, on either side of the peak anchovy spawning period (Figure 27, left). There is also sardine spawning on the east coast and even off KwaZulu-Natal, where sardine eggs are found during July–November.
- Anchovies spawn on the whole Agulhas Bank (Figure 27, right), with spawning peaking during mid-summer (November–December) and some shifts to the west coast in years when Agulhas Bank water intrudes strongly north of Cape Point.

The eggs and larvae are carried around Cape Point and up the coast in northward flowing surface waters. At the start of winter every year, the juveniles recruit in large numbers into coastal waters across broad stretches of the shelf between the Orange River and Cape Columbine to utilise the shallow shelf region as nursery grounds before gradually moving southwards in the inshore southerly flowing surface current, towards the major spawning grounds east of Cape Point. Following spawning, the eggs and larvae of snoek are transported to inshore (<150 m) nursery grounds north of Cape Columbine and east of Danger Point, where the juveniles remain until maturity. There is no overlap of the Reconnaissance Permit Area or indicative 3D acquisition area with the northward egg and larval drift of commercially important species, and the return migration of recruits (Figure 24). In the offshore oceanic waters of the Application Area, ichthyoplankton abundance is, therefore, expected to be low.

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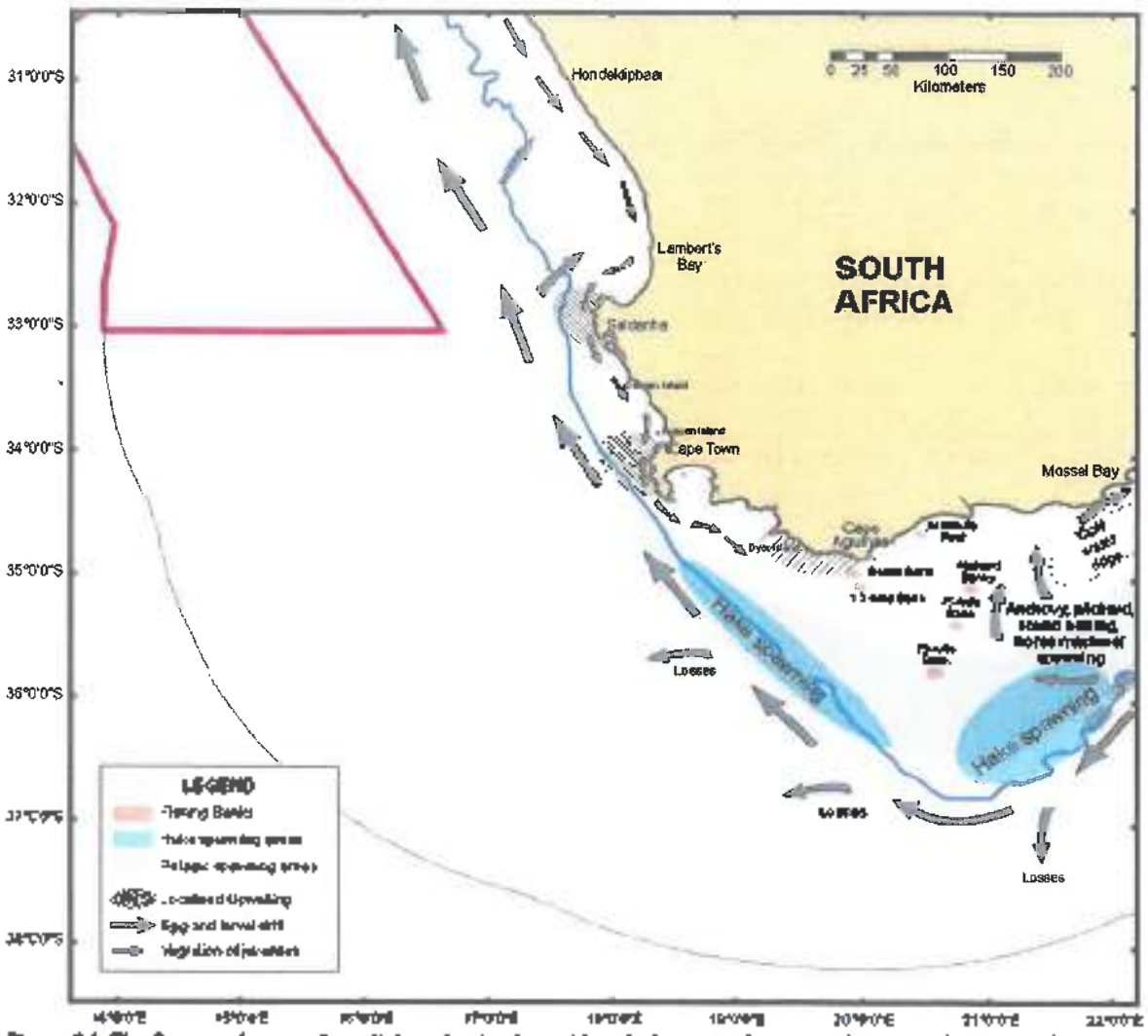

Figure 24: The Reconnaissance Permit Area (red polygon) in relation to major spawning, recruitment and nursery areas in the southern Benguela region (adapted from Crawford *et al.* 1987; Hutchings 1994; Hutchings *et al.* 2002).

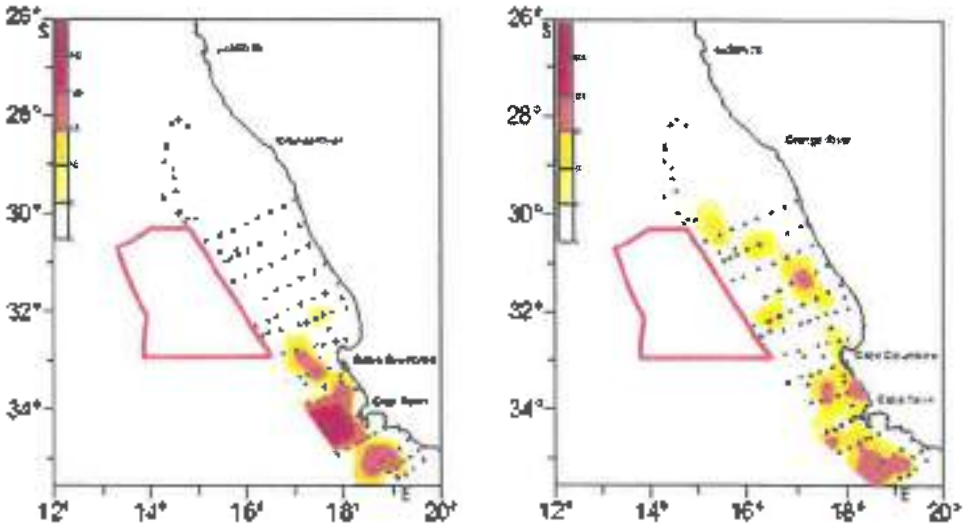

Figure 25: Distribution of hake eggs (left) and larvae (right) off the West Coast of South Africa between September and October 2005 (adapted from Stenevik *et al.* 2008) in relation to the Reconnaissance Permit Area (red polygon).

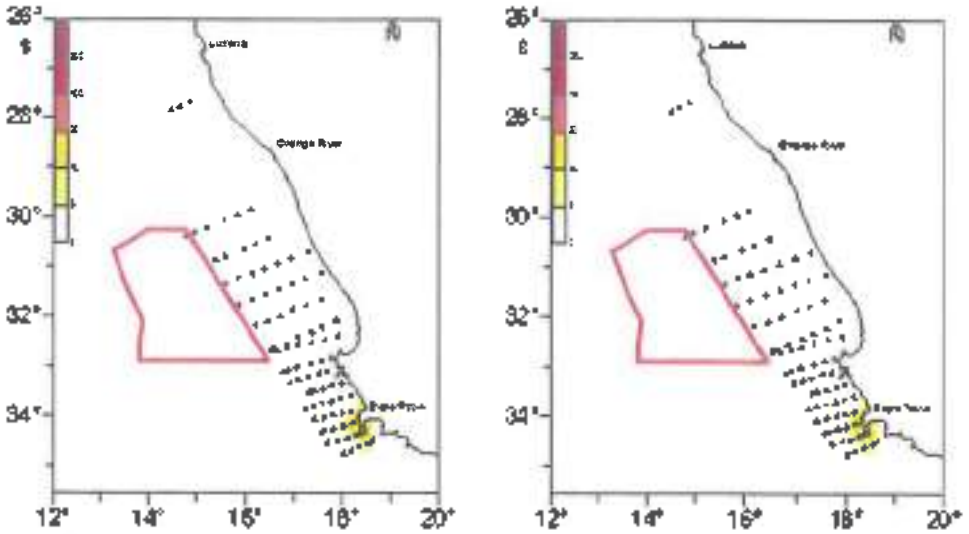

Figure 26: Distribution of hake eggs (left) and larvae (right) off the West Coast of South Africa between March and April 2007 (adapted from Stenevik *et al.* 2008) in relation to the Reconnaissance Permit Area (red polygon).

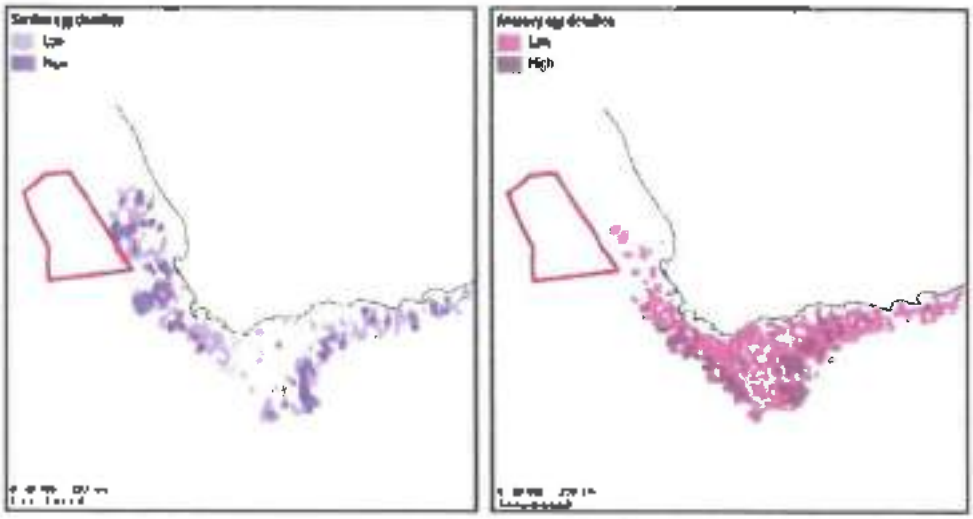

Figure 27: Distribution of sardine (left) and anchovy (right) spawning areas, as measured by egg densities, in relation to the Reconnaissance Permit Area (red polygon) (adapted from Harris *et al.* 2022).

8.4.3.2 CEPHALOPODS

Fourteen species of cephalopods have been recorded in the southern Benguela, the majority of which are sepioids/cuttlefish (Lipinski 1992; Augustyn *et al.* 1995). Most of the cephalopod resource is distributed on the mid-shelf with *Sepia australis* being most abundant at depths between 60-190 m, whereas *S. hierredda* densities were higher at depths between 110-250 m. *Rossia enigmatica* occurs most commonly on the edge of the shelf to depths of 500 m. Biomass of these species was generally higher in the summer than in winter.

Cuttlefish are largely epi-benthic and occur on mud and fine sediments in association with their major prey item; mantis shrimps (Augustyn *et al.* 1995). They form an important food item for demersal fish.

The colossal squid *Mesonychoteuthis hamiltoni* and the giant squid *Architeuthis* sp. may also be encountered in the project area. Both are deep dwelling species, with the colossal squid's distribution confined to the entire circum-Antarctic Southern Ocean (Figure 28, top) while the giant squid is usually found near continental and island slopes all around the world's oceans (Figure 28, bottom). Both species could thus potentially occur in the pelagic habitats of the project area, although the likelihood of encounter is extremely low.

Growing to in excess of 10 m in length, they are the principal prey of the sperm whale, and are also taken by beaked whales, pilot whales, elephant seals and sleeper sharks. Nothing is known of their vertical distribution, but data from trawled specimens and sperm whale diving behaviour suggest they may span a depth range of

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300 – 1 000 m. They lack gas-filled swim bladders and maintain neutral buoyancy through an ammonium chloride solution occurring throughout their bodies.

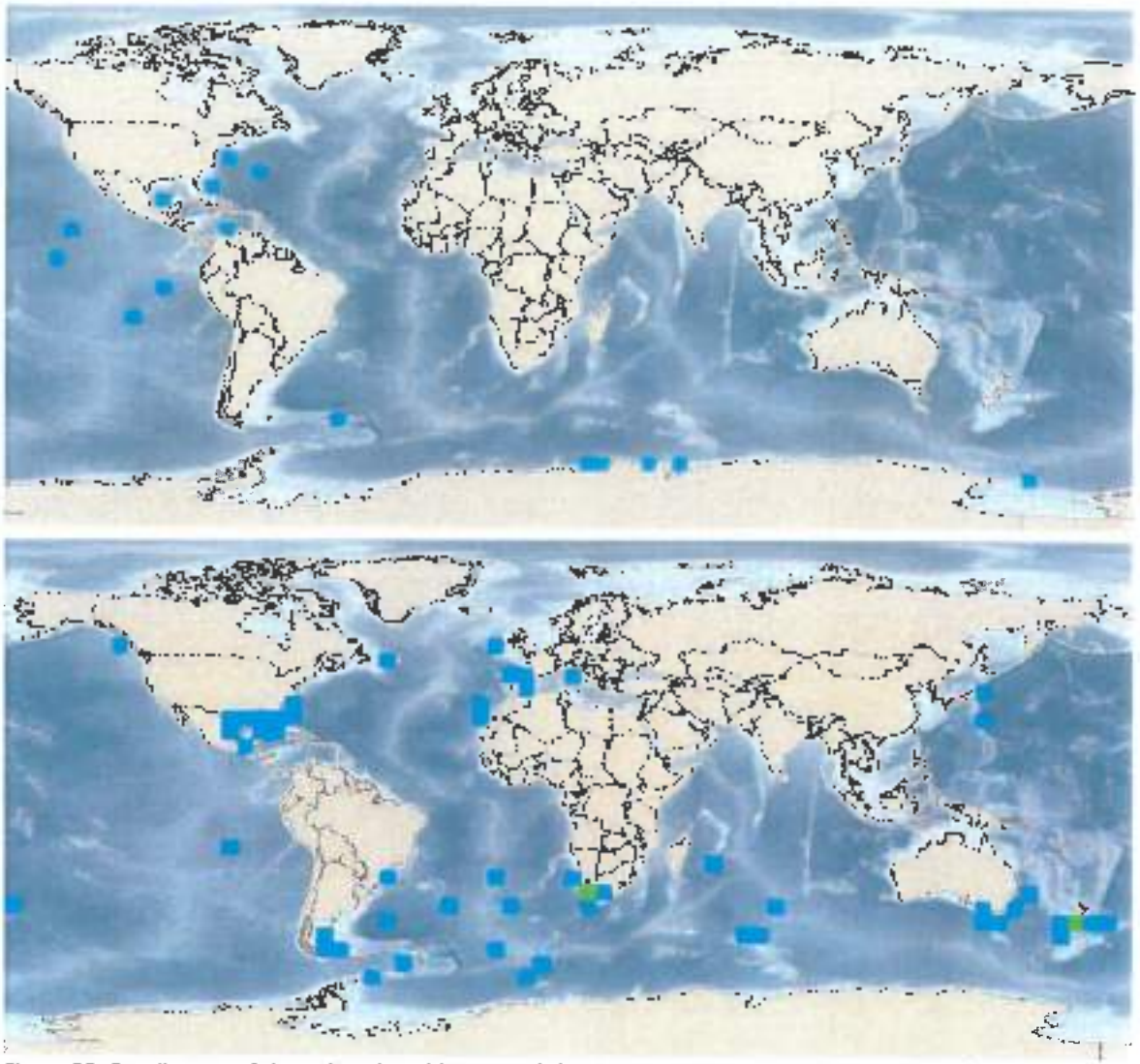

Figure 28: Distribution of the colossal squid (top) and the giant squid (bottom). Blue squares <5 records, green squares 5-10 records (Source: http://iobis.org).

8.4.3.3 PELAGIC FISH

Small pelagic species include the sardine/pilchard (*Sadinops ocellatus*) (Figure 29, left), anchovy (*Engraulis capensis*), chub mackerel (*Scomber japonicus*), horse mackerel (*Trachurus capensis*) (Figure 29, right) and round herring (*Etrumeus whiteheadi*). These species typically occur in mixed shoals of various sizes (Crawford et al. 1987), and generally occur within the 200 m contour and thus likely to only be encountered in southeastern inshore portion of the project area. Most of the pelagic species exhibit similar life history patterns involving seasonal migrations between the west and south coasts. The spawning areas of the major pelagic species are distributed on the continental shelf and along the shelf edge extending from south of St Helena Bay to Mossel Bay on the South Coast (Shannon & Pillar 1986) (see Figure 24). They spawn downstream of major upwelling centres in spring and summer, and their eggs and larvae are subsequently carried around Cape Point and up the coast in northward flowing surface waters.

At the start of winter every year, juveniles of most small pelagic shoaling species recruit into coastal waters in large numbers between the Orange River and Cape Columbine. They recruit in the pelagic stage, across broad stretches of the shelf, to utilise the shallow shelf region as nursery grounds before gradually moving southwards in the inshore southerly flowing surface current, towards the major spawning grounds east of Cape Point. Recruitment success relies on the interaction of oceanographic events, and is thus subject to spatial and

temporal variability. Consequently, the abundance of adults and juveniles of these small, short-lived (1-3 years) pelagic fish is highly variable both within and between species.

Figure 29: Cape fur seal preying on a shoal of pilchards (left). School of horse mackerel (right) (photos: www.underwatervideo.co.za; www.delivery.superstock.com).

Two species that migrate along the West Coast following the shoals of anchovy and pilchards are snoek *Thyrsites atun* and chub mackerel *Scomber japonicus*. Both these species have been rated as 'Least concern' on the national assessment (Sink *et al.* 2019). While the appearance of chub mackerel along the West and South-West coasts is highly seasonal, adult snoek are found throughout their distribution range and longshore movement are random and without a seasonal basis (Griffiths 2002). Initially postulated to be a single stock that undergoes a seasonal longshore migration from southern Angola through Namibia to the South African West Coast (Crawford & De Villiers 1985; Crawford *et al.* 1987), Benguela snoek are now recognised as two separate sub-populations separated by the Lüderitz upwelling cell (Griffiths 2009). On the West Coast, snoek move offshore to spawn and there is some southward dispersion as the spawning season progresses, with females on the West Coast moving inshore to feed between spawning events as spawning progresses. In contrast, those found further south along the western Agulhas Bank remain on the spawning grounds throughout the spawning season (Griffiths 2002) (Figure 30). They are voracious predators occurring throughout the water column, feeding on both demersal and pelagic invertebrates and fish. Chub mackerel similarly migrate along the southern African West Coast reaching South-Western Cape waters between April and August. They move inshore in June and July to spawn before starting the return northwards offshore migration later in the year. Their abundance and seasonal migrations are thought to be related to the availability of their shoaling prey species (Payne & Crawford 1989). The distribution of snoek and chub mackerel therefore lies well inshore of the Reconnaissance Permit Area.

The fish most likely to be encountered on the shelf, beyond the shelf break and in the offshore waters of the Application Areas are the large migratory pelagic species, including various tunas, billfish and sharks, many of which are considered threatened by the International Union for the Conservation of Nature (IUCN), primarily due to overfishing (Table 9). Tuna and swordfish are targeted by high seas fishing fleets and illegal overfishing has severely damaged the stocks of many of these species. Similarly, pelagic sharks, are either caught as bycatch in the pelagic tuna longline fisheries, or are specifically targeted for their fins, where the fins are removed and the remainder of the body discarded.

These large pelagic species migrate throughout the southern oceans, between surface and deep waters (>300 m) and have a highly seasonal abundance in the Benguela. Species occurring off western southern Africa include the albacore/longfin tuna *Thunnus alalunga* (Figure 31, right), yellowfin *T. albacores*, bigeye *T. obesus*, and skipjack *Katsuwonus pelamis tunas*, as well as the Atlantic blue marlin *Makaira nigricans* (Figure 31, left), the white marlin *Tetrapturus albidus* and the broadbill swordfish *Xiphias gladius* (Payne & Crawford 1989). The distribution of these species is dependent on food availability in the mixed boundary layer between the Benguela and warm central Atlantic waters. Concentrations of large pelagic species are also known to occur associated with underwater feature such as canyons and seamounts as well as meteorologically induced oceanic fronts (Shannon *et al.* 1989; Penney *et al.* 1992). Seasonal association with Child's Bank and Tripp Seamount occurs between October and June, with commercial catches often peaking in March and April (www.fao.org/fi/fcp/en/NAM/body.htm; see CapMarine 2022 – Fisheries Specialist Study in Appendix 3).

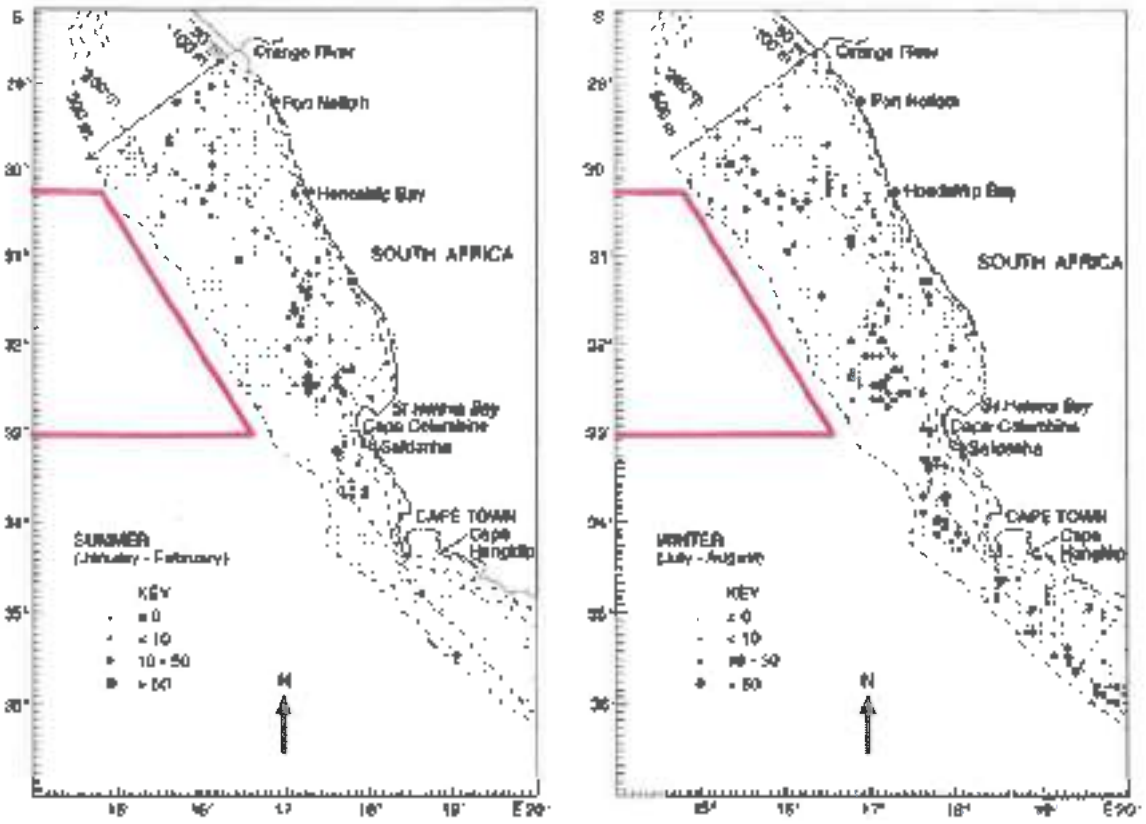

Figure 30: Mean number of snoek per demersal trawl per grid block (5 x 5 Nm) by season for (A) the west coast (July 1985–Jan 1991) and (B) the south coast in relation to the Reconnaissance Permit Area (red polygon) (adapted from Griffiths 2002).

Table 9: Some of the more important large migratory pelagic fish likely to occur in the offshore regions of the West Coast (TOPS list under NEMBA, Act 10 of 2004; Sink *et al.* 2019; www.iucnredlist.org;). The National and Global IUCN Conservation Status are also provided.

Common Name	Species	National Assessment	IUCN Conservation Status
Tunas			
Southern Bluefin Tuna	*Thunnus maccoyii*	Not Assessed	Endangered
Bigeye Tuna	*Thunnus obesus*	Vulnerable	Vulnerable
Longfin Tuna/Albacore	*Thunnus alalunga*	Near Threatened	Least concern
Yellowfin Tuna	*Thunnus albacares*	Near Threatened	Least concern
Frigate Tuna	*Auxis thazard*	Not Assessed	Least concern
Eastern Little Tuna	*Euthynnus affinis*	Least concern	Least concern
Skipjack Tuna	*Katsuwonus pelamis*	Least concern	Least concern
Atlantic Bonito	*Sarda sarda*	Not Assessed	Least concern
Billfish			

Common Name	Species	National Assessment	IUCN Conservation Status
Black Marlin	*Istiompax indica*	Data deficient	Data deficient
Blue Marlin	*Makaira nigricans*	Vulnerable	Vulnerable
Striped Marlin	*Kajikia audax*	Near Threatened	Near Threatened
Sailfish	*Istiophorus platypterus*	Least concern	Least concern
Swordfish	*Xiphias gladius*	Data deficient	Least concern
Pelagic Sharks			
Oceanic Whitetip Shark	*Carcharhinus longimanus*	Not Assessed	Vulnerable
Dusky Shark	*Carcharhinus obscurus*	Data deficient	Vulnerable
Bronze Whaler Shark	*Carcharhinus brachyurus*	Data deficient	Near Threatened
Great White Shark	*Carcharodon carcharias*	Least concern	Vulnerable
Shortfin Mako	*Isurus oxyrinchus*	Vulnerable	Endangered
Longfin Mako	*Isurus paucus*	Not Assessed	Vulnerable
Whale Shark	*Rhincodon typus*	Not Assessed	Endangered
Blue Shark	*Prionace glauca*	Least concern	Near Threatened

A number of species of pelagic sharks are also known to occur on the West and South-West Coast, including blue *Prionace glauca*, short-fin mako *Isurus oxyrinchus* and oceanic whitetip sharks *Carcharhinus longimanus*. Occurring throughout the world in warm temperate waters, these species are usually found further offshore on the West Coast. Great whites *Carcharodon carcharias* and whale sharks *Rhincodon typus* may also be encountered in coastal and offshore areas, although the latter occurs more frequently along the South and East coasts. The recapture of a juvenile blue shark off Uruguay, which had been tagged off the Cape of Good Hope, supports the hypothesis of a single blue shark stock in the South Atlantic (Hazin 2000; Montealegre-Quijano & Vooren 2010) and Indian Oceans (da Silva *et al.* 2010). Using the Benguela drift in a north-westerly direction, it is likely that juveniles from the parturition off the south-western Cape would migrate through the project area *en route* to South America (da Silva *et al.* 2010).

The shortfin mako inhabits offshore temperate and tropical seas worldwide. It can be found from the surface to depths of 500 m, and as one of the few endothermic sharks is seldom found in waters <16 °C (Compagno 2001; Loefer *et al.* 2005). As the fastest species of shark, shortfin makos have been recorded to reach speeds of 40 km/h with burst of up to 74 km/h, and can jump to a height of 9 m (http://www.elasmo-research.org/education/shark_profiles/I_oxyrinchus.htm). Most makos caught by longliners off South Africa are immature, with reports of juveniles and sub-adults sharks occurring near the edge of the Agulhas Bank and off the South Coast between June and November (Groeneveld *et al.* 2014), whereas larger and reproductively mature sharks were more common in the inshore environment along the East Coast (Foulis 2013).

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Figure 31: Large migratory pelagic fish such as blue marlin (left) and longfin tuna (right) occur in offshore waters (photos: www.samathatours.com; www.osfimages.com).

Whale sharks are regarded as a broad ranging species typically occurring in offshore epipelagic areas with sea surface temperatures of 18–32°C (Eckert & Stewart 2001). Adult whale sharks reach an average size of 9.7 m and 9 tonnes, making them the largest non-cetacean animal in the world. They are slow-moving filter-feeders and therefore particularly vulnerable to ship strikes (Rowat 2007). Although primarily solitary animals, seasonal feeding aggregations occur at several coastal sites all over the world, those closest to the project area being off Sodwana Bay in KwaZulu Natal (KZN) in the Greater St. Lucia Wetland Park (Cliff *et al.* 2007). Satellite tagging has revealed that individuals may travel distances of tens of 1 000s of kms (Eckert & Stewart 2001; Rowat & Gore 2007; Brunnschweiler *et al.* 2009). On the West Coast their summer and winter distributions are centred around the Orange River mouth and between Cape Columbine and Cape Point (Harris *et al.* 2022). The likelihood of an encounter in the offshore waters of the Reconnaissance Permit Area is relatively low.

The whale shark and shortfin mako are listed in Appendix II (species in which trade must be controlled in order to avoid utilization incompatible with their survival) of CITES (Convention on International Trade in Endangered Species) and Appendix I and/or II of the Bonn Convention for the Conservation of Migratory Species (CMS). The whale shark is also listed as 'vulnerable' in the List of Marine Threatened or Protected Species (TOPS) as part of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA).

8.4.3.4 TURTLES

Three species of turtle occur along the West Coast, namely the Leatherback (*Dermochelys coriacea*) (Figure 32, left), and occasionally the Loggerhead (*Caretta caretta*) (Figure 32, right) and the Green (*Chelonia mydas*) turtle. Loggerhead and Green turtles are expected to occur only as occasional visitors along the West Coast. The most recent conservation status, which assessed the species on a sub-regional scale, is provided in Table 10.

The Leatherback is the only turtle likely to be encountered in the offshore waters of west South Africa. The Benguela ecosystem, especially the northern Benguela where jelly fish numbers are high, is increasingly being recognized as a potentially important feeding area for leatherback turtles from several globally significant nesting populations in the south Atlantic (Gabon, Brazil) and south east Indian Ocean (South Africa) (Lambardi *et al.* 2008, Elwen & Leeney 2011; SASTN 2011[2]). Leatherback turtles from the east South Africa population have been satellite tracked swimming around the west coast of South Africa and remaining in the warmer waters west of the Benguela ecosystem (Lambardi *et al.* 2008) (Figure 33).

[2] SASTN Meeting – Second meeting of the South Atlantic Sea Turtle Network, Swakopmund, Namibia, 24-30 July 2011.

Figure 52: Leatherback (left) and loggerhead turtles (right) occur along the West Coast of Southern Africa (Photos: Retos Ecology 2009; www.aquaworld-crete.com).

Table 10: Global and Regional Conservation Status of the turtles occurring off the South Coast showing variation depending on the listing used.

Listing	Leatherback	Loggerhead	Green
IUCN Red List:			
Species (date)	V (2013)	V (2017)	E (2004)
Population (RMU)	CR (2013)	NT (2017)	*
Sub-Regional/National			
NEMBA TOPS (2017)	CR	E	E
Sink & Lawrence (2008)	CR	E	E
Hughes & Nel (2014)	E	V	NT

NT – Near Threatened, V – Vulnerable, E – Endangered, CR – Critically Endangered, DD – Data Deficient, UR – Under Review, * - not yet assessed

Leatherback turtles inhabit deeper waters and are considered a pelagic species, travelling the ocean currents in search of their prey (primarily jellyfish). While hunting they may dive to over 600 m and remain submerged for up to 54 minutes (Hays et al. 2004). Their abundance in the study area is unknown but expected to be low. Leatherbacks feed on jellyfish and are known to have mistaken plastic marine debris for their natural food. Ingesting this can obstruct the gut, lead to absorption of toxins and reduce the absorption of nutrients from their real food. Leatherback Turtles are listed as 'Critically Endangered' worldwide by the IUCN and are in the highest categories in terms of need for conservation in CITES (Convention on International Trade in Endangered Species), and CMS (Convention on Migratory Species). The 2017 South African list of Threatened and Endangered Species (TOPS) similarly lists the species as 'Critically Endangered', whereas on the National Assessment (Hughes & Nel 2014) leatherbacks were listed as 'Endangered', whereas Loggerhead and green turtles are listed globally as 'Vulnerable' and 'Endangered', respectively, whereas on TOPS both species are listed as 'Endangered'. As a signatory of CMS, South Africa has endorsed and signed a CMS International Memorandum of Understanding specific to the conservation of marine turtles. South Africa is thus committed to conserve these species at an international level.

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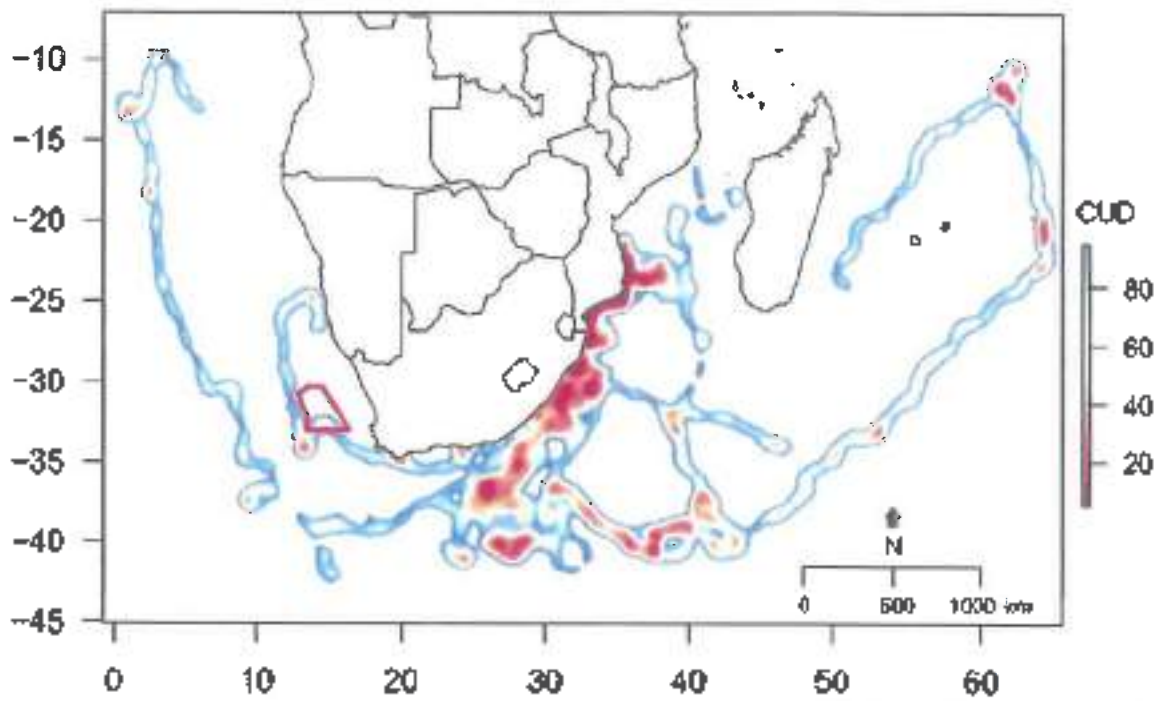

Figure 33: The Reconnaissance Permit Area (red polygon) in relation to the migration corridors of leatherback turtles in the south-western Indian Ocean. Relative use (CUD, cumulative utilization distribution) of corridors is shown through intensity of shading: light, low use; dark, high use (adapted from Harris *et al.* 2018).

8.4.3.5 SEABIRDS

Large numbers of pelagic seabirds exploit the pelagic fish stocks of the Benguela system. Of the 49 species of seabirds that occur in the Benguela region, 14 are defined as resident, 10 are visitors from the northern hemisphere and 25 are migrants from the Southern Ocean. The species classified as being common in the southern Benguela are listed in Table 11. The area between Cape Point and the Orange River supports 38% and 33% of the overall population of pelagic seabirds in winter and summer, respectively. Most of the species in the region reach highest densities offshore of the shelf break (200 – 500 m depth), with highest population levels during their non-breeding season (winter). Pintado petrels and Prion spp. show the most marked variation here. Pelagic seabird species are therefore likely to be relatively frequently encountered in the offshore waters of the Reconnaissance Permit Area.

Fifteen species of seabirds breed in southern Africa; Cape Gannet (Figure 34, left), African Penguin (Figure 34, right), four species of Cormorant, White Pelican, three Gull and four Tern species (Table 12). The breeding areas are distributed around the coast with islands being especially important. The closest breeding islands to the Reconnaissance Permit Area are Bird Island in Lambert's Bay, the Saldanha Bay Islands and Dassen Island, which lie approximately 192 km,126 km and 150 km to the east and south east of the eastern and southern boundary of the Reconnaissance Permit Area, respectively. The number of successfully breeding birds at the particular breeding sites varies with food abundance. Most of the breeding seabird species forage at sea with most birds being found relatively close inshore (10-30 km). Cape Gannets, which breed at only three locations in South Africa (Bird Island Lamberts Bay, Malgas Island and Bird Island Algoa Bay) are known to forage within 200 km offshore (Dundee 2006; Ludynia 2007; Grémillet *et al.* 2008; Crawford *et al.* 2011), and African Penguins have also been recorded as far as 60 km offshore. The Application Area lies well offshore of the aggregate core home ranges of Cape Gannet and African Penguin (Figure 35) (BirdLife South Africa 2022). Aggregate core home ranges and foraging areas for Cape Cormorant and Bank Cormorant similarly lie well inshore of the Reconnaissance Permit Area (see Harris *et al.* 2022). There is, however, overlap of the foraging areas of Wandering Albatross and Atlantic Yellow-nosed Albatross with the Reconnaissance Permit Area (Figure 35) (BirdLife South Africa 2022; Harris *et al.* 2022).

Figure 34: Cape Gannets Morus capensis (left) (Photo: NACOMA) and African Penguins Spheniscus demersus (right) (Photo: Klaus Jost) breed primarily on the offshore islands.

Table 11: Pelagic seabirds common in the southern Benguela region (Crawford *et al.* 1991; BirdLife 2021). IUCN Red List and Regional Assessment status are provided (Sink *et al.* 2019).

Common Name	Species name	Global IUCN	Regional Assessment
Shy Albatross	*Thalassarche cauta*	Near Threatened	Near Threatened
Black-browed Albatross	*Thalassarche melanophrys*	Least concern	Endangered
Atlantic Yellow-nosed Albatross	*Thalassarche chlororhynchos*	Endangered	Endangered
Indian Yellow-nosed Albatross	*Thalassarche carteri*	Endangered	Endangered
Wandering Albatross	*Diomedea exulans*	Vulnerable	Vulnerable
Southern Royal Albatross	*Diomedea epomophora*	Vulnerable	Vulnerable
Northern Royal Albatross	*Diomedea sanfordi*	Endangered	Endangered
Sooty Albatross	*Phoebetria fusca*	Endangered	Endangered
Light-mantled Albatross	*Phoebetria palpebrata*	Near Threatened	Near Threatened
Tristan Albatross	*Diomedea dabbenena*	[illegible]	[illegible]
Grey-headed Albatross	*Thalassarche chrysostoma*	Endangered	Endangered
Giant Petrel sp.	*Macronectes halli/giganteus*	Least concern	Near Threatened
Southern Fulmar	*Fulmarus glacialoides*	Least concern	Least concern
Pintado Petrel	*Daption capense*	Least concern	Least concern
Blue Petrel	*Halobaena caerulea*	Least concern	Near Threatened
Salvin's Prion	*Pachyptila salvini*	Least concern	Near Threatened
Arctic Prion	*Pachyptila desolata*	Least concern	Least concern
Slender-billed Prion	*Pachyptila belcheri*	Least concern	Least concern

Common Name	Species name	Global IUCN	Regional Assessment
Broad-billed Prion	*Pachyptila vittata*	Least concern	Least concern
Kerguelen Petrel	*Aphrodroma brevirostris*	Least concern	Near Threatened
Greatwinged Petrel	*Pterodroma macroptera*	Least concern	Near Threatened
Soft-plumaged Petrel	*Pterodroma mollis*	Least concern	Near Threatened
White-chinned Petrel	*Procellaria aequinoctialis*	Vulnerable	Vulnerable
Spectacled Petrel	*Procellaria conspicillata*	Vulnerable	Vulnerable
Cory's Shearwater	*Calonectris diomedea*	Least concern	Least concern
Sooty Shearwater	*Puffinus griseus*	Near Threatened	Near Threatened
Flesh-footed Shearwater	*Ardenna carneipes*	Near Threatened	Least concern
Great Shearwater	*Puffinus gravis*	Least concern	Least concern
Manx Shearwater	*Puffinus puffinus*	Least concern	Least concern
Little Shearwater	*Puffinus assimilis*	Least concern	Least concern
European Storm Petrel	*Hydrobates pelagicus*	Least concern	Least concern
Leach's Storm Petrel	*Oceanodroma leucorhoa*	Vulnerable	[illegible]
Wilson's Storm Petrel	*Oceanites oceanicus*	Least concern	Least concern
Black-bellied Storm Petrel	*Fregetta tropica*	Least concern	Near Threatened
White-bellied Storm Petrel	*Fregetta grallaria*	Least concern	Least concern
Pomarine Jaeger	*Stercorarius pomarinus*	Least concern	Least concern
Subantarctic Skua	*Catharacta antarctica*	Least concern	Endangered
Parasitic Jaeger	*Stercorarius parasiticus*	Least concern	Least concern
Long-tailed Jaeger	*Stercorarius longicaudus*	Least concern	Least concern
Sabine's Gull	*Larus sabini*	Least concern	Least concern
Lesser Crested Tern	*Thalasseus bengalensis*	Least concern	Least concern
Sandwich Tern	*Thalasseus sandvicensis*	Least concern	Least concern
Little Tern	*Sternula albifrons*	Least concern	Least concern
Common Tern	*Sterna hirundo*	Least concern	Least concern
Arctic Tern	*Sterna paradisaea*	Least concern	Least concern
Antarctic Tern	*Sterna vittata*	Least concern	Endangered

Table 12: Breeding resident seabirds present along the South-West Coast (adapted from CCA & CMS 2001). IUCN Red List and National Assessment status are provided (Sink *et al.* 2019). * denotes endemicity.

Common Name	Species name	Global IUCN	Regional Assessment
African Penguin*	*Spheniscus demersus*	Endangered	Endangered
African Black Oystercatcher*	*Haematopus moquini*	Near Threatened	Least Concern
White-breasted Cormorant	*Phalacrocorax carbo*	Least Concern	Least Concern
Cape Cormorant*	*Phalacrocorax capensis*	Endangered	Endangered
Bank Cormorant*	*Phalacrocorax neglectus*	Endangered	Endangered
Crowned Cormorant*	*Phalacrocorax coronatus*	Near Threatened	Near Threatened
White Pelican	*Pelecanus onocrotalus*	Least Concern	Vulnerable
Cape Gannet*	*Morus capensis*	Endangered	Endangered
Kelp Gull	*Larus dominicanus*	Least Concern	Least Concern
Grey-headed Gull	*Larus cirrocephalus*	Least Concern	Least Concern
Hartlaub's Gull*	*Larus hartlaubii*	Least Concern	Least Concern
Caspian Tern	*Hydroprogne caspia*	Least Concern	Vulnerable
Swift Tern	*Sterna bergii*	Least Concern	Least Concern
Roseate Tern	*Sterna dougallii*	Least Concern	Endangered
Damara Tern*	*Sterna balaenarum*	Vulnerable	Vulnerable

Interactions with commercial fishing operations, either through incidental bycatch or competition for food resources, are the greatest threat to southern African seabirds, impacting 56% of seabirds of special concern. Crawford *et al.* (2014) reported that four of the seabirds assessed as 'Endangered' compete with South Africa's fisheries for food: African Penguins, Cape Gannets and Cape Cormorants for sardines and anchovies, and Bank Cormorants for rock lobsters (Crawford *et al.* 2015). Populations of seabirds off the West Coast have recently shown significant decreases, with the population numbers of African Penguins currently only 2.5% of what the population was 80 years ago; declining from 1 million breeding pairs in the 1920s, 25 000 pairs in 2009 and 15 000 in 2018 (Sink *et al.* 2019). For Cape Gannets, the global population decreased from about 250 000 pairs in the 1950s and 1960s to approximately 130 000 in 2018, primarily as a result of a >90% decrease in Namibia's population in response to the collapse of Namibia's sardine resource. In South Africa, numbers of Cape Gannets have increased since 1956 and South Africa now holds >90% of the global population. However, numbers have recently decreased in the Western Cape but increased in Algoa Bay mirroring the southward and eastward shift sardine and anchovy. Algoa Bay currently holds approximately 75% of the South African Gannet population.

Cape cormorants and Bank cormorants showed a substantial decline from the late 1970s/early 1980s to the late 2000s/early 2010s, with numbers of Cape cormorants dropping from 106 500 to 65 800 breeding pairs, and Bank cormorants from 1 500 to only 800 breeding pairs over that period (Crawford *et al.* 2015).

Demersal and pelagic longlining are key contributors to the mortality of albatrosses (Browed albatross 7%, Indian and Atlantic Yellow-Nosed Albatross 3%), petrels (white-chinned petrel 66%), shearwaters and Cape Gannets (2%) through accidental capture (bycatch and/or entanglement in fishing gear), with an estimated annual mortality of 450 individuals of 14 species for the period 2006 to 2013 (Rollinson *et al.* 2017). Other threats

include predation by mice on petrel and albatross chicks on sub-Antarctic islands, predation of chicks of Cape, Crowned and Bank Cormorants by Great White Pelicans, and predation of eggs and chicks of African Penguins, Bank, Cape and Crowned Cormorants by Kelp gulls. Disease (avian flu), climate change (heat stress and environmental variability) and oil spills are also considered major contributors to seabird declines (Sink *et al.* 2019).

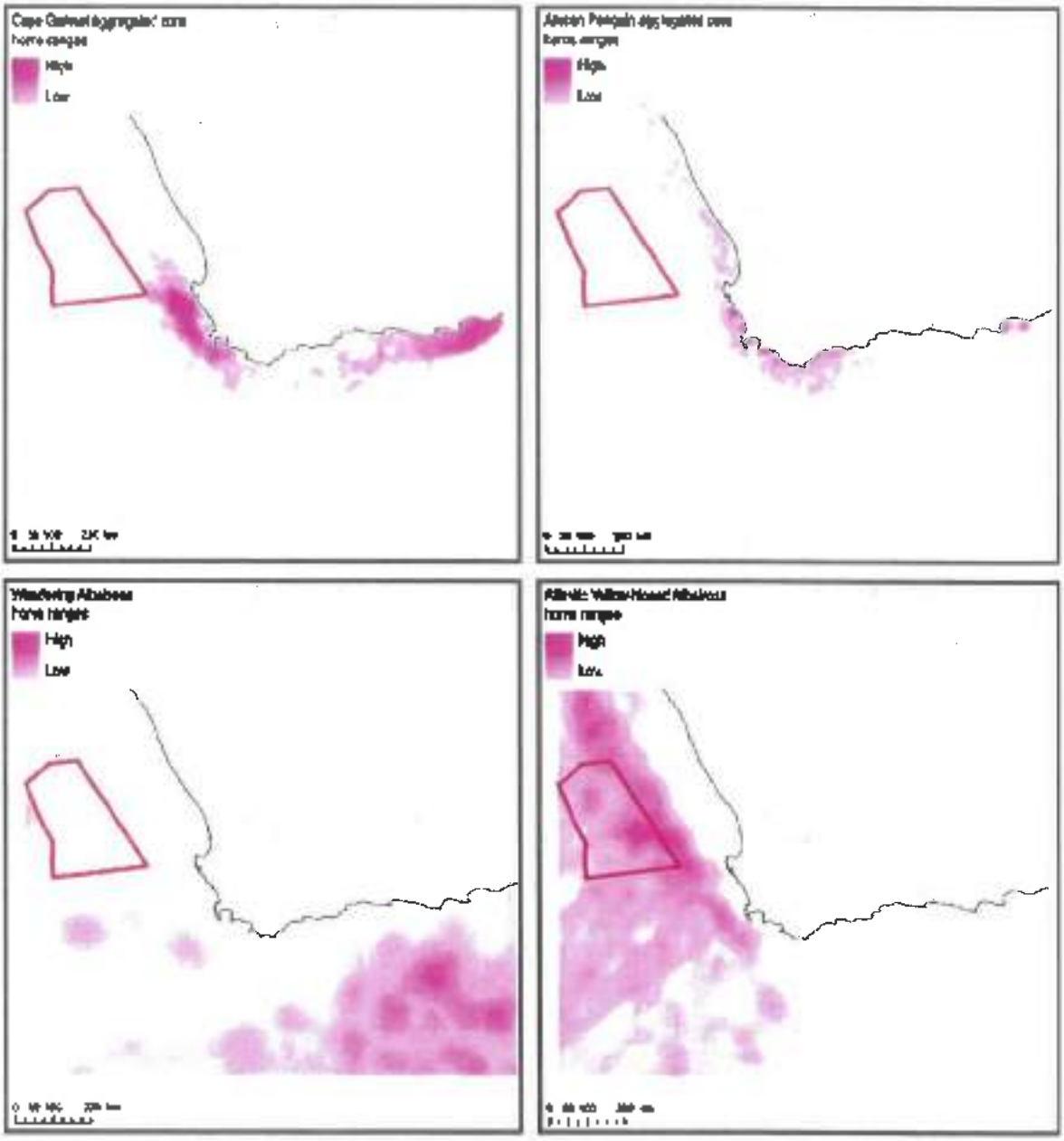

Figure 35: The Reconnaissance Permit Area (red polygon) in relation to aggregate core home ranges of Cape Gannet (top left), *African Penguin* (top right) for different colonies and life-history stages, and foraging areas of Wandering Albatross (bottom left) and Atlantic Yellow-nosed Albatross (bottom right). For foraging areas, darker shades are areas of higher use and where foraging areas from different colonies overlap (adapted from Harris *et al.* 2022).

8.4.3.6 MARINE MAMMALS

The marine mammal fauna occurring off the southern African coast includes several species of whales and dolphins and one resident seal species. Thirty-three species of whales and dolphins are known (based on historic sightings or strandings records) or likely (based on habitat projections of known species parameters) to occur in these waters (Table 13). Of the species listed, the blue whale is considered 'Critically Endangered', fin and sei

whales are 'Endangered' and one is considered vulnerable (IUCN Red Data list Categories). Altogether 17 species are listed as 'data deficient' underlining how little is known about cetaceans, their distributions and population trends. The offshore areas have been particularly poorly studied with most available information from deeper waters (>200 m) arising from historic whaling records prior to 1970. In the past ten years, passive acoustic monitoring and satellite telemetry have begun to shed light on current patterns of seasonality and movement for some large whale species (Best *et al.* 2009; Elwen *et al.* 2011; Rosenbaum *et al.* 2014; Shabangu *et al.* 2019; Thomisch *et al.* 2019) but information on smaller cetaceans in deeper waters remains poor. Records from marine mammal observers on seismic survey vessels have provided valuable data into cetacean presence although these are predominantly during summer months (Purdon *et al.* 2020). Information on general distribution and seasonality is improving but data population sizes and trends for most cetacean species occurring on the west coast of southern Africa is lacking.

The 3D acquisition area extends from the Namibian border to 32°27' offshore of St Helena Bay from roughly the 500 m isobath to nearly 4 000 m water depth. Oceanographically this area lies largely outside the cool waters of the Benguela Ecosystem and receives some input from the warm Agulhas Current as well as the warm waters of the South Atlantic. In terms of cetacean distribution patterns, the area thus covers a broad range of habitats and species associated with each of those water masses may occur within the target area. Records from stranded specimens show that the area between St Helena Bay (~32° S) and Cape Agulhas (~34° S, 20° E) is an area of transition between Atlantic and Indian Ocean species, and includes records from Benguela associated species such as dusky dolphins, Heaviside's dolphins and long finned pilot whales, and those of the warmer east coast such as striped and Risso's dolphins (Findlay *et al.* 1992). Species such as rough toothed dolphins, Pan-tropical spotted dolphins and short finned pilot whales are known from the southern Atlantic. Owing to the uncertainty of species occurrence offshore, species that may occur there have been included here for the sake of completeness.

The distribution of cetaceans can largely be split into those associated with the continental shelf and those that occur in deep, oceanic water. Importantly, species from both environments may be found on the continental slope (200 – 2 000 m) making this the most species rich area for cetaceans and also high in density (De Rock *et al.* 2019; SLR data). Cetacean density on the continental shelf is usually higher than in pelagic waters as species associated with the pelagic environment tend to be wide ranging across 1 000s of km. The most common species within the project area (in terms of likely encounter rate not total population sizes) are likely to be the long-finned pilot whale, Risso's dolphin, common dolphin, sperm whale (winter distribution) and humpback whale (Figure 36) (Harris *et al.* 2022).

Cetaceans are comprised of two taxonomic groups, the mysticetes (filter feeders with baleen) and the odontocetes (predatory whales and dolphins with teeth). The term 'whale' is used to describe species in both groups and is taxonomically meaningless (e.g. the killer whale and pilot whale are members of the Odontoceti, family Delphinidae and are thus dolphins). Due to differences in sociality, communication abilities, ranging behaviour and acoustic behaviour, these two groups are considered separately.

Table 13 lists the cetaceans likely to be found within the project area, based on all available data sources but mainly: Findlay et al. (1992), Best (2007), Weir (2011), De Rock et al. (2019), Purdon et al. (2020a, 2020b, 2020c), and unpublished records held by Sea Search and those held by SLR consulting and shared for this report (see also Figure 37, Figure 38, Figure 40). The majority of data available on the seasonality and distribution of large whales in the project area is the result of commercial whaling activities mostly dating from the 1960s. Changes in the timing and distribution of migration may have occurred since these data were collected due to extirpation of populations or behaviours (e.g. migration routes may be learnt behaviours). The large whale species for which there are current data available are the humpback and southern right whale, although almost all data is limited to that collected on the continental shelf close to shore. A review of the distribution and seasonality of the key cetacean species likely to be found within the project area is provided below.

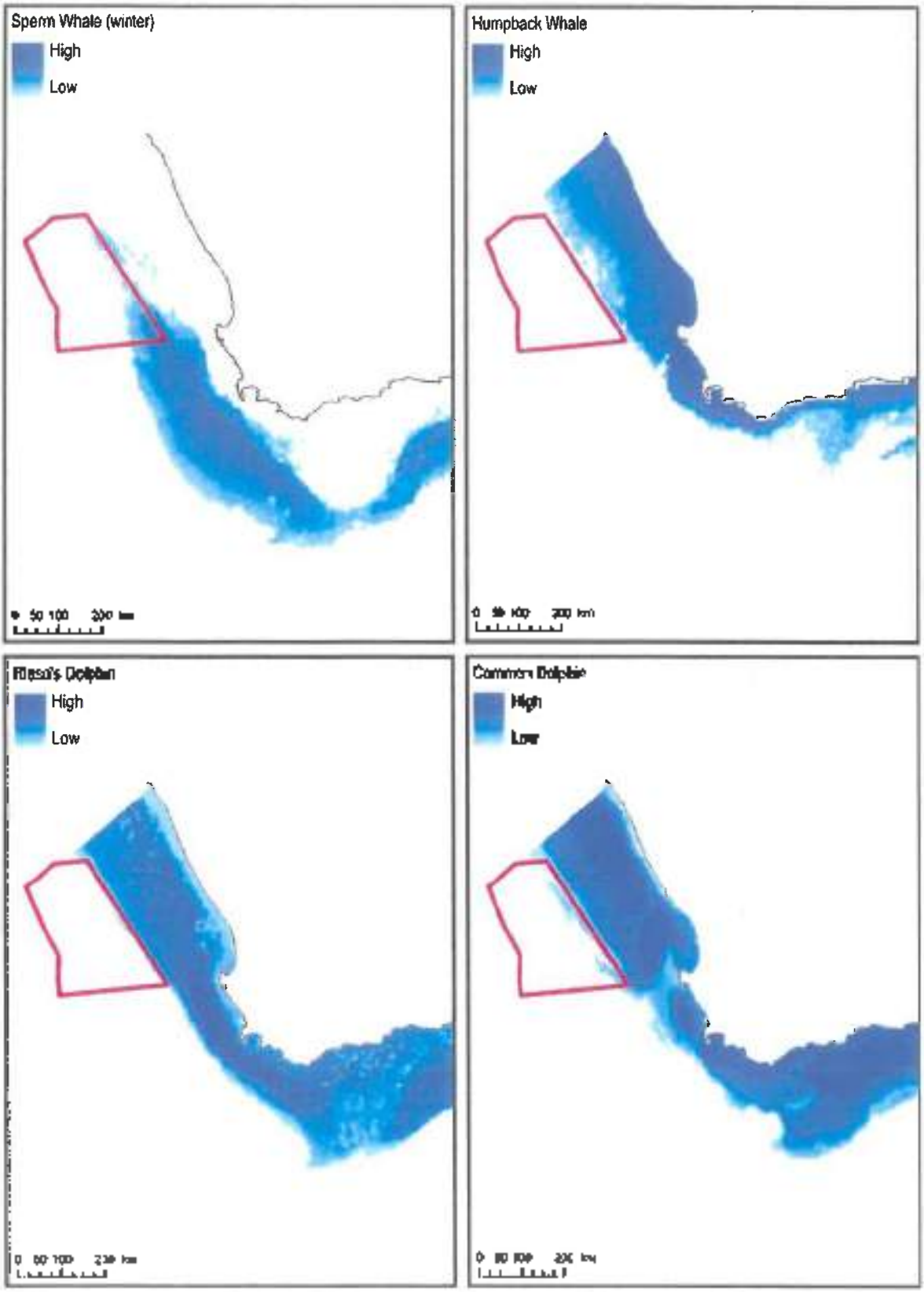

Figure 36: The Reconnaissance Permit Area (red polygon) in relation to the predicted distribution of Sperm whales (winter distribution)(left), humpback whale (middle) and Risso's dolphin (right) with darker shades of blue indicating highest likelihood of occurrence (adapted from Harris *et al.* 2022).

8.4.3.6.1 MYSTICETE (BALEEN) WHALES

The majority of mysticetes whales fall into the family Balaenopteridae. Those occurring in the area include the blue, fin, sei, Antarctic minke, dwarf minke, humpback and Bryde's whales. The southern right whale (Family Balaenidae) and pygmy right whale (Family Neobalaenidae) are from taxonomically separate groups. The majority of mysticete species occur in pelagic waters with only occasional visits to shelf waters. All of these species show some degree of migration either to or through the latitudes encompassed by the broader project area when enroute between higher latitude (Antarctic or Subantarctic) feeding grounds and lower latitude breeding grounds.

Depending on the ultimate location of these feeding and breeding grounds, seasonality may be either unimodal, usually in winter months, or bimodal (e.g. May to July and October to November), reflecting a northward and southward migration through the area. Northward and southward migrations may take place at different distances from the coast due to whales following geographic or oceanographic features, thereby influencing the seasonality of occurrence at different locations. Because of the complexities of the migration patterns, each species is discussed separately below.

Bryde's whales: Two genetically and morphologically distinct populations of Bryde's whales (Figure 39, left) live off the coast of southern Africa (Best 2001; Penry 2010). The "offshore population" lives beyond the shelf (>200 m depth) off west Africa and migrates between wintering grounds off equatorial west Africa (Gabon) and summering grounds off western South Africa. Its seasonality on the West Coast is thus opposite to the majority of the balaenopterids with abundance likely to be highest in the area in January - March. The "inshore population" of Bryde's whale live mainly on the continental shelf and Agulhas Bank, and are unique amongst baleen whales in the region by being non-migratory. The inshore population has recently been recognised as its own (yet to be named) sub species (*Balaenoptera brydei edeni*, Penry *et al.* 2018) with a total population for this subspecies of likely fewer than 600 individuals. The published range of the population is the continental shelf and Agulhas Bank of South Africa ranging from Durban in the east to at least St Helena Bay off the west coast with possible movements further north up the West Coast and into Namibia during the winter months (Best 2007). The offshore stock was subjected to heavy whaling in the mid-20th century (Best 2001) and there are no current data on population size or stock recovery therefrom and is currently listed as 'Data deficient' on the South African Red List. The inshore stock is regarded as extremely 'Vulnerable' and listed as such on the South African red list as it regularly suffers losses from entanglement in trap fisheries and has been subject to significant changes in its prey base due to losses and shifts in the sardine and small pelgic stocks around South Africa.

Sei whales: Almost all information is based on whaling records 1958-1963, most from shore-based catchers operating within a few hundred kilometres of Saldanha Bay. At this time the species was not well differentiated from Bryde's whales and records and catches of the two species intertwined. There is no current information on population recovery, abundance or much information on distribution patterns outside of the whaling catches and the species remains listed as 'Endangered' on the SA Red List. Sei whales feed at high latitudes (40-50°S) during summer months and migrate north through South African waters to unknown breeding grounds further north (Best 2007). Their migration pattern thus shows a bimodal peak with numbers west of Saldanha Bay being highest in May and June, and again in August, September and October. All whales were caught in waters deeper than 200 m with most deeper than 1 000 m (Best & Lockyer 2002). A recent survey to Vema Seamount ~1 000 km west of Cape Town during Oct-Nov 2019, encountered a broadly spread feeding aggregation of over 30 sei and fin whales at around 200 m water depth (Elwen *et al.* in prep.). This poorly surveyed area (roughly 32°S, 15°E) is just to the NW of the historic whaling grounds suggesting this region remains an important feeding area for the species. This region lies well within the impact area of the proposed 3D seismic survey and caution is recommended to reduce impacts on this endangered and poorly known species.

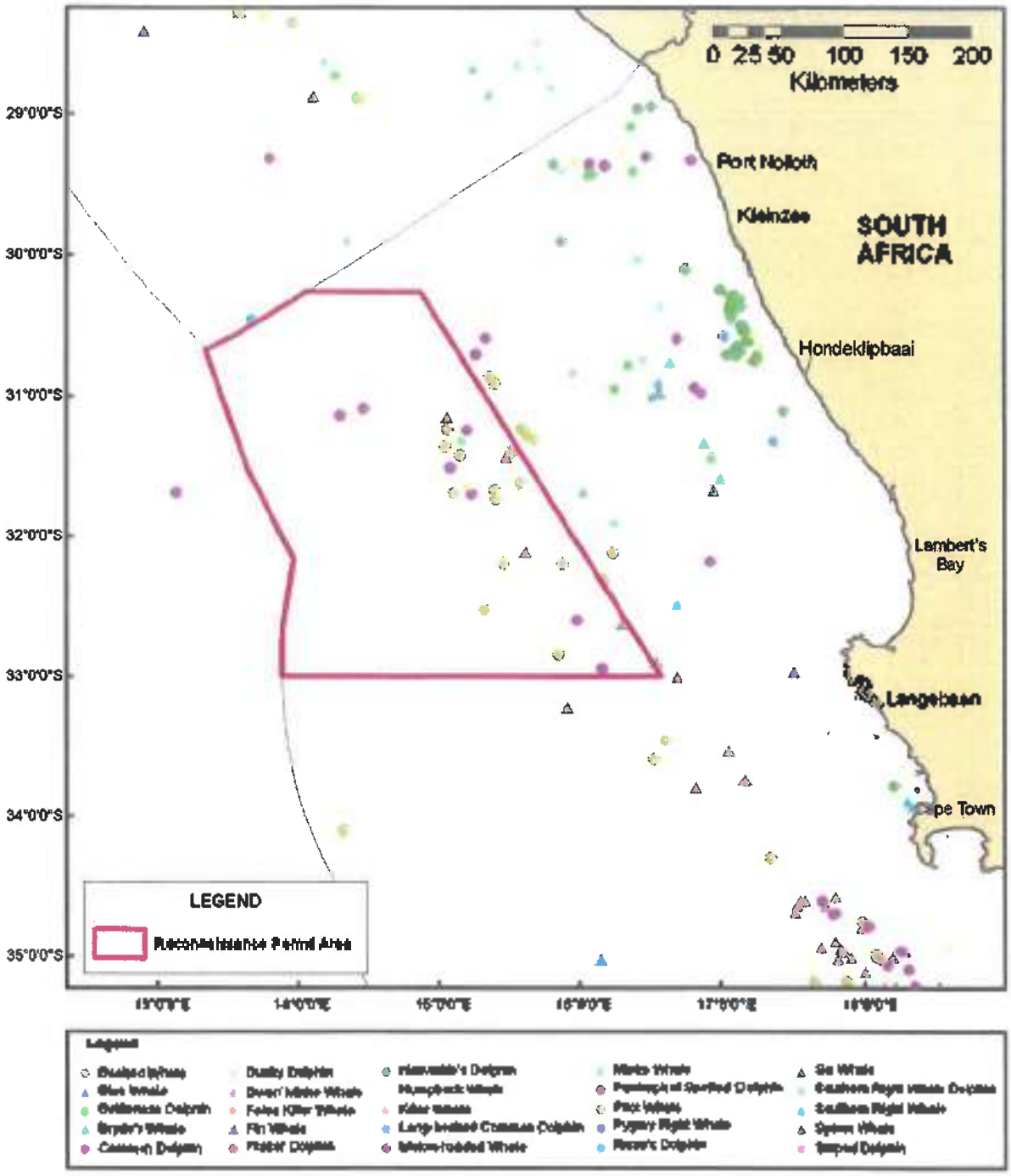

Figure 37: The Reconnaissance Permit Area (red polygon) in relation to the distribution and movement of cetaceans along the West Coast collated between 2001 and 2020 (SLR MMO database).

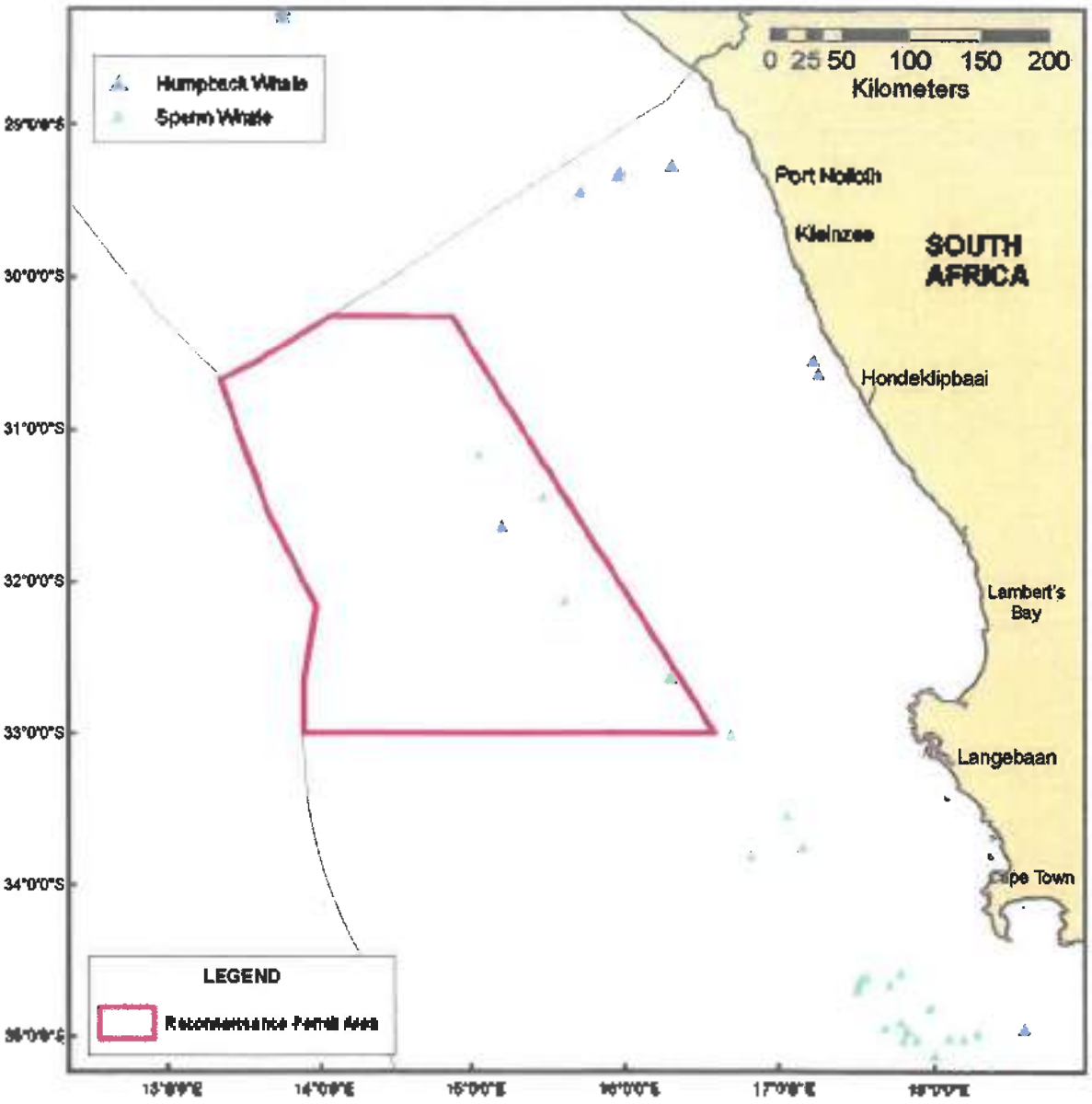

Figure 38: The Reconnaissance Permit Area (red polygon) in relation to the distribution and movement of Humpback whales and Sperm whales along the West Coast collated between 2001 and 2020 (SLR MMO database).

Figure 39: The Bryde's whale *Balaenoptera brydei* (left) and the Minke whale *Balaenoptera bonaerensis* (right) (Photos: www.dailymail.co.uk; www.marinebio.org).

Table 13: Cetaceans occurrence off the West Coast of South Africa, their seasonality, likely encounter frequency with proposed exploration activities and South African (Child et al. 2016) and Global IUCN Red List conservation status.

Common Name	Species	Hearing Frequency	Shelf (<200 m)	Offshore (>200 m)	Seasonality	RSA Regional Assessment	IUCN Global Assessment
Dolphinids							
Dusky dolphin	*Lagenorhynchus obscurus*	HF	Yes (0-800 m)	No	Year round	Least Concern	Least Concern
Heaviside's dolphin	*Cephalorhynchus heavisidii*	VHF	Yes (0-200 m)	No	Year round	Least Concern	Near Threatened
Common bottlenose dolphin	*Tursiops truncatus*	HF	Yes	Yes	Year round	Least Concern	Least Concern
Common dolphin	*Delphinus delphis*	HF	Yes	Yes	Year round	Least Concern	Least Concern
Southern right whale dolphin	*Lissodelphis peronii*	HF	Yes	Yes	Year round	Least Concern	Least Concern
Striped dolphin	*Stenella coeruleoalba*	HF	No	Yes	Year round	Least Concern	Least Concern
Pantropical spotted dolphin	*Stenella attenuata*	HF	Edge	Yes	Year round	Least Concern	Least Concern
Long-finned pilot whale	*Globicephala melas*	HF	Edge	Yes	Year round	Least Concern	Least Concern
Short-finned pilot whale	*Globicephala macrorhynchus*	HF	Edge	Yes	Year round	Least Concern	Least Concern
Rough-toothed dolphin	*Steno bredanensis*	HF	No	Yes	Year round	Not Assessed	Least Concern
Killer whale	*Orcinus orca*	HF	Occasional	Yes	Year round	Least Concern	Data deficient
False killer whale	*Pseudorca crassidens*	HF	Occasional	Yes	Year round	Least Concern	Near Threatened
Pygmy killer whale	*Feresa attenuata*	HF	No	Yes	Year round	Least Concern	Least Concern
Risso's dolphin	*Grampus griseus*	HF	Yes (edge)	Yes	Year round	Data Deficient	Least Concern
Sperm whales							

Common Name	Species	Hearing Frequency	Shelf (<200 m)	Offshore (>200 m)	Seasonality	RSA Regional Assessment	IUCN Global Assessment
Pygmy sperm whale	*Kogia breviceps*	VHF	Edge	Yes	Year round	Data Deficient	Data Deficient
Dwarf sperm whale	*Kogia sima*	VHF	Edge	Yes	Year round	Data Deficient	Data Deficient
Sperm whale	*Physeter macrocephalus*	MF	Edge	Yes	Year round	Vulnerable	Vulnerable
Beaked whales							
Cuvier's	*Ziphius cavirostris*	MF	No	Yes	Year round	Data Deficient	Least Concern
Arnoux's	*Berardius arnuxii*	MF	No	Yes	Year round	Data Deficient	Data Deficient
Southern bottlenose	*Hyperoodon planifrons*	MF	No	Yes	Year round	Least Concern	Least Concern
Layard's	*Mesoplodon layardii*	MF	No	Yes	Year round	Data Deficient	Data Deficient
True's	*Mesoplodon mirus*	MF	No	Yes	Year round	Data Deficient	Data Deficient
Gray's	*Mesoplodon grayi*	MF	No	Yes	Year round	Data Deficient	Data Deficient
Blainville's	*Mesoplodon densirostris*	MF	No	Yes	Year round	Data Deficient	Data Deficient
Baleen whales							
Antarctic Minke	*Balaenoptera bonaerensis*	LF	Yes	Yes	>Winter	Least Concern	Near Threatened
Dwarf minke	*B. acutorostrata*	LF	Yes	Yes	Year round	Least Concern	Least Concern
Fin whale	*B. physalus*	LF	Yes	Yes	MJ & ON	Endangered	Vulnerable
Blue whale (Antarctic)	*B. musculus intermedia*	LF	No	Yes	Winter peak	[illegible]	[illegible]
Sei whale	*B. borealis*	LF	Yes	Yes	MJ & ASO	Endangered	Endangered

Common Name	Species	Hearing Frequency	Shelf (<200 m)	Offshore (>200 m)	Seasonality	RSA Regional Assessment	IUCN Global Assessment
Bryde's (inshore)	*B brydei (proposed)*	LF	Yes	Edge	Year round	Vulnerable	Least Concern
Bryde's (offshore)	*B. brydei*	LF	Edge	Yes	Summer (JFM)	Data Deficient	Least Concern
Pygmy right	*Caperea marginata*	LF	Yes	?	Year round	Least Concern	Least Concern
Humpback sp.	*Megaptera novaeangliae*	LF	Yes	Yes	Year round, SOND/F	Least Concern	Least Concern
Humpback B2 population	*Megaptera novaeangliae*	LF	Yes	Yes	Spring/Summer peak OND/F	Vulnerable	Not Assessed
Southern Right	*Eubalaena australis*	LF	Yes	No	Year round, OND/JFMA	Least Concern	Least Concern

Marine animals do not hear equally well at all frequencies within their functional hearing range. Based on the hearing range and sensitivities, Southall et al. (2019) have categorised noise sensitive marine mammal species into six underwater hearing groups: low-frequency (LF), high-frequency (HF) and very high-frequency (VHF) cetaceans, Sirenians (SI), Phocid carnivores in water (PCW) and other marine carnivores in water (OCW).

Table 14: Seasonality of baleen whales in the broader project area based on data from multiple sources, predominantly commercial catches (Best 2007 and other sources) and data from stranding events (NDP unpubl data).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bryde's Inshore	L	L	M	M	M	M	M	L	L	M	M	L
Sei	M	L	L	L	H	H	M	H	H	H	M	M
Fin	M	M	M	M	H	H	H	L	L	H	H	M
Blue	L	L	L	L	M	M	M	L	L	L	L	L
Minke	M	M	M	H	H	H	M	H	H	H	M	M
Humpback	H	M	L	L	L	M	M	M	H	H	H	H
Southern Right	H	M	L	L	L	M	M	M	H	H	H	H

Values of high (H), Medium (M) and Low (L) are relative within each row (species) and not comparable between species. For abundance / likely occupancy rate within the broader project area, see Table 9.

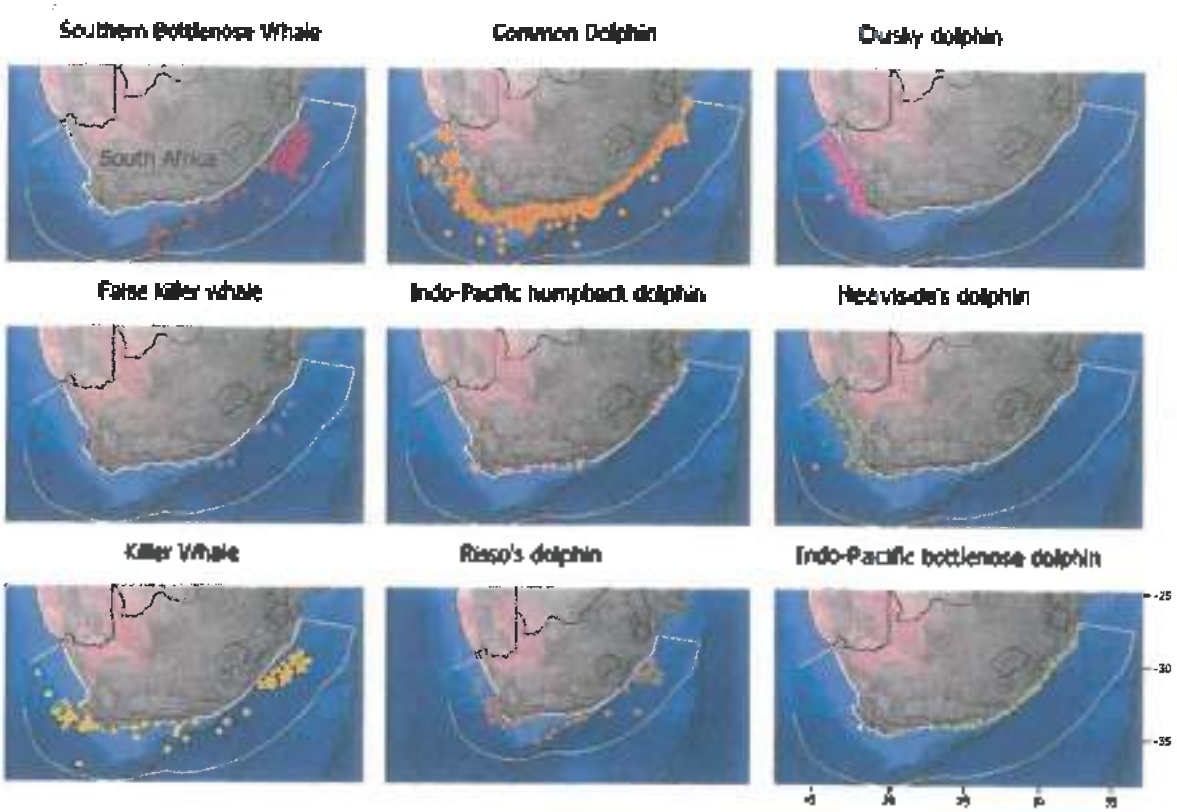

Figure 40: The Reconnaissance Permit area (cyan polygon) in relation to projections of predicted distributions for nine odontocete species off the West Coast of South Africa (adapted from: Purdon *et al.* 2020a).

Fin whales: Fin whales were historically caught off the West Coast of South Africa, with a bimodal peak in the catch data suggesting animals were migrating further north during May-June to breed, before returning during August-October *en route* to Antarctic feeding grounds. However, the location of the breeding ground (if any) and how far north it is remains a mystery (Best 2007). Some juvenile animals may feed year round in deeper waters off the shelf (Best 2007). Aggregations of up to eight animals have been seen on multiple occasions on the coast either side of Lüderitz in Apr-May of 2014 and January 2015 (Sea Search unpubl. Data), the occasional single whale has been reported during humpback whale research in November in the southern Benguela, and a feeding aggregation of ~30 animals was observed in November 2019 ~200 km west of St Helena Bay in ~2 000 m of water (see above). Current sightings records support the bimodal peak in presence observed from whaling data (but with some chance of year-round sightings) with animals apparently feeding in the nutrient rich Benguela during their southward migration as is observed extensively for humpback and right whales (see below) there clearly is a chance of encounters year round. There are no recent data on abundance or distribution of fin whales off western South Africa.

Blue whales: Although Antarctic blue whales were historically caught in high numbers off the South African West Coast, with a single peak in catch rates during July in Namibia and Angola suggesting that these latitudes are close to the northern migration limit for the species in the eastern South Atlantic (Best 2007). Although there were only two confirmed sightings of the species in the area between 1979 and 2006 (Branch *et al.* 2007), evidence of blue whale presence off Namibia is increasing. Recent acoustic detections of blue whales in the Antarctic peak between December and January (Širović *et al.* 2016), off western South Africa (Shabangu *et al.* 2019) and in northern Namibia between May and July (Thomisch 2017) supporting observed timing from whaling records. Several recent (2014-2015) sightings of blue whales during seismic surveys off the southern part of Namibia (water depth >1 000 m) confirm their existence in the area and occurrence in Autumn months. The chance of encountering the species in the Application Area is considered low but the species is 'Critically Endangered' so all precautions must be taken to avoid impact.

Minke whales: Two forms of minke whale (Figure 39, right) occur in the southern Hemisphere, the Antarctic minke whale (*Balaenoptera bonaerensis*) and the dwarf minke whale (*B. acutorostrata* subsp.); both species occur in the Benguela (Best 2007). Antarctic minke whales range from the pack ice of Antarctica to tropical

waters and are usually seen more than ~50 km offshore. Although adults migrate from the Southern Ocean (summer) to tropical/temperate waters (winter) to breed, some animals, especially juveniles, are known to stay in tropical/temperate waters year-round. Recent data available from passive acoustic monitoring over a two-year period off the Walvis Ridge shows acoustic presence in June - August and November - December (Thomisch *et al.* 2016), supporting a bimodal distribution in the area. The dwarf minke whale has a more temperate distribution than the Antarctic minke and they do not range further south than 60-65°S. Dwarf minkes have a similar migration pattern to Antarctic minkes with at least some animals migrating to the Southern Ocean during summer. Dwarf minke whales occur closer to shore than Antarctic minkes and have been seen <2 km from shore on several occasions around South Africa. Both species are generally solitary and densities are likely to be low in the project area, although sightings have been reported (SLR data).

The pygmy right whale is the smallest of the baleen whales reaching only 6 m total length as an adult (Best 2007). The species is typically associated with cool temperate waters between 30°S and 55°S with records from southern and central Namibia being the northern most for the species (Leeney *et al.* 2013). Its distribution off the west coast of South Africa is thus likely to be limited to the cooler shelf waters of the main Benguela upwelling areas.

The most abundant baleen whales in the Benguela are southern right whales and humpback whales (Figure 41a & b). Both species have long been known to feed in the Benguela Ecosystem and numbers since 2000 here grown substantially. The feeding peak in the Benguela is spring and early summer (October – February) and follows the 'traditional' South African breeding season (June – November) and its' associated migrations (Johnson *et al.* 2022). Some individual right whales are known to move directly from the south coast breeding area into the west coast feeding area where they remained for several months (Barendse *et al.* 2011; Mate *et al.* 2011). Increasing numbers of summer records of both species, from the southern half of Namibia suggest that animals may also be feeding in the Lüderitz upwelling cell (NDP unpubl. data).

Humpback whales: The majority of humpback whales passing through the Benguela are migrating to breeding grounds off tropical west Africa, between Angola and the Gulf of Guinea (Rosenbaum *et al.* 2009; Barendse *et al.* 2010). Until recently it was believed that that these breeding grounds were functionally separate from those off east (Mozambique-Kenya-Madagascar), with only rare movements between them (Pomilla & Rosenbaum 2005) and movements to other continental breeding grounds being even more rare. Recent satellite tagging of animals between Plettenberg Bay and Port Alfred during the northward migration, showed them to turn around and end up feeding in the Southern Benguela (Saakamela *et al.* 2015) before heading offshore and southwards using the same route as whales tracked off Gabon and the West Coast of South Africa. Unexpected results such as this highlight the complexities of understanding whale movements and distribution patterns and the fact that descriptions of broad season peaks in no way captures the wide array of behaviours exhibited by these animals. Furthermore, three separate matches have been made between individuals off South Africa and Brazil by citizen scientist photo-identification (www.happywhale.com). This included whales from the Cape Town and Algoa Bay-Transkei areas. Analysis of humpback whale breeding song on Sub-Antarctic feeding grounds also suggests exchange of singing male whales from western and eastern South Atlantic populations (Darling & Sousa-Lima 2005; Schall *et al.* 2021; but see also Darling *et al.* 2019; Tyaris *et al.* 2021).

Figure 41: The Humpback whale *Megaptera novaeangliae* (left) and the Southern Right whale *Eubalaena australis* (right) are the most abundant large cetaceans occurring along the southern African West Coast (Photos: www.divephotoguide.com; www.aad.gov.au).

In southern African coastal waters, the northward migration stream is larger than the southward peak (Best & Allison 2010; Elwen *et al.* 2014), suggesting that animals migrating north strike the coast at varying places north of St Helena Bay, resulting in increasing whale density on shelf waters and into deeper pelagic waters as one moves northwards. On the southward migration, many humpbacks follow the Walvis Ridge offshore then head directly to high latitude feeding grounds, while others follow a more coastal route (including the majority of mother-calf pairs) possibly lingering in the feeding grounds off west South Africa in summer (Elwen *et al.* 2014; Rosenbaum *et al.* 2014). Although migrating through the Benguela, there is no existing evidence of a clear 'corridor' and humpback whales appear to be spread out widely across the shelf and into deeper pelagic waters, especially during the southward migration (Barendse *et al.* 2010; Best & Allison 2010; Elwen *et al.* 2014). The only available abundance estimate put the number of animals in the West African breeding population (Gabon) to be in excess of 9 000 individuals in 2005 (IWC 2012) and it is likely to have increased substantially since this time at about 5% per annum (IWC 2012; see also Wilkinson 2021). The number of humpback whales feeding in the southern Benguela has increased substantially since estimates made in the early 2000s (Barendse *et al.* 2011). Since ~2011, 'supergroups' of up to 200 individual whales have been observed feeding within 10 km from shore (Findlay *et al.* 2017) with many hundred more passing through and whales are now seen in all months of the year around Cape Town. It has been suggested that the formation of these super-groups may be in response to anomalous oceanographic conditions in the Southern Benguela, which result in favourable food availability, thereby leading to these unique humpback whale feeding aggregations (Dey *et al.* 2021; see also Avila *et al.* 2019; Meynecke *et al.* 2020; Cade *et al.* 2021). Humpback whales are thus likely to be the most frequently encountered baleen whale in the project area (see Figure 29b), ranging from the coast out beyond the shelf, with year round presence but numbers peaking during the northward migration in June – February and a smaller peak with the southern breeding migration around September – October but with regular encounters until February associated with subsequent feeding in the Benguela ecosystem.

In the first half of 2017 (when numbers are expected to be at their lowest) more than 10 humpback whales were reported stranded along the Namibian and South African west coasts. A similar event was recorded in late 2021-early 2022 when numerous strandings of young humpbacks were reported along the Western Cape Coast and in Namibia (Simon Elwen, Sea Search, pers. comm.). The cause of these deaths is not known, but a similar event off Brazil in 2010 (Siciliano *et al.* 2013) was linked to possible infectious disease or malnutrition. Unusual mortality events of humpback whales between 2016 and 2022 have similarly been reported along the US Atlantic Coast from Maine to Florida (https://www.fisheries.noaa.gov/national/marine-life-distress/2016-2022-humpback-whale-unusual-mortality-event-along-atlantic-coast). The West African population may be undergoing similar stresses in response to changes in their ecosystem (see for example Kershaw *et al.* 2021). It is not yet understood what may be driving these ecosystem changes and what the long-term effects to populations could potentially be.

Southern right whales: The southern African population of southern right whales historically extended from southern Mozambique (Maputo Bay) to southern Angola (Baie dos Tigres) and is considered to be a single population within this range (Roux *et al.* 2011). The most recent abundance estimate for this population is available for 2017 which estimated the population at ~6 100 individuals including all age and sex classes, and still growing at ~6.5% per annum (Brandão *et al.* 2017). When the population numbers crashed in 1920, the range contracted down to just the south coast of South Africa, but as the population recovers, it is repopulating its historic grounds including Namibia (Roux *et al.* 2001, 2015; de Rock *et al.* 2019) and Mozambique (Banks *et al.* 2011).

Some southern right whales move from the South Coast breeding ground directly to the West Coast feeding ground (Mate *et al.* 2011). When departing from feeding ground all satellite tagged animals in that study took a direct south-westward track. Mark-recapture data from 2003-2007 estimated roughly one third of the South African right whale population at that time were using St Helena Bay for feeding (Peters *et al.* 2005). While annual surveys have revealed a steady population increase since the protection of the species from commercial whaling, the South African right whale population has undergone substantial changes in breeding cycles and feeding areas, and numbers of animal using our coast since those studies were done – notably a significant decrease in the numbers of cow-calf-pairs following the all-time record in 2018, a marked decline of unaccompanied adults since 2010 and variable presence of mother-calf pairs since 2015 (Roux *et al.* 2015; Vermeulen *et al.* 2020). The change in demographics are indications of a population undergoing nutritional stress and has been attributed to likely spatial and/or temporal displacement of prey due to climate variability (Vermeulen *et al.* 2020; see also Derville *et al.* 2019, 2020; Kershaw *et al.* 2021; van Weelden *et al.* 2021). Recent sightings (2018-2021) confirm that there is still a clear peak in numbers on the West Coast (Table Bay to St

Helena Bay) between February and April. Given this high proportion of the population known to feed in the southern Benguela, and current numbers reported, it is highly likely that several hundreds of right whales can be expected to pass through the southern portion of the Reconnaissance Permit Area when migrating southwards from the feeding areas between April and June (Figure 42).

Figure 42: The Reconnaissance Permit Area (red polygon) in relation to 'blue corridors' or 'whale superhighways' showing tracks of Humpback whales (orange) and Southern Right whales (green) between southern Africa and the Southern Ocean feeding grounds (adapted from Johnson *et al.* 2022).

8.4.3.6.2 ODONTOCETES (TOOTHED) WHALES

The Odontoceti are a varied group of animals including the dolphins, porpoises, beaked whales and sperm whales. Species occurring within the broader project area display a diversity of features, for example their ranging patterns vary from extremely coastal and highly site specific to oceanic and wide ranging (see Figure 40). Those in the region can range in size from 1.6-m long (Heaviside's dolphin) to 17 m (bull sperm whale).

Sperm whales: Most information about sperm whales in the southern African sub-region results from data collected during commercial whaling activities prior to 1985 when over 10 000 whales were taken, although passive acoustic monitoring (Shabangu & Andrew 2020) and sightings from MMOs are beginning to provide insights into current behaviour. Sperm whales are the largest of the toothed whales and have a complex,

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structured social system with adult males behaving differently to younger males and female groups. They live in deep ocean waters, usually greater than 1 000 m depth, although they occasionally come onto the shelf in water 500 - 200 m deep (Best 2007) (Figure 43, left). They are considered to be relatively abundant globally (Whitehead 2002), although no estimates are available for South African waters. Seasonality of catches suggests that medium and large sized males are more abundant in winter months while female groups are more abundant in autumn (March - April), although animals occur year round (Best 2007). Analysis of recent passive acoustic monitoring data from the edge of the continental shelf (800 - 1 000 m water depth, roughly 80 km WSW of Cape Point) confirms year-round presence. Sperm whales have also been regularly identified by MMOs working in this area (SLR data). Sperm whales feed at great depths during dives in excess of 30 minutes making them difficult to detect visually, however the regular echolocation clicks made by the species when diving make them relatively easy to detect acoustically using Passive Acoustic Monitoring (PAM).

Figure 43: Sperm whales *Physeter macrocephalus* (left) and killer whales *Orcinus orca* (right) are toothed whales likely to be encountered in offshore waters (Photos: www.onpoint.wbur.org; www.wikipedia.org).

Pygmy and Dwarf Sperm Whales: The genus *Kogia* currently contains two recognised species, the pygmy (*K. breviceps*) and dwarf (*K. sima*) sperm whales, both of which occur worldwide in pelagic and shelf edge waters, with with few sighting records of live animals in their natural habitat (McAlpine 2018). Their abundance, population trends and seasonality in South African waters are unknown (Seakamela *et al.* 2021). Due to their small body size, cryptic behaviour, low densities and small school sizes, these whales are difficult to observe at sea, and morphological similarities make field identification to species level problematic, although their narrow-band high frequency echolocation clicks make them detectable and identifiable (at least to the genus) using passive acoustic monitoring equipment. The majority of what is known about the distribution and ecology of Kogiid whales in the southern African subregion is derived mainly from stranding records (e.g. Ross 1979; Findlay *et al.* 1992; Plön 2004; Elwen *et al.* 2013, but see also Moura *et al.* 2016). *Kogia* species are most frequently occur in pelagic and shelf edge waters, are thus likely to occur in the Application Area at low levels; seasonality is unknown. Dwarf sperm whales are associated with warmer tropical and warm-temperate waters, being recorded from both the Benguela and Agulhas ecosystem (Best 2007) in waters deeper than ~1 000 m.

During 2020 the incidence of kogiid strandings between Strandfontein on the West Coast and Groot Brak River on the South Coast (n=17), was considerably higher than the annual average during the previous 10 years (n=7). The dwarf sperm whale (*K. sima*) accounted for 60% of these strandings, of which most were recorded during autumn and winter. These seasonal stranding patterns are consistent with previously published accounts for the South African coast. In 2020, 40% of the total strandings were recorded in winter and 15% during summer. The occurrence of strandings throughout the year may, however, indicate the presence of a resident population with a seasonal distribution off the South Coast in autumn and winter (Seakamela *et al.* 2020, 2021). The cause of the strandings is unknown.

Killer whales: Killer whales in South African waters were referred to a single morphotype, Type A, although recently a second 'flat-toothed' morphotype that seems to specialise in an elasmobranch diet has been identified but only 5 records are known all from strandings (Best *et al.* 2014). Killer whales (Figure 43) have a circum-global distribution being found in all oceans from the equator to the ice edge (Best 2007). Killer whales occur year-round in low densities off South Africa (Best *et al.* 2010, Elwen *et al.* In prep.), Namibia (Elwen & Leeney 2011) and in the Eastern Tropical Atlantic (Weir *et al.* 2010). Historically sightings were correlated with that of baleen whales, especially sei whales on their southward migration. In more recent years – their presence in coastal waters (e.g. False Bay) has been strongly linked to the presence and hunting of common dolphins (Best *et al.* 2010; Sea Search unpublished data). Further from shore, there have been regular reports of killer whales

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associated with long-line fishing vessels on the southern and eastern Agulhas Bank, and the Cape Canyon to the south-west of Cape Point. Killer whales are found in all depths from the coast to deep open ocean environments and may thus be encountered in the project area at low levels.

False killer whale: Although the false killer whale is globally recognized as one species, clear differences in morphological and genetic characteristics between different study sites show that there is substantial difference between populations and a revision of the species taxonomy may be needed (Best 2007). False killer whales are more likely to be confused with the smaller melon-headed or pygmy killer whales with which they share all-black colouring and a similar head-shape, than with killer whales. The species has a tropical to temperate distribution and most sightings off southern Africa have occurred in water deeper than 1 000 m, but with a few recorded close to shore (Findlay *et al.* 1992). They usually occur in groups ranging in size from 1 - 100 animals (Best 2007). The strong bonds and matrilineal social structure of this species makes it vulnerable to mass stranding (8 instances of 4 or more animals stranding together have occurred in the Western Cape, all between St Helena Bay and Cape Agulhas). There is no information on population numbers or conservation status and no evidence of seasonality in the region (Best 2007).

Pilot Whales: Long finned pilot whales display a preference for temperate waters and are usually associated with the continental shelf or deep water adjacent to it, but moving inshore to follow prey (primarily squid) (Mate *et al.* 2005; Findlay *et al.* 1992; Weir 2011; Seakamela *et al.* 2022). They are regularly seen associated with the shelf edge by MMOs, fisheries observers and researchers. The distinction between long-finned and short finned pilot whales is difficult to make at sea. As the latter are regarded as more tropical species confined to the southwest Indian Ocean (Best 2007), it is likely that the majority of pilot whales encountered in the project area will be long-finned. There are many confirmed sightings of pilot whales along the shelf edge of South Africa and Namibia including within the Application Area since 2010 (de Bock *et al.* 2019; Sea Search unpublished data, SLR data). Observed group sizes range from 8-100 individuals (Seakamela *et al.* 2022). Pilot whales are commonly sighting by MMOs and detected by PAM during a seismic surveys. A recent tagging study showed long-finned pilot whale movements within latitudes of 33-36°S, along the shelf-edge from offshore of Cape Columbine to the Agulhas Bank, with concentrations in canyon areas, especially around the Cape Point Valley, and to a lesser degree around the Cape Canyon. It is postulated that the pilot whales target prey species in these productive areas (Seakamela *et al.* 2022).

Common dolphin: Two forms of common dolphins occur around southern Africa, a long-beaked and short-beaked form (Findlay *et al.* 1992; Best 2007), although they are currently considered part of a single global species (Cunha *et al.* 2015). The long-beaked common dolphin lives on the continental shelf of south Africa rarely being observed north of St Helena Bay on the west coast or in waters more 500 m deep (Best 2007), although more recent sightings, including those from MMOs, suggest sightings regularly out to 1 000 m or more (SLR data, Sea Search data). Group sizes of common dolphins can be large, averaging 267 (± SD 287) for the South Africa region. Far less is known about the short-beaked form, which is challenging to differentiate at sea from the long-beaked form. Group sizes are also typically large. It is likely that common dolphins encountered in the Northern Cape or deeper than 2 000 m are of the short-beaked form.

Dusky dolphin: In water <500 m deep, dusky dolphins (Figure 44, right) are likely to be the most frequently encountered small cetacean as they are very "boat friendly" and often approach vessels to bowride. The species is resident year round throughout the Benguela ecosystem in waters from the coast to at least 500 m deep (Findlay *et al.* 1992). A recent abundance estimate from southern Namibia calculated roughly ~3 500 dolphins in the ~400 km long Namibian Islands Marine Protected area (Martin *et al.* 2020), at a density of 0.16 dolphins/km^2 and similar density is expected to occur off the South African coast where they are regularly encountered in near shore waters between Cape Town and Lamberts Bay (Elwen *et al.* 2030; NDP unpubl. data) with group sizes of up to 800 having been reported. Dusky dolphins are resident year round in the Benguela.

Heaviside's dolphins: Heaviside's dolphins (Figure 44, left) are relatively abundant in the Benguela ecosystem region with 10 000 animals estimated to live in the 400 km of coast between Cape Town and Lambert's Bay (Elwen *et al.* 2009) and ~1 600 in the ~400 km long Namibian Islands Marine Protected Area (Martin *et al.* 2020). This species occupies waters from the coast to at least 200 m depth, and may show a diurnal onshore-offshore movement pattern (Elwen *et al.* 2010a, 2010b), as they feed offshore at night. Heaviside's dolphins are resident year round but will only occur well inshore of the Reconnaissance Permit Area.

Figure 44: The dusky dolphin *Lapenorhynchus obscurus* (left) and endemic Heaviside's Dolphin *Cephalorhynchus heavisidii* (right) (Photos: Simon Elwen, Sea Search Research and Conservation).

Bottlenose dolphin: Two species of bottlenose dolphins occur around southern Africa. The smaller Indo-Pacific bottlenose dolphin (*aduncus* form) occurs exclusively to the east of Cape Point in water usually less than 50 m deep and generally within 1 km of the shore (Ross 1984; Ross *et al.* 1987). The larger common bottlenose dolphin (*truncatus* form) is widely distributed in tropical and temperate waters throughout the world, but frequently occur in small (10s to low 100s) isolated coastal populations. An offshore 'form' of common bottlenose dolphins occurs around the coast of southern Africa including Namibia and Angola (Best 2007) with sightings restricted to the continental shelf edge and deeper. Offshore bottlenose dolphins frequently form mixed species groups, often with pilot whales or Risso's dolphins. Encounters in the offshore waters of Reconnaissance Permit Area are likely to be low.

Risso's Dolphin: A medium sized dolphin with a distinctively high level of scarring and a proportionally large dorsal fin and blunt head. Risso's dolphins are distributed worldwide in tropical and temperate seas and show a general preference for shelf edge waters <1 500 m deep (Best 2007; Purdon *et al.* 2020a, 2020b). Many sightings in southern Africa have occurred around the Cape Peninsula and along the shelf edge of the Agulhas Bank. Presence within the inshore portions of the Reconnaissance Permit Area is possible (see Figure 36).

Other Delphinids: Several other species of dolphins that might occur in deeper waters at low levels include the pygmy killer whale, southern right whale dolphin, rough toothed dolphin, pantropical spotted dolphin and striped dolphin. Nothing is known about the population size or density of these species in the project area but encounters are likely to be rare.

Beaked whales: These whales were never targeted commercially and their pelagic distribution makes them the most poorly studied group of cetaceans. They are all considered to be true deep water species usually being seen in waters in excess of 1 000 – 2 000 m deep (see various species accounts in Best 2007). With recorded dives of well over an hour and in excess of 2 km deep, beaked whales are amongst the most extreme divers of any air breathing animals (Tyack *et al.* 2011). All the beaked whales that may be encountered in the project area are pelagic species that tend to occur in small groups usually less than five, although larger aggregations of some species are known (MacLeod & D'Amico 2006; Best 2007). The long, deep dives of beaked whales make them difficult to detect visually, but PAM will increase the probability of detection as animals are frequently echo-locating when on foraging dives. Beaked whales seem to be particularly susceptible to man-made sounds and several strandings and deaths at sea, often *en masse*, have been recorded in association with mid-frequency naval sonar (Cox *et al.* 2006; MacLeod & D'Amico 2006) and a seismic survey for hydrocarbons also running a multi-beam echo-sounder and sub bottom profiler (Southall *et al.* 2008; Cox *et al.* 2006; DeRuiter *et al.* 2013). Although the exact reason that beaked whales seem particularly vulnerable to man-made noise is not yet fully understood, existing evidence suggests that animals change their dive behaviour in response to acoustic disturbance (Tyack *et al.* 2011), showing a fear-response and surfacing too quickly with insufficient time to release nitrogen resulting in a form on decompression sickness. Necropsy of stranded animals has revealed gas embolisms and haemorrhage in the brain, ears and acoustic fat - injuries consistent with decompression sickness (acoustically mediated bubble formation). Beyond decompression sickness, the fear/flee response may be the first stage in a multi-stage process ultimately resulting in stranding. Thus, although hard to detect and avoid – beaked whales are amongst the most sensitive marine mammals to noise exposure and all cautions must be taken to reduce impact. Presence in the project area may fluctuate seasonally, but insufficient data exist to define this clearly. Sightings of beaked whales in the project area are expected to be very low.

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All whales and dolphins are given protection under the South African Law. The Marine Living Resources Act, 1998 (No. 18 of 1998) states that no whales or dolphins may be harassed, killed or fished. No vessel or aircraft may, without a permit or exemption, approach closer than 300 m to any whale and a vessel should move to a minimum distance of 300 m from any whales if a whale surfaces closer than 300 m from a vessel or aircraft.

8.4.3.6.3 SEALS

The Cape fur seal (*Arctocephalus pusillus pusillus*) (Figure 45) is the only species of seal resident along the west coast of Africa, occurring at numerous breeding and non-breeding sites on the mainland and on nearshore islands and reefs (see Figure 89). The South African population, which includes the West Coast colonies, was estimated at ca. 725 000 individuals in 2020. This is about 40% of the total southern African population, which has previously been estimated at up to 2 million (Seakamela *et al.* 2022). Vagrant records from four other species of seal more usually associated with the subantarctic environment have also been recorded: southern elephant seal (*Mirounga leonina*), subantarctic fur seal (*Arctocephalus tropicalis*), crabeater (*Lobodon carcinophagus*) and leopard seals (*Hydrurga leptonyx*) (David 1989).

Figure 45: Colony of Cape fur seals *Arctocephalus pusillus pusillus* (Photo: Dirk Heinrich).

There are a number of Cape fur seal colonies within the broader study area: at Bucchu Twins near Alexander Bay, at Cliff Point (~17 km north of Port Nolloth), at Kleinzee (incorporating Robeiland), Strandfontein Point (south of Hondeklipbaai), Paternoster Rocks and Jacobs Reef at Cape Columbine, Vondeling Island, Robbesteen near Koeberg, Seal Island in False Bay and Geyser Rock at Dyer Island, Quoin Point and Seal Island in Mossel Bay. The colony at Kleinzee has the highest seal population and produces the highest seal pup numbers on the South African Coast (Wickens 1994). The colony at Buchu Twins and Cliff Point, formerly non-breeding colonies, have also attained breeding status (M. Meyer, SFRI, pers. comm.). Non-breeding colonies and haul-out sites occur occur at Doringbaai south of Cliff Point, Rooiklippies, Swartduin and Hoep between Kleinzee and Hondeklipbaai, at Spoeg River and Langklip south of Hondeklip Bay, on Bird Island at Lambert's Bay, at Paternostar Point at Cape Columbine and Duikerklip in Hout Bay. These colonies all fall well inshore and to the east of the Reconnaissance Permit Area.

Seals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles offshore (Shaughnessy 1979), with bulls ranging further out to sea than females. Their diet varies with season and availability and includes pelagic species such as horse mackerel, pilchard, and hake, as well as squid and cuttlefish. Benthic feeding to depths of nearly 200 m for periods of up to 2 minutes has, however, also been recorded (Kirkman *et al.* 2015). Seals are unlikely to be encountered in the offshore waters of the Reconnaissance Permit Area (Figure 46).

The timing of the annual breeding cycle is very regular, occurring between November and January. Breeding success is highly dependent on the local abundance of food, territorial bulls and lactating females being most vulnerable to local fluctuations as they feed in the vicinity of the colonies prior to and after the pupping season (Oosthuizen 1991).

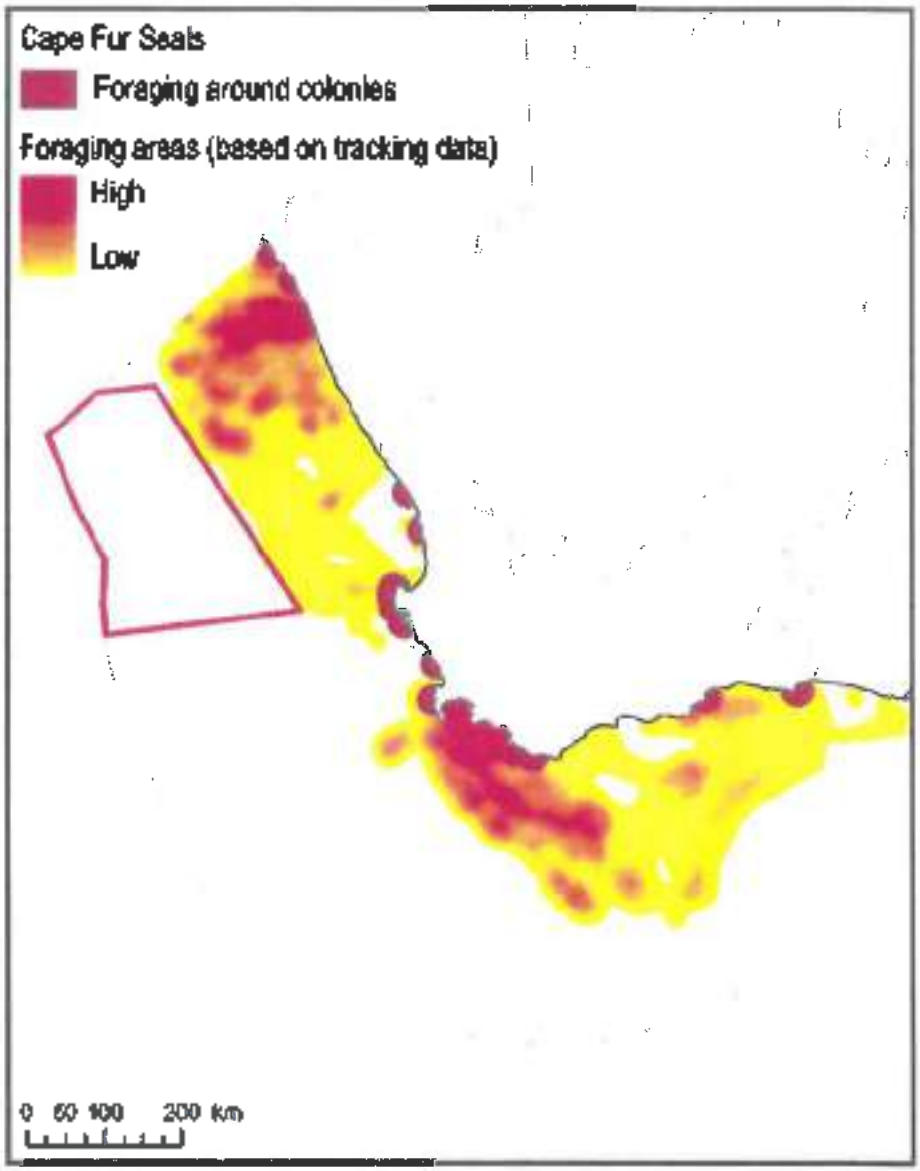

Figure 46: Reconnaissance Permit Area (red polygon) in relation to seal foraging areas on the West and South Coasts. Brown areas are generalised foraging areas around colonies, and areas in shades of red are foraging areas based on tracking data. Darker shades of red indicate areas of higher use.

Historically the Cape fur seal was heavily exploited for its luxurious pelt. Sealing restrictions were first introduced to southern Africa in 1893, and harvesting was controlled until 1990 when it was finally prohibited. The protection of the species has resulted in the recovery of the populations, and numbers continue to increase. Consequently, their conservation status is not regarded as threatened. The Cape Fur Seal population in South Africa is regularly monitored by the Department of Fisheries, Forestry and Environment (DFFE) (e.g. Kirkman *et al.* 2013). The overall population is considered healthy and stable in size, although there has been a westward and northward shift in the distribution of the breeding population (Kirkman *et al.* 2013).

An unprecedented mortality event was recorded in South Africa between September and December 2021 at colonies around the West Coast Peninsula and north to Lambert's Bay and Elands Bay. Primarily pups and juveniles were affected. Post-mortem investigations revealed that seals died in a poor condition with reduced blubber reserves, and protein energy malnutrition was detected for aborted foetuses, for juveniles and

subadults. Although no unusual environmental conditions were identified that may have triggered the die-off, or caused it indirectly (e.g. HABs), 2021 was a year of below average recruitment of anchovy and sardine, the main food source for seals. While a lack of food, as a result of possibly climate change and/or overfishing, has been predicted to be the cause of this mass mortality, the underlying causes of the mortality event remain uncertain (Seakamela et al. 2022).

8.5 FISHERIES

This section provides a description of the fisheries activities of the application area. The information has been sourced from the Fisheries Impact Assessment undertaken by CapeMarine included in Appendix 3.

8.5.1 OVERVIEW OF FISHERIES SECTORS

South Africa has a coastline that spans two ecosystems over a distance of 3623 km, extending from the Orange River in the west on the border with Namibia, to Ponta do Ouro in the east on the Mozambique border. The western coastal shelf has highly productive commercial fisheries similar to other upwelling ecosystems around the world, while the East Coast is considerably less productive but has high species diversity, including both endemic and Indo-Pacific species. South Africa's fisheries are regulated and monitored by the DFFE. All fisheries in South Africa, as well as the processing, sale in and trade of almost all marine resources, are regulated under the Marine Living Resources Act, 1998 (No. 18 of 1998) (MLRA).

Approximately 22 different fisheries sectors currently operate within South African waters. Table 15 lists these along with ports and regions of operation, catch landings and the number of active vessels and rights holders (2017). The proportional volume of catch and economic value of each of these sectors for 2017 is indicated in Figure 47. The primary fisheries in terms of economic value and overall tonnage of landings are the demersal (bottom) trawl and long-line fisheries targeting the Cape hakes (*Merluccius paradoxus* and *M. capensis*) and the pelagic-directed purse-seine fishery targeting pilchard (*Sardinops sagax*), anchovy (*Engraulis encrasicolus*) and red-eye round herring (*Etrumeus whiteheadi*). Highly migratory tuna and tuna-like species are caught on the high seas and seasonally within the South African waters by the pelagic long-line and pole fisheries. Targeted species include albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*), yellowfin tuna (*T. albacares*) and swordfish (*Xiphias gladius*). The traditional line fishery targets a large assemblage of species close to shore including snoek (*Thyrsites atun*), Cape bream (*Pachymetopon blochii*), geelbek (*Atractoscion aequidens*), kob (*Argyrosomus japonicus*), yellowtail (*Seriola lalandi*) and other reef fish. Crustacean fisheries comprise a trap and hoop net fishery targeting West Coast rock lobster (*Jasus lalandii*), a line trap fishery targeting the South Coast rock lobster (*Palinurus gilchristi*) and a trawl fishery based solely on the East Coast targeting penaeid prawns, langoustines (*Metanephrops andamanicus* and *Nephropsis stewarti*), deep-water rock lobster (*Palinurus delagoae*) and red crab (*Chaceon macphersoni*). Other fisheries include a mid-water trawl fishery targeting horse mackerel (*Trachurus trachurus capensis*) predominantly on the Agulhas Bank (South Coast) and a hand-jig fishery targeting chokka squid (*Loligo vulgaris reynaudii*) exclusively on the South Coast. In addition to commercial sectors, recreational fishing occurs along the coastline comprising shore angling and small, open boats generally less than 10 m in length. The commercial and recreational fisheries are reported to catch over 250 marine species, although fewer than 5% of these are actively targeted by commercial fisheries, which comprise 90% of the landed catch.

Most commercial fish landings must take place at designated fishing harbours. For the larger industrial vessels targeting hake, only the major ports of Saldanha Bay, Cape Town, Mossel Bay and Port Elizabeth are used. On the West Coast, St. Helena Bay and Saldanha Bay are the main landing sites for the small pelagic fleets. These ports also have significant infrastructure for the processing of anchovy into fishmeal as well as the canning of sardine. Smaller fishing harbours on the West / South-West Coast include Port Nolloth, Hondeklip, Doringbaai, Lamberts Bay, Hout Bay and Gansbaai harbours. On the East Coast, Durban and Richards Bay are deployment ports for the crustacean trawl and large pelagic longline sectors. There are more than 230 small-scale fishing communities on the South African coastline (DAFF, 2016). Small-scale fisheries operate in the nearshore environment. Recreational fisheries comprise shore-based, estuarine and boat-based line fisheries as well as spearfishing and net fisheries, including cast, drag and hoop net techniques.

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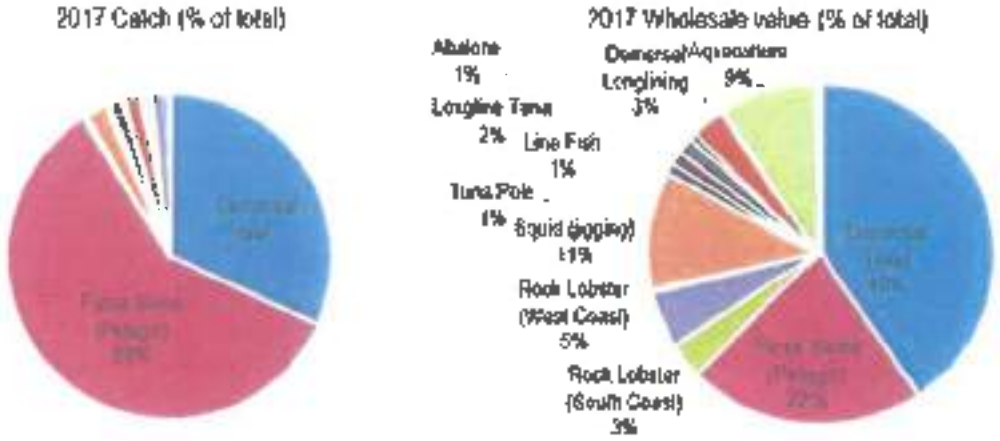

Figure 47: Pie chart showing percentage of landings by weight (left) and wholesale value (right) of each commercial fishery sector as a contribution to the total landings and value for all commercial fisheries sectors combined (2017). Source: DEFF, 2019.

Table 15: South African offshore commercial fishing sectors: wholesale value of production in 2017 (adapted from DEFF, 2019).

Sector	No. of Rights Holders (Vessels)	Catch (tons)	Landed Catch /sales (tons)	Wholesale Value of Production in 2017 (R'000)	% of Total Value
Small pelagic purse-seine	111 (101)	313476	313476	2164224	22.0
Demersal trawl (offshore)	50 (45)	163743	98200	8891978	89.5
Demersal trawl (inshore)	18 (31)	4452	2736	90104	0.9
Midwater trawl	34 (6)	19 555			
Demersal long-line	146 (64)	8113	8113	319228	3.2
Large pelagic long-line	80 (31)	2541	2541	184199	1.8
Tuna pole	170 (128)	2399	2399	97583	1.0
Linefish	422 (450)	4981	4981	122096	1.2
Longline shark demersal	4	72	72	1566	0.0
South coast rock lobster	13 (12)	699	451	337912	3.4
West coast rock lobster	240 (105)	1298	1298	531659	5.4
Crustacean trawl	6 (5)	310	310	31012	0.3
Squid jig	92 (138)	11578	11578	1099910	11.2
Miscellaneous nets	190 (N/a)	1502	1502	25589	0.3
Oysters	146 pickers	42	42	3300	0.0
Seaweeds	14 (N/a)	9877	6874	27095	0.3

Sector	No. of Rights Holders (Vessels)	Catch (tons)	Landed Catch /sales (tons)	Wholesale Value of Production in 2017 (R'000)	% of Total Value
Abalone	N/a (N/a)	86	86	61920	0.6
Aquaculture		3907	3907	881042	9.0
TOTAL		528966	458456	9841417	100

Table16: South African offshore commercial fishing sectors, landings, number of rights holders, wholesale catch value and target species (DEFF, 2019).

Sector	Areas of Operation	Main Ports	Target Species
Small pelagic purse-seine	West Coast South Coast	St Helena Bay, Saldanha, Hout Bay, Gansbaai, Mossel Bay	Anchovy (*Engraulis encrasicolus*), sardine (*Sardinops sagax*), redeye round herring (*Etrumeus whiteheadi*)
Demersal trawl (offshore)	West Coast South Coast	Cape Town, Saldanha, Mossel Bay, Port Elizabeth	Deepwater hake (*Merluccius paradoxus*), shallow-water hake (*Merluccius capensis*)
Demersal trawl (inshore)	South Coast	Cape Town, Saldanha, Mossel Bay	East coast sole (*Austroglossus pectoralis*), shallow-water hake (*Merluccius capensis*), juvenile horse mackerel (*Trachurus capensis*)
Mid-water trawl	West Coast South Coast	Cape Town, Port Elizabeth	Adult horse mackerel (*Trachurus capensis*)
Demersal longline	West Coast South Coast	Cape Town, Saldanha, Mossel Bay, Port Elizabeth, Gansbaai	Shallow-water hake (*Merluccius capensis*)
Large pelagic longline	West Coast South Coast East Coast	Cape Town, Durban, Richards Bay, Port Elizabeth	Yellowfin tuna (*T. albacares*), big eye tuna (*T. obesus*), Swordfish (*Xiphias gladius*), southern bluefin tuna (*T. maccoyii*)
Tuna pole-line	West Coast South Coast	Cape Town, Saldanha	Albacore tuna (*T. alalunga*), yellowfin tuna
Linefish	West Coast South Coast East Coast	All ports, harbours and beaches around the coast	Snoek (*Thyrsites atun*), Cape bream (*Pachymetopon blochii*), geelbek (*Atractoscion aequidens*), kob (*Argyrosomus japonicus*), yellowtail (*Seriola lalandi*), Sparidae, Serranidae, Carangidae, Scombridae, Sciaenidae
South coast rock lobster	South Coast	Cape Town, Port Elizabeth	*Palinurus gilchristi*
West coast rock lobster	West Coast	Hout Bay, Kalk Bay, St Helena	*Jasus lalandii*

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Sector	Areas of Operation	Main Ports	Target Species
Crustacean trawl	East Coast	Durban, Richards Bay	Tiger prawn (*Penaeus monodon*), white prawn (*Fenneropenaeus indicus*), brown prawn (*Metapenaeus monoceros*), pink prawn (*Haliporoides triarthrus*)
Squid jig	South Coast	Port Elizabeth, Port St Francis	Squid/chokka (*Loligo vulgaris reynaudii*)
Gillnet	West Coast	False Bay to Port Nolloth	Mullet / harders (*Liza richardsonii*)
Beach seine	West Coast South Coast East Coast	Coastal/Nearshore	Mullet / harders (*Liza richardsonii*)
Oysters	South Coast East Coast	Coastal/Nearshore	Cape rock oyster (*Striostrea margaritacea*)
Seaweeds	West Coast South Coast East Coast	Coastal/Nearshore	Beach-cast seaweeds (kelp, *Gelidium* spp. and *Gracilaria* spp.
Abalone	West Coast	Coastal/Nearshore	*Haliotis midae*
Small-Scale Fisheries	West Coast South Coast East Coast	Coastal/Nearshore	

8.5.2 SPAWNING AND RECRUITMENT OF FISH STOCKS

The South African coastline is dominated by seasonally variable and sometimes strong currents, and most species have evolved selective reproductive patterns to ensure that eggs and larvae can enter suitable nursery grounds situated along the coastline. Three nursery grounds can be identified in South African waters, viz the Natal Bight; the Agulhas Bank and the inshore Western Cape coasts. Each is linked to a spawning area, a transport and/or recirculation mechanism, a potential for deleterious offshore or alongshore transport and an enriched productive area of coastal or shelf-edge upwelling (Hutchings *et al.*, 2002).

Hake, sardines, anchovy and horse mackerel are mostly serial, broadcast spawners, producing large numbers of eggs sporadically that are widely dispersed in ocean currents (Hutchings *et al.*, 2002). The principal commercial fish species undergo a critical migration pattern in the Agulhas and Benguela ecosystems. Adults spawn on the Agulhas Bank between the shelf-edge upwelling and the cold-water ridge, where copepod availability is highest (Crawford 1980; Hutchings 1994; Roel & Armstrong 1991; Hutchings *et al.* 2002). The spawn products are thought to move southwards from the central Agulhas Bank and then may drift northwards in the Benguela current across the shelf and up the west coast, or inshore and eastwards towards the south coast. As the eggs drift, hatching takes place followed by larval development. Settlement of larvae occurs in the inshore areas, in particular the bays that are used as nurseries, from October to March. In the southern Benguela system, juveniles shoal and then begin a southward migration down the west coast – it is at this stage that anchovy and sardine are targeted by the small pelagic purse seine fishery. Juveniles of demersal species such as hake are thought to move from a pelagic phase and to systematically migrate to the seafloor (a vertical migration) and then as they mature and grow in size, move offshore into deeper water where they are targeted by commercial fisheries (in hake this occurs in their third year of growth and is referred to as "recruiting" to the fishery).

Spawning of key species exploited by commercial fishery sectors off the West Coast are presented below (Hutchings *et al.* 2002):

- Hake, snoek and round herring move to the western Agulhas Bank and southern west coast to spawn during key periods (late winter to early spring), when losses due to offshore drift are at a minimum and eggs and larvae drift northwards and inshore to the west coast nursery grounds.

- Hake are serial spawners and are reported to spawn throughout the year with peaks in October/November and March/April (Johann Augustyn, SADSTIA and Dave Japp, CapMarine pers com.). During these periods there is a greater concentration of drifting eggs and larvae compared to other months. Spawning of the shallow-water hake occurs primarily over the shelf (<200 m) whereas that by the deep-water hake occurs off the shelf.
- Horse mackerel spawn over the east/central Agulhas Bank during winter months but are also concentrated on the eastern part of the bank most months in feeding aggregations. Juveniles occur close inshore off the southern Cape coastline and west coast nursery habitats.
- Anchovies are known to spawn on the western, central and eastern Agulhas Bank, from October to March with spawning peaking during October to January (van der Lingen and Huggett, 2003) and some shifts to the west coast in years when Agulhas Bank water intrudes strongly north of Cape Point (van der Lingen *et al.*, 2001 in Hutchings *et al.*, 2002).
- Genomic and transcriptomic analyses have shown that there are two stocks of sardine off South Africa; the Cool Temperate Sardine (CTS) off the west coast and Warm Temperate Sardine (WTS) off the south coast, with some mixing (in both directions) between the two (Teske *et al.* 2021). Sardines spawn on the western, central and eastern Agulhas Bank, and also off the west coast north of Cape Point. Sardine eggs are found throughout the year, but spawning occurs from August to February (spring-summer) for the CTS off the west coast, and from June to November (winter-spring) for WTS off the south coast. There is an intense seasonal movement of sardine eastwards (the "sardine run") that occurs in mid-winter and which is associated with westerly frontal systems driving fish inshore in counter currents. And whilst sardine eggs are found off the east coast from June to December (see Connell 2010 AJMS 32(2)), the KwaZulu-Natal sardine run is not the spawning migration of a third stock but a navigation error by CTS.
- Squid (*Loligo spp.*) spawn in the nearshore zone on the eastern Agulhas Bank, principally in shallow waters (<50 m) between Knysna and Gqeberha. Their distribution and abundance are erratic and linked to temperature, turbidity, and currents (Augustyn *et al.* 1994; Schön *et al.* 2002). This niche area on the eastern Agulhas Bank optimises their spawning and early life stage as nowhere else on the shelf are both bottom temperature and bottom dissolved oxygen simultaneously at optimal levels for egg development (Roberts 2005; Oosthuizen & Roberts 2009). The greatest concentration of their food (copepods) tends to be found further west in the cold-water ridge on the central Agulhas Bank (Roberts & van den Berg 2002). Squid are not broadcast spawners but instead they lay benthic egg sacs. The paralarvae that hatch from the sacs are distributed close inshore and juveniles are dispersed over the entire shelf region of the Agulhas Bank. Larvae and juveniles are carried offshore and westwards (via the Benguela Jet) to feed and mature, before returning to the spawning grounds to complete their lifecycle (Olyott *et al.* 2007).
- Snoek spawning occurs offshore during winter-spring (June to October), along the shelf break (150–400 m) of the western Agulhas Bank and the South African west coast. Prevailing currents transport eggs and larvae to a primary nursery ground north of Cape Columbine and to a secondary nursery area to the east of Danger Point; both shallower than 150 m. Juveniles remain on the nursery grounds until maturity, growing to between 33 and 44 cm in the first year (3.25 cm/month). Onshore-offshore distribution (between 5- and 150-m isobaths) of juveniles is determined largely by prey availability and includes a seasonal inshore migration in autumn in response to clupeoid recruitment. Adults are found throughout the distribution range of the species, and although they move offshore to spawn - there is some southward dispersion as the spawning season progresses - longshore movement is apparently random and without a seasonal basis (Griffiths, 2002; refer to Figure 48).
- The inshore area of the Agulhas Bank, especially between the cool water ridge and the shore, serves as an important nursery area for numerous linefish species (e.g. elf *Pomatomus saltatrix*, leervis *Lichia amia*, geelbek *Atractoscion aequidens*, carpenter *Argyrozona argyrozona*) (Wallace *et al.* 1984; Smale *et al.* 1994). A significant proportion of these eggs and larvae originate from spawning grounds along the east coast, as adults undertake spawning migrations along the South Coast into KwaZulu-Natal

waters (van der Elst 1976, 1981; Griffiths 1997; Garratt 1988; Beckley & van Ballegooyen 1992). The eggs and larvae are subsequently dispersed southwards by the Agulhas Current, with juveniles occurring on the inshore Agulhas Bank, using the area between the cold-water ridge and the shore as nursery grounds (van der Elst 1976, 1981; Garratt 1988). In the case of the carpenter, a high proportion of the reproductive output comes from the central Agulhas Bank and the Tsitsikamma Marine Protected Area (MPA), and two separate nursery grounds appear to exist, one near Gqeberha and a second off the deep reefs off Cape Agulhas, with older fish spreading eastwards and westwards (van der Lingen et al. 2006).

Table 17 shows known spawning periods of key commercial species off the West Coast of South Africa.

Table 17: Table showing known spawning periods of key commercial species off the West Coast of South Africa.

Species	Spawning Intensity by Month (peak spawning = orange)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Cape Gurnard												
Anchovy												
Sardine												
Snoek												

Refer to Figure 48 and Figure 49 for an overview of the main fish spawning grounds and nursery areas off the West and South Coasts of South Africa. Figure 50 shows the distribution of egg density of sardine and anchovy, and Figure 51 shows spawning ground and nursery areas of snoek and anchovy. Figure 48 shows the West Coast nursery area and the western/central Agulhas Bank spawning grounds. Light stippled area on the West Coast marks the main recruiting area for the small pelagic fishery and dark stippled area on the Agulhas Bank marks the main spawning grounds for small pelagic fish.

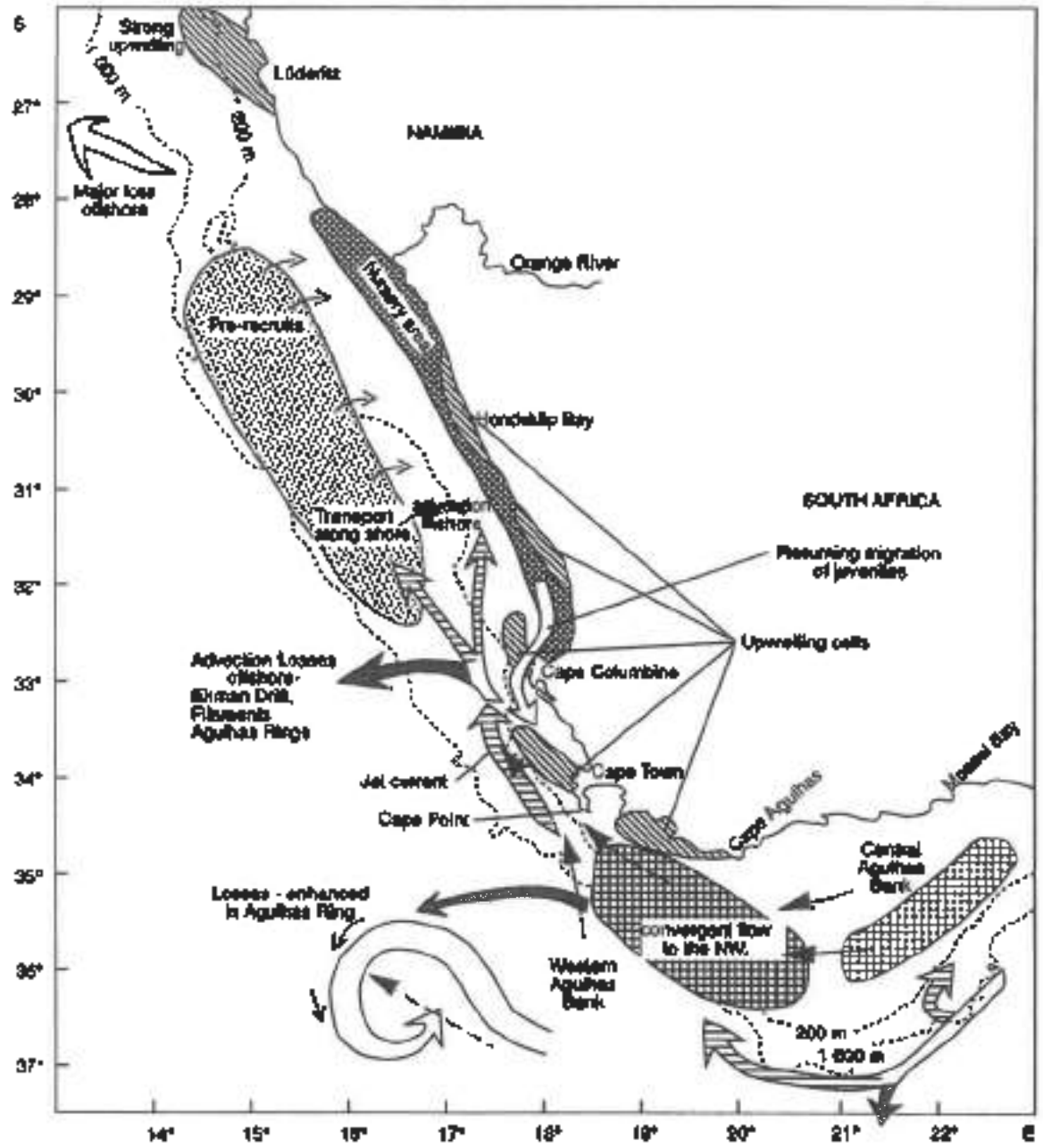

Figure 48: Generalised figure of the main fish recruiting process for species caught on the West Coast of South Africa (after Hutchings *et al.*, 2002).

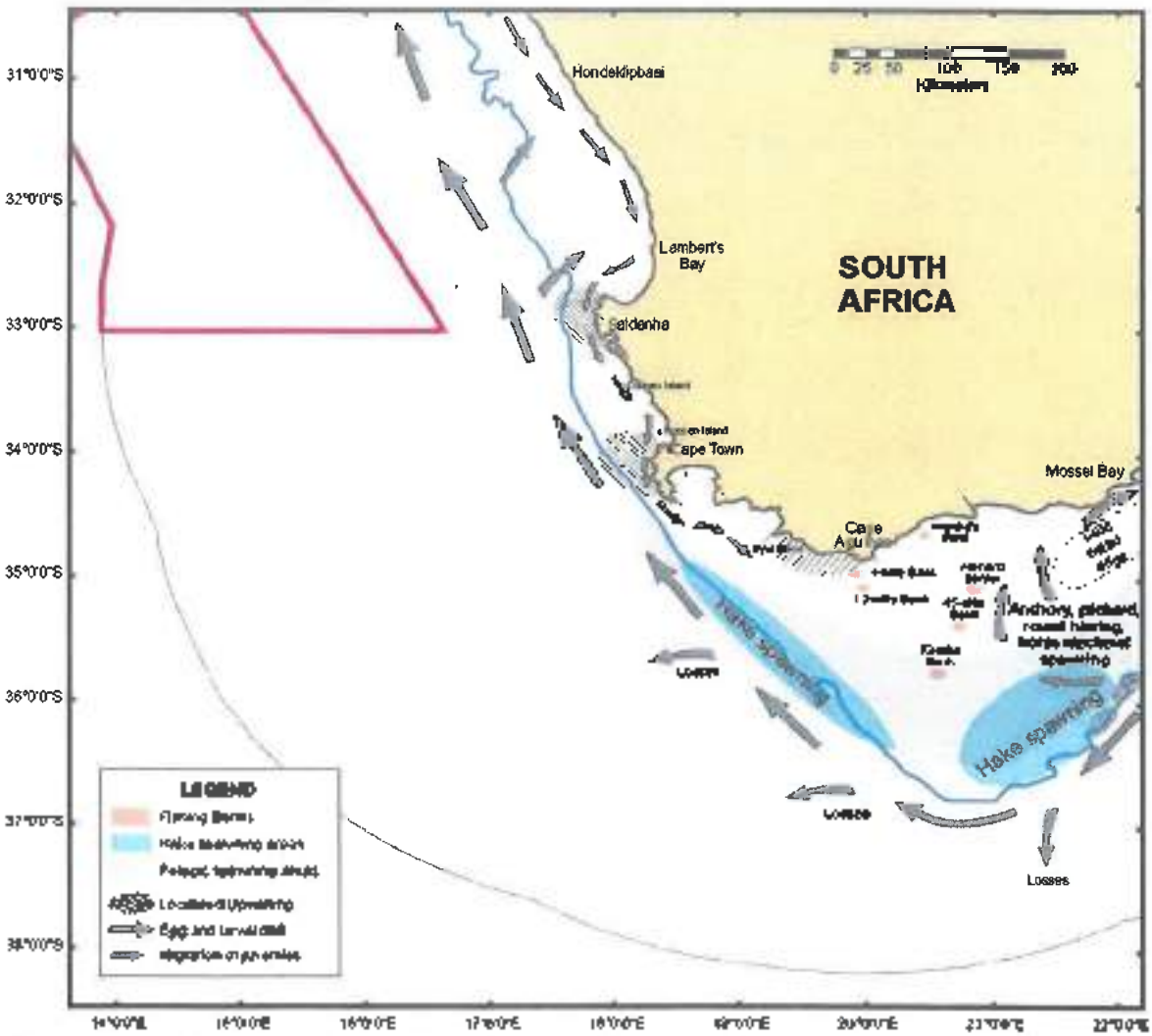

Figure 49: The Reconnaissance Permit area in relation to major spawning, recruitment and nursery areas in the southern Benguela region (adapted from Crawford *et al.* 1987, Hutchings 1994, and Hutchings *et al.*, 2002, in Pisces 2022).

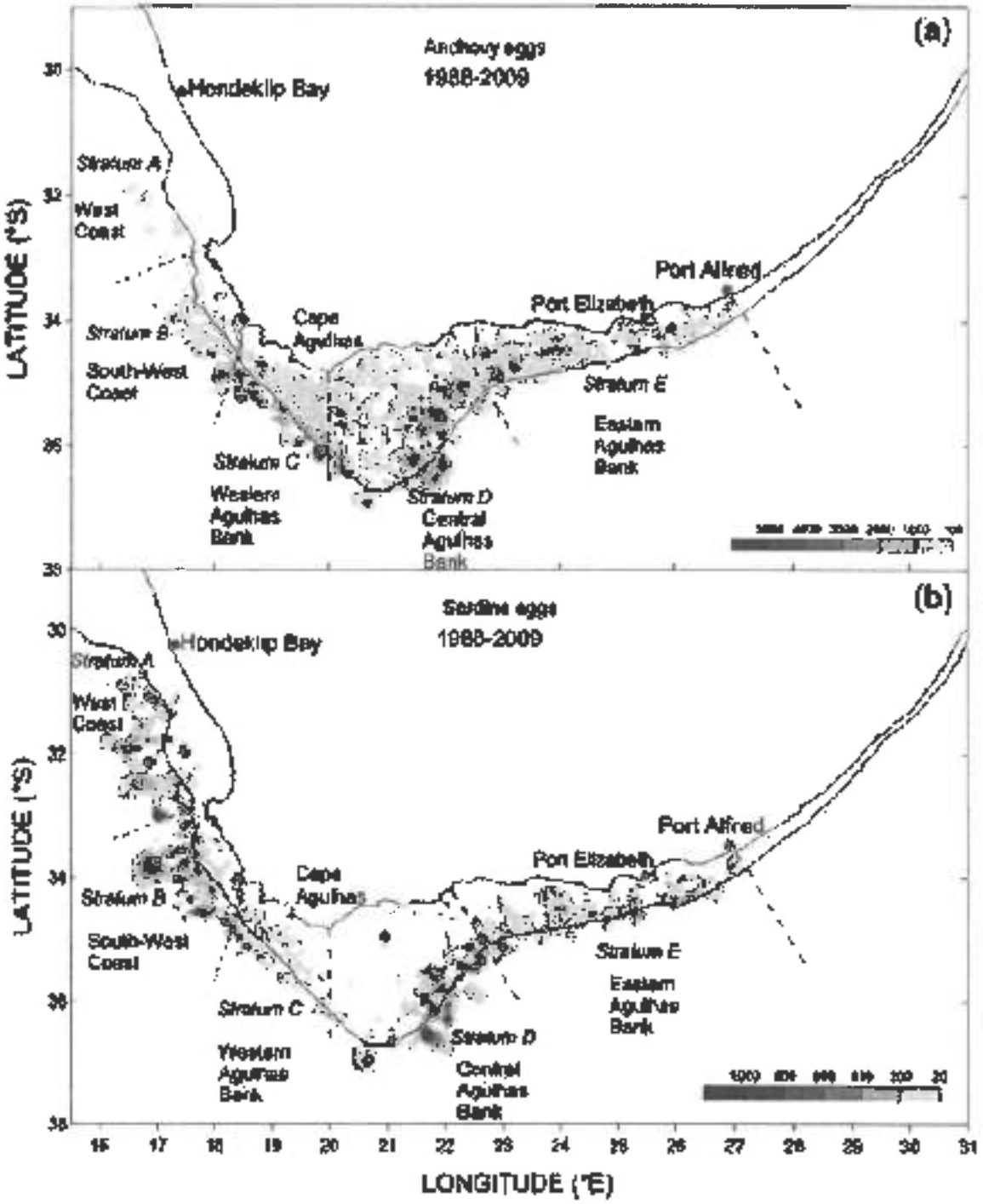

Figure 50: Composite distribution maps for eggs (eggs.m-2) of (a) anchovy and (b) sardine collected during spawner biomass surveys by DFFE over the period 1988–2009 (Mhlongo *et al.*, 2015).

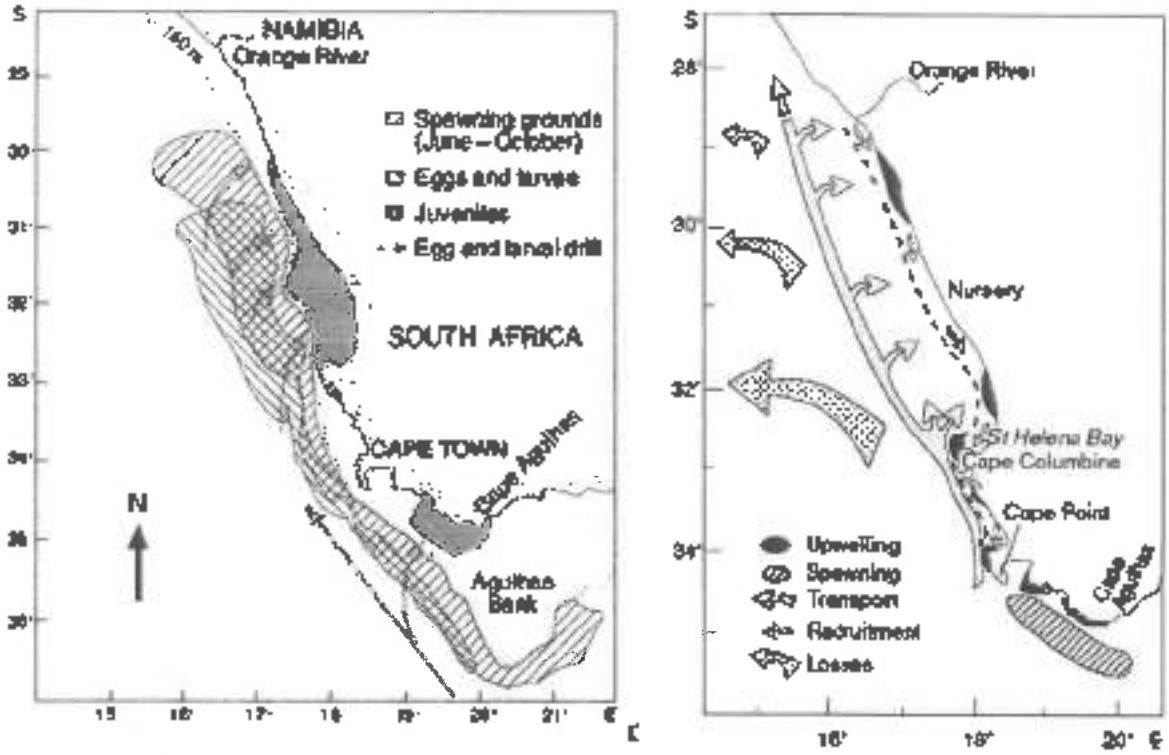

Figure 51: Conceptual model depicting the life history of snoek (left; Source: Griffiths, 2002) and anchovy (right; Hutchings *et al.*, 1992) in the southern Benguela ecosystem, including spawning grounds, distribution and transport of eggs and larvae, and the nursery areas.

8.5.3 COMMERCIAL FISHING SECTORS

8.5.3.1 DEMERSAL TRAWL

The primary fisheries in terms of highest economic value are the demersal (bottom) trawl and longline fisheries targeting the Cape hakes (*Merluccius paradoxus* and *M. capensis*). Secondary species include a large assemblage of demersal fish of which monkfish (*Lophius vomerinus*), kingklip (*Genypterus capensis*) and snoek (*Thyrsites atun*) are the most commercially important. The demersal trawl fishery comprises an offshore (deep-sea) and inshore fleet, which differ primarily in terms of vessel capacity and the areas in which they operate. The wholesale value of catch landed by the inshore and offshore demersal trawl sectors, combined, during 2017 was R5.982 Billion, or 40.5% of the total value of all fisheries combined. The 2022 total allowable catch (TAC) for hake is set at 132 154 tons, of which 84% and 6% is allocated to the offshore and inshore trawl sectors, respectively (The remaining 10% is allocated to the hake demersal longline sector – refer to Section 8.5.3.3).

The annual TAC limits and landings of hake (both species) by the trawl and longline sectors is listed in Table 18. A time-series of total hake catch as well as hake catch by sector is shown in Figure 52.

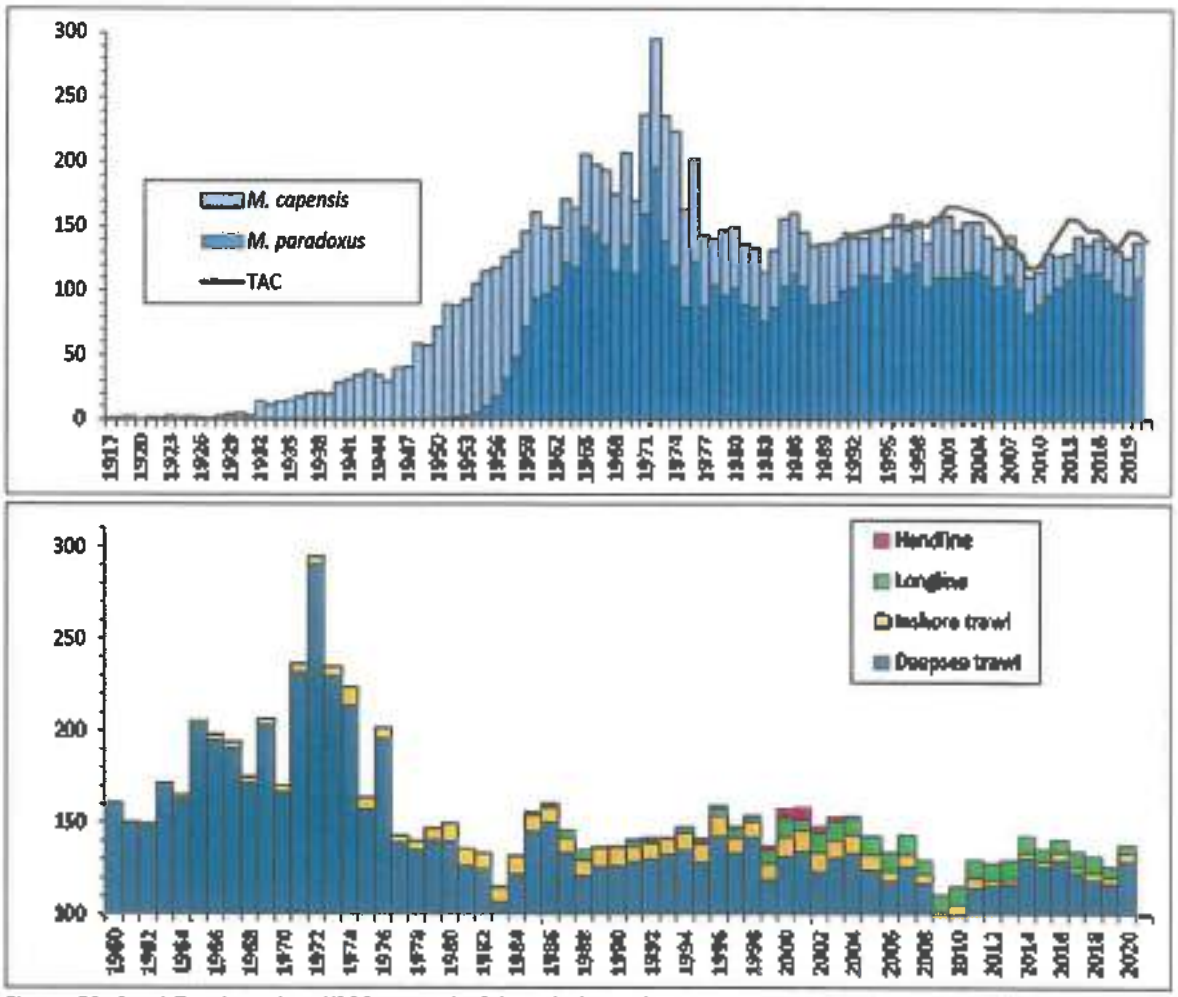

Figure 52: (top) Total catches ('000 tonnes) of Cape hakes split by species over the period 1917–2020 and the TAC set each year since the 1991. (bottom) Catches of Cape hakes per fishing sector for the period 1960–2020. Prior to 1960, all catches are attributed to the deep-sea trawl sector. Note that the vertical axis commences at 100 000 tonnes to better clarify the contributions by each sector. (Source DEFF, 2022)

Table 18: Annual total allowable catch (TAC) limits and catches (tons) of the two species of hake by the hake-directed fisheries on the West (WC) and South (SC) coasts (Adapted from DEFF, 2020[3]).

		M. paradoxus					*M. capensis*						TOTAL (both species)
Year	TAC	Offshore		Longline		TOTAL	Offshore		Inshore	Longline		TOTAL	
		WC	SC	WC	SC		WC	SC	SC	WC	SC		
2019	129681	69709	15457	2294	1527	88987	18186	4955	5472	3086	1024	26008	114995
2021	151788	76576	17984	2522	140	97342	19473	4984	6013	3921	2047	35438	129667
2022	144671	81411	18842	4134	806	105616	12928	4584	3228	2570	1737	25050	127648
2023	154075	74841	25459	4954	40	105316	8741	4475	3909	3606	1309	20071	125387
2024	191280	71252	41196	4879	0	117285	9971	6255	2965	2123	385	21961	142854

[3] FISHERIES/2021/OCT/SWG-DEM/21rev

		M. paradoxus					*M. capensis*						TOTAL (both species)
Year	TAC	Offshore		Longline		TOTAL	Offshore		Inshore	Longline		TOTAL	
		WC	SC	WC	SC		WC	SC	SC	WC	SC		
2015	147900	77521	31745	4801	18	113286	12727	4086	3877	2825	58	22257	135543
2016	147900	91371	18968	2006	3	112348	14744	2830	3878	4880	2	25439	140787
2017	140125	72535	30961	5298	25	108819	11273	4466	1812	2887	126	20446	134265
2018	133319	64252	25218	5158	88	94715	12883	12983	3963	2985	463	32888	181870
2019	148431	76035	22263	3177	20		14183	9454	4149	2340	179		
2020	148408	97091	10063	3229	8		16135	8540	4596	1299	179		
2021	139909												
2022	132164												

The offshore fishery is comprised of 45 vessels operating from most major harbours on both the West and South Coasts. On the West and South-West Coasts, these grounds extend in a continuous band along the shelf edge approximately between the 200 m and 1 000 m bathymetric contours although most effort is in the >300 m to 600 m depth range. Monkfish-directed trawlers tend to fish shallower waters than hake-directed vessels on mostly muddy substrates. Trawl nets are generally towed parallel to the depth contours (thereby maintaining a relatively constant depth) in a north-westerly or south-easterly direction. Trawlers also target fish aggregations around bathymetric features, in particular seamounts and canyons, where there is an increase in seafloor slope and in these cases the direction of trawls follow the depth contours. The deep-sea sector is prohibited from operating in waters shallower than 110 m or within five nautical miles of the coastline. Fishing activity occurs year-round.

The inshore fishery consists of 31 vessels, which operate on the South Coast mainly from the harbours of Mossel Bay and Port Elizabeth. Inshore grounds are located on the Agulhas Bank and extend towards the Great Kei River in the east. Vessels also target sole close inshore between Struisbaai and Mossel Bay, between the 50 m and 80 m isobaths. Hake is targeted further offshore in traditional grounds between 100 m and 200 m depth in fishing grounds known as the Blues located on the Agulhas Bank.

Otter trawling is the main trawling method used in the South African hake fishery. This method of trawling makes use of trawl doors (also known as otter boards) that are dragged along the seafloor ahead of the net, maintaining the horizontal net opening. Bottom contact is made by the footrope and by long cables and bridles between the doors and the footrope. Behind the trawl doors are bridles connecting the doors to the wings of the net (to the ends of the footrope and headrope). A headline, bearing floats and the weighted footrope (that may include rope, steel wire, chains, rubber discs, spacers, bobbins or weights) maintain the vertical net opening. The "belly", "wings" and the "cod-end" (the part of the net that retains the catch) may contact the seabed (see Figure 53). The configuration of trawling gear is similar for both offshore and inshore vessels however inshore vessels are smaller and less powerful than those operating within the offshore sector. The offshore fleet is segregated into wetfish and freezer vessels which differ in terms of the capacity for the processing of fish at sea and in terms of vessel size and capacity. While freezer vessels may work in an area for up to a month at a time, wetfish vessels may only remain in an area for about a week before returning to port. Wetfish vessels range between 24 m and 56 m in length while freezer vessels are usually larger, ranging up to 90 m in length. Inshore vessels range in length from 15 m to 40 m. Trips average three to five days in length and all catch is stored on ice.

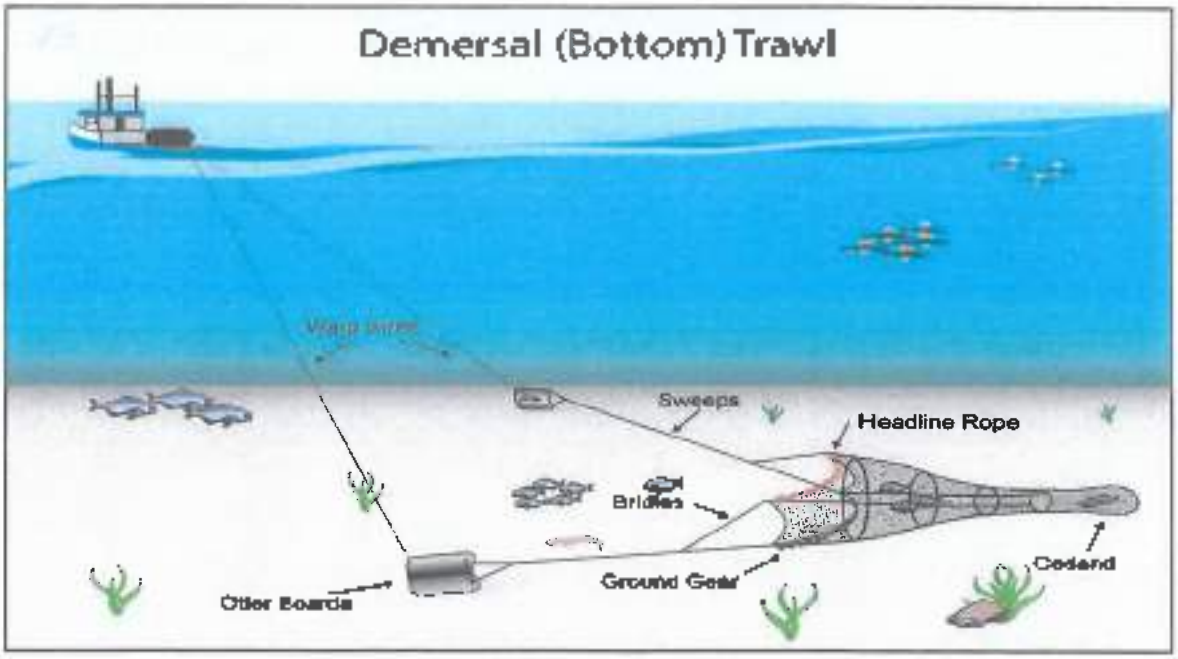

Figure 53: Typical gear configuration used by offshore demersal trawlers targeting hake (Source: www.afma.gov.au/fisheries-management/methods-and-gear/trawling).

The activity of the fishery is restricted by permit condition to operating within the confines of a historical "footprint" – an area of approximately 57 300 km² and 17 000 km² for the offshore and inshore fleets, respectively. Offshore trawlers operate along the west coast along the shelf break between approximately Hondeklipbaai and the southern tip of the Agulhas Bank between the 200 m and 750 m bathymetric contours, with sporadic trawls to a maximum depth of 900 m. The Reconnaissance Permit extends offshore of fishing grounds referred to as the "North Grounds" (Sink et. al, 2012). These grounds are characterised by sandy and muddy sand, with isolated patches of hard ground. The area has been trawled since the 1990's commencing on shallower grounds and with effort extending into deeper waters with the advancement of fishing technologies over time.

At it's closest point the demersal trawl footprint is situated approximately 5 km offshore of the area fished around the slopes of the submarine feature Childs Bank (referred to by the fishing industry as the "karbonkel") off Hondeklipbaai. The demersal trawl footprint is situated at least 10 km inshore of the eastern extent of the Reconnaissance Permit area towards the productive fishing grounds between Lamberts Bay and Saldanha Bay. Figure 54 shows the demersal trawling footprint and recent effort off the west coast of South Africa and in relation to the Reconnaissance Permit application area.

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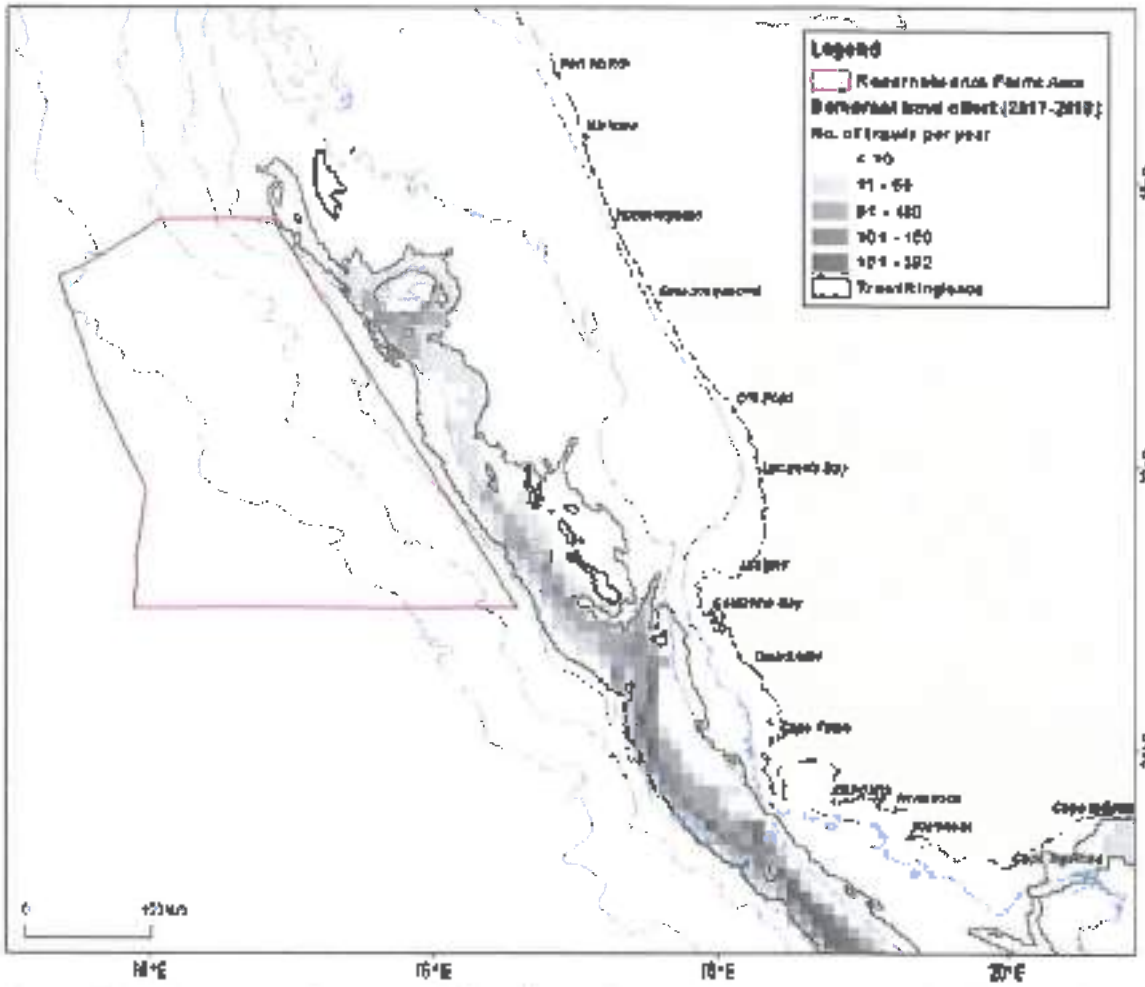

Figure S4: Overview of the trawl ringfence and the spatial distribution of fishing effort expended by the demersal trawl sector in relation the Reconnaissance Permit application area.

8.5.3.2 **MIDWATER TRAWL**

The midwater trawl fishery targets adult Cape horse mackerel (*Trachurus capensis*), which aggregate in highest concentration on the Agulhas Bank. Cape horse mackerel are semi-pelagic shoaling fish that occur on the continental shelf off southern Africa from southern Angola to the Wild Coast. Off South Africa, adult horse mackerel are currently more abundant off the South Coast than the West Coast. Horse mackerel yield a low-value product and are a source of cheap protein (DEFF, 2020).

This sector comprises six vessels and 34 rights holders which landed a total catch of 19 555 in 2019. Refer to Figure S5 for the catches and TACs for the midwater trawl fishery between 1998 and 2018. The fleet is split between dual rights holders who fish horse mackerel on hake-directed trawlers and others that combine their allocation on a single large midwater trawl vessel (the MFV Desert Diamond). Dual rights holders fishing only occurs if horse mackerel availability is high when fishing for hake at which point that may switch from bottom trawl to midwater trawl. The amounts of horse mackerel caught by these vessels is a relatively small component of the horse mackerel TAC. Those horse mackerel rights holders that do not have hake rights or who do not have a suitable vessel to catch horse mackerel allow their share of the horse mackerel to be caught on a single large midwater trawler. This facilitates the economic use of a single large vessel that can more efficiently catch their horse mackerel allowing the vessels to fish year round. The area fished by this vessel is restricted largely (but not exclusively) to water deeper than 110 m or more than 20 nm from the coast and in an area east of Cape Point. The dual vessels may fish in a broader area, mostly on or near the hake fishing grounds.

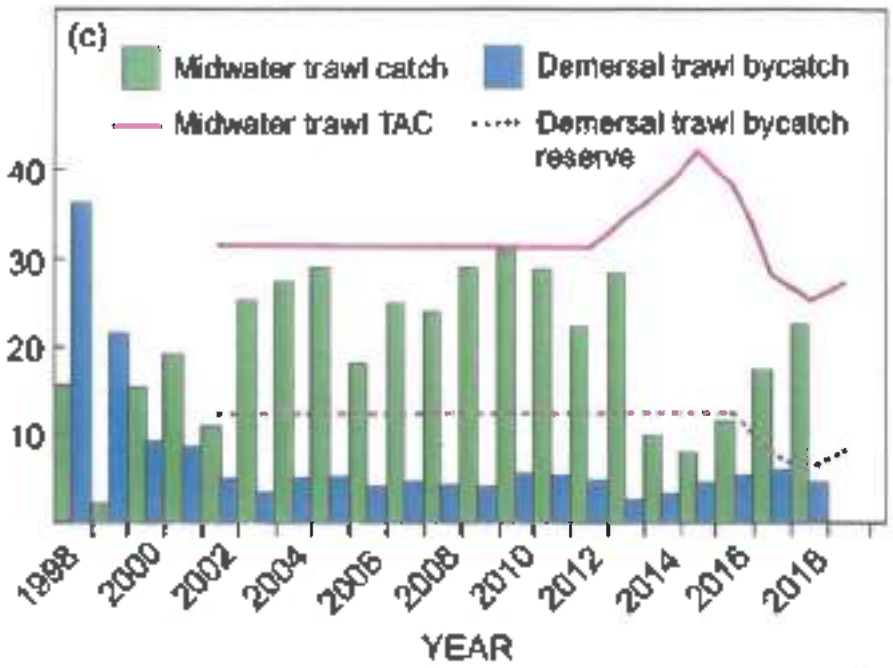

Figure 55: Trawl catches (tons, 1998 – 2018) split into the demersal and midwater trawl components. The midwater trawl TAC (solid line) and demersal trawl bycatch reserve (dashed line) are also shown (Source: DEFF, 2020).

Midwater trawl is defined in the Marine Living Resources Act (No. 18 of 1998) (MLRA) as any net which can be dragged by a fishing vessel along any depth between the seabed and the surface of the sea without continuously touching the bottom. In practice, midwater trawl gear does occasionally come into contact with the seafloor. Midwater trawling gear configuration is similar to that of demersal trawlers, except that the net is manoeuvred vertically through the water column (refer to Figure 56 for a schematic diagram of gear configuration). The towed gear may extend up to 1 km astern of the vessel and comprises trawl warps, net and cod end. Trawl warps are between 32 mm and 38 mm in diameter. The trawl doors (3.5 t each) maintain the net opening which ranges from 120 to 130 m in width and from 40 m to 80 m in height. Weights in front of, and along the ground-rope provide for vertical opening of the trawl. The cable transmitting acoustic signal from the net sounder might also provide a lifting force that maximizes the vertical trawl opening. To reduce the resistance of the gear and achieve a large opening, the front part of the trawls are usually made from very large rhombic or hexagonal meshes. The use of nearly parallel ropes instead of meshes in the front part is also a common design. Once the gear is deployed, the net is towed for several hours at a speed of 4.8 to 6.8 knots predominantly parallel with the shelf break.

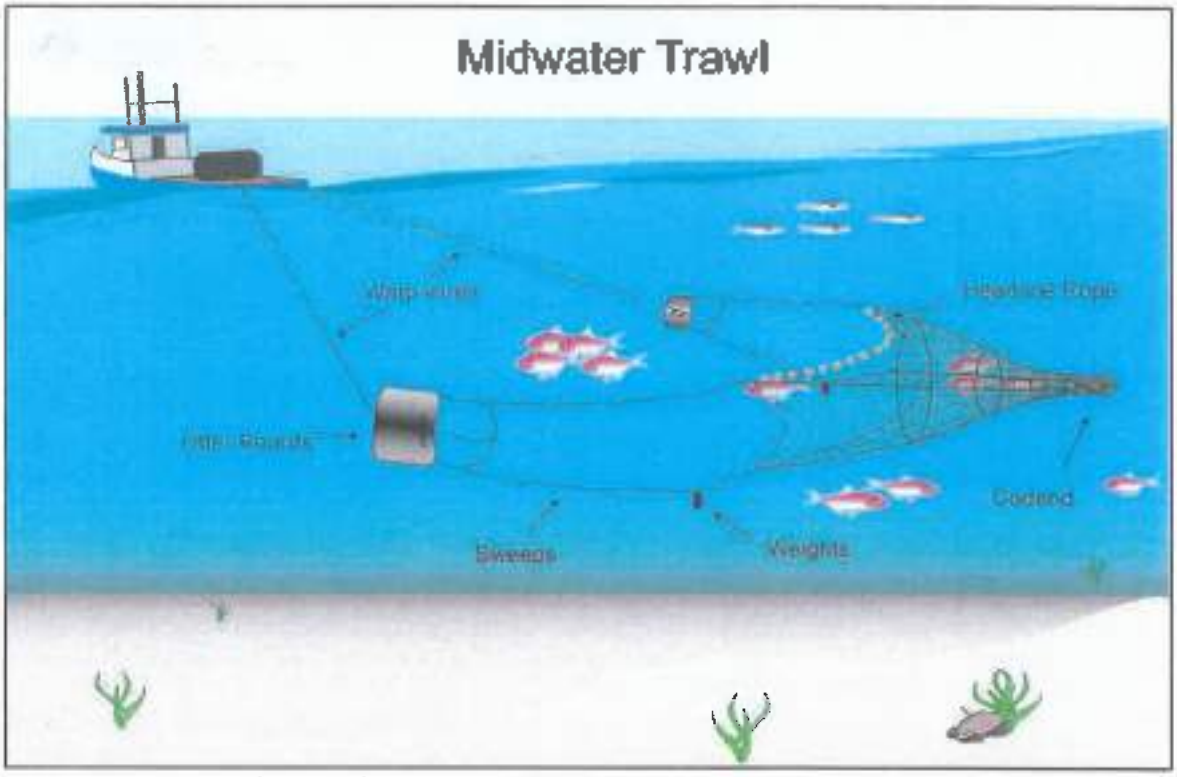

Figure 56: Schematic diagram showing the typical gear configuration of a midwater trawler. Source: www.afma.gov.au/fisheries-management/methods-and-gear/trawling

The fishery operates predominantly on the edge of the Agulhas Bank, where shoals are found in commercial abundance. Fishing grounds off the South Coast are situated along the shelf break and three dominant areas can be defined. The first lies between 22 °E and 23 °E at a distance of approximately 70 nm offshore from Mossel Bay and the second extends from 24 °E to 27 °E at a distance of approximately 80 nm offshore. The third area lies to the south of the Agulhas Bank 21 °E and 22 °E. These grounds range in depth from 100 m to 400 m and isolated trawls are occasionally recorded up to 650 m. Since 2017, DFFE has permitted experimental fishing to take place westward of 20°E.

Figure 57 shows the spatial extent of midwater trawls undertaken between 2017 and 2019 in relation to the Reconnaissance Permit application area. Sector activity off the West Coast takes place predominantly south of Cape Town at a depth range of between 120 m and 580 m. There is no overlap between midwater trawl grounds and the Reconnaissance Permit application area which is situated at least 30 km from the closest fishing location and 150 km from the main fishing areas.

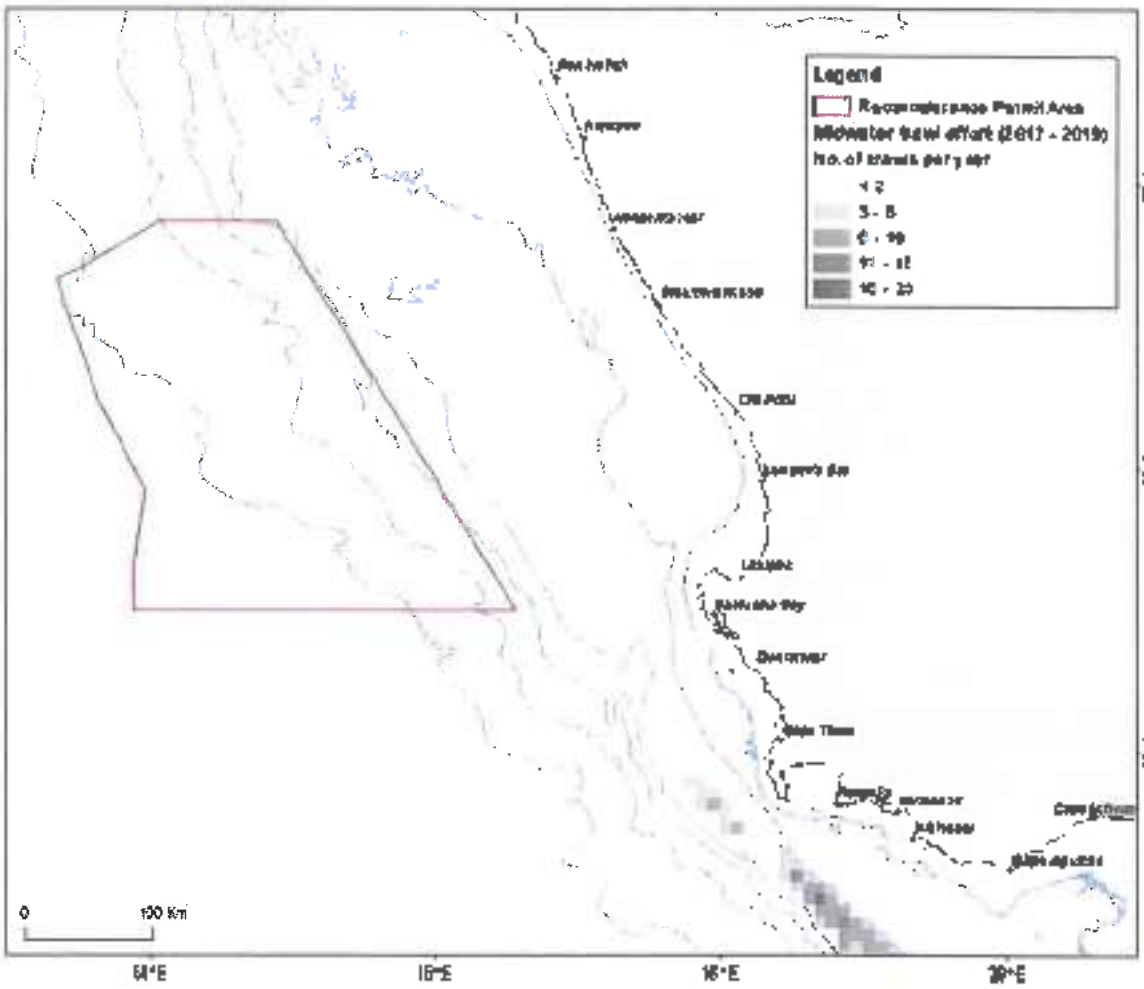

Figure 57: DFFE's catch reporting grid system and the spatial distribution of fishing effort expended by the midwater trawl sector in relation to the Reconnaissance Permit application area.

8.5.3.3 DEMERSAL HAKE LONGLINE

Like the demersal trawl fishery, the target species of the longline fishery is the Cape hakes, with a small non-targeted commercial by-catch that includes kingklip. In 2017, 8113 tons of catch was landed with a wholesale value of R319.2 million, or 9.2% of the total value of all fisheries combined. Landings of 8 230 tons were reported in 2018.

A demersal longline vessel may deploy either a double or single line which is weighted along its length to keep it close to the seafloor. Steel anchors, of 40 kg to 60 kg, are placed at the ends of each line to anchor it, and are marked with an array of floats. If a double line system is used, top and bottom lines are connected by means of dropper lines. Since the top-line (polyethylene, 10 – 16 mm diameter) is more buoyant than the bottom line, it is raised off the seafloor and minimizes the risk of snagging or fouling. The purpose of the top-line is to aid in gear retrieval if the bottom line breaks at any point along the length of the line. Lines are typically between 10 km and 20 km in length, carrying between 6 900 and 15 600 hooks each. Baited hooks are attached to the bottom line at regular intervals (1 to 1.5 m) by means of a snood. Gear is usually set at night at a speed of between five and nine knots. Once deployed the line is left to soak for up to eight hours before it is retrieved. A line hauler is used to retrieve gear (at a speed of approximately one knot) and can take six to ten hours to complete. A schematic representation of the gear configuration used by the demersal longline fleet is shown in Figure 58.

Currently 64 hake-directed vessels are active within the fishery, most of which operate from the harbours of Cape Town and Hout Bay. Fishing grounds are similar to those targeted by the hake-directed trawl fleet. The hake longline footprint extends down the west coast from approximately 150 km offshore of Port Nolloth (15°E, 29°S). It lies inshore to the south of St Helena Bay moving offshore once again as it skirts the Agulhas Bank to the south of the country (21°E, 37°S). Along the South Coast the footprint moves inshore again towards Mossel

Bay. The eastern extent of the footprint lies at approximately (26°E, 34.5°S). Lines are set parallel to bathymetric contours, along the shelf edge up to the 1 000 m depth contour in places. The more patchy nature of effort in the north western extents of the footprint and the eastern edge of the Agulhas Bank may be attributed to proximity to fishing harbours. Fishing activity within the area occurs year-round with slightly lower levels during winter.

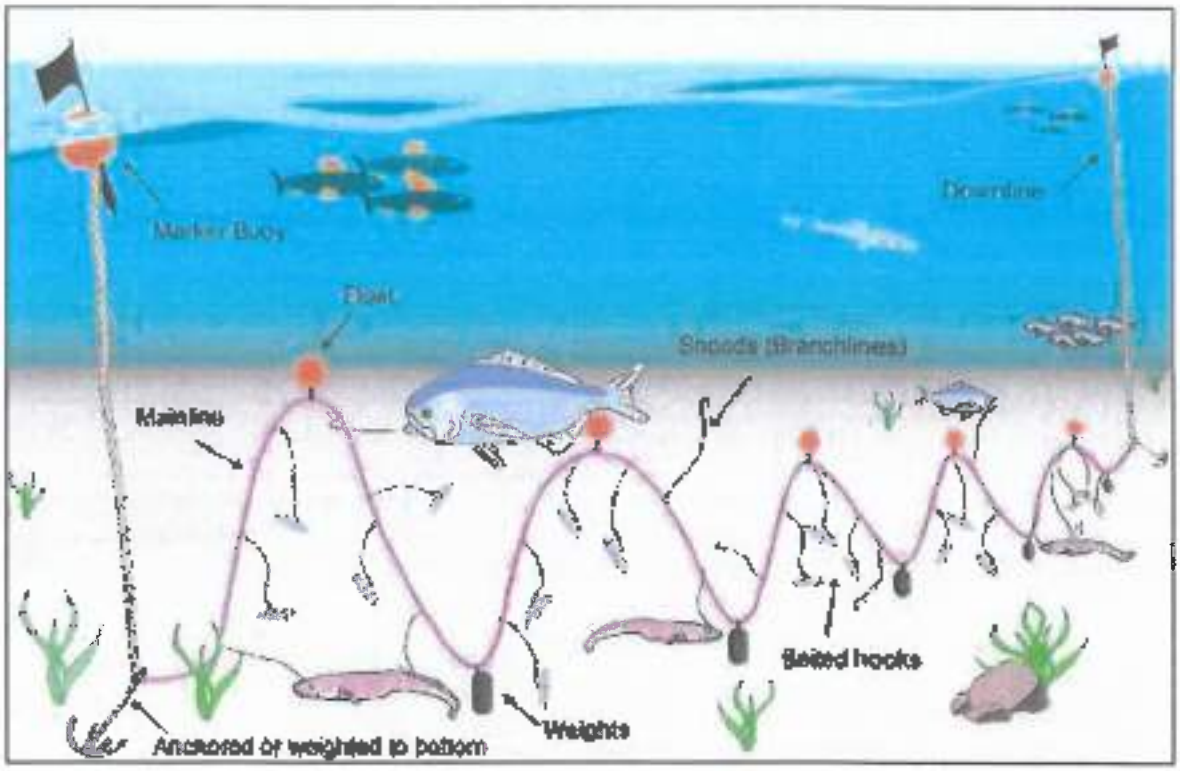

Figure 58: Typical configuration of demersal longline gear used in the South African hake-directed fishery.

Figure 59 shows the spatial distribution of demersal longline fishing areas in relation to the Reconnaissance Permit application area. Fishing effort takes place between the 100 m and 750 m bathymetric contours, but the majority of effort takes place within the depth range 200 m to 650 m. There is no overlap between demersal hake-directed longline grounds and the Reconnaissance Permit application area, which is situated approximately 12 km offshore of the closest fishing locations.

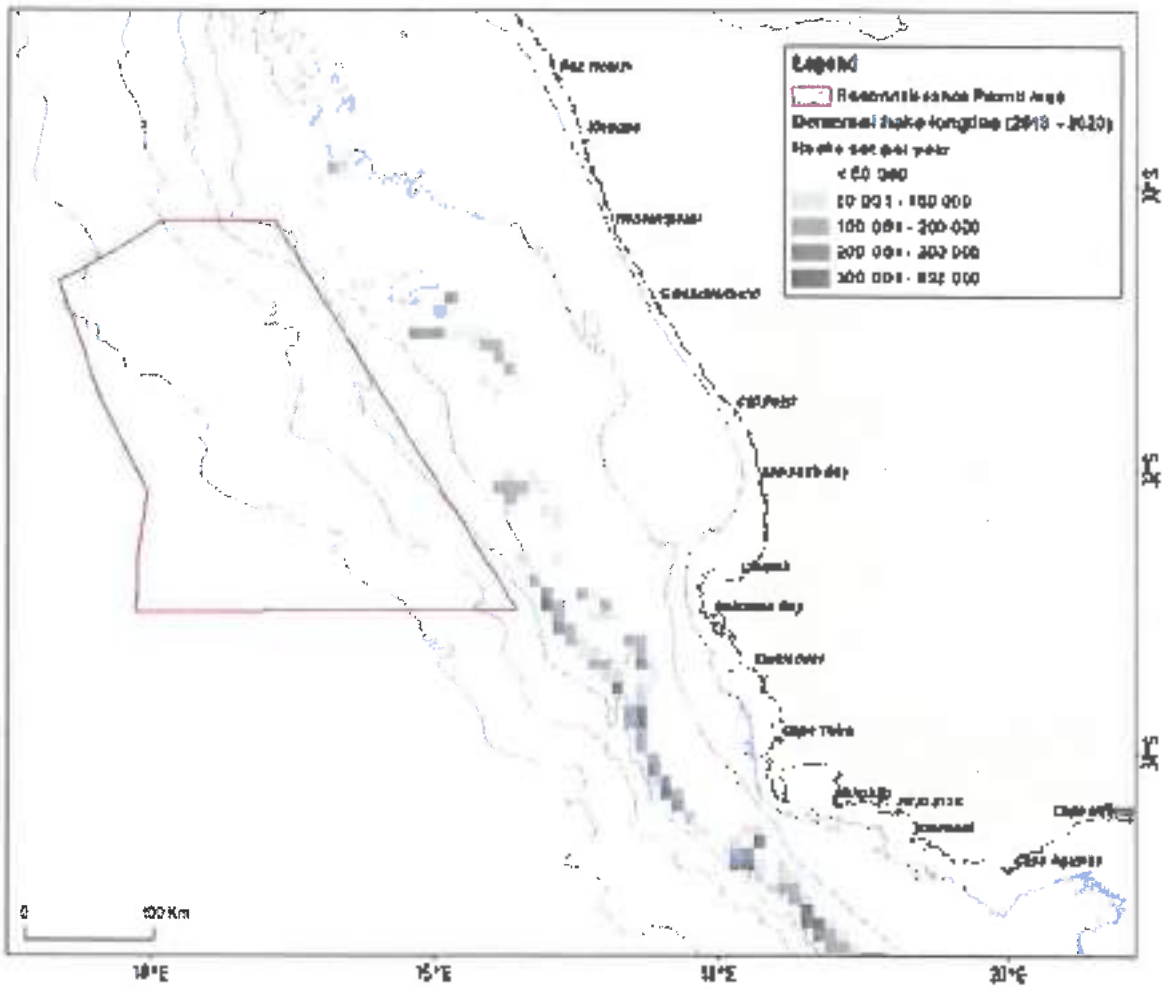

Figure 59: Spatial distribution of fishing effort expended by the hake-directed demersal longline sector in relation to the Reconnaissance Permit application area.

8.5.3.4 DEMERSAL SHARK LONGLINE

The shark longline sector formally commenced in 1991 when 30 permits were issued initially to target both demersal and pelagic sharks (pelagic sharks are those living in the water column, often occurring further offshore). In 2005 the dual targeting of demersal and pelagic sharks under the same permit was discontinued and the sector became an exclusive demersal shark longline fishery reduced to eleven Right Holders in 2004 and just six in 2006. The demersal shark longline fishery is permitted to operate in coastal waters from the Orange River on the West Coast to the Kei River on the East Coast, but fishing rarely takes place north of Table Bay. Vessels are typically <30 m in length and use nylon monofilament Lindgren Pitman spool-systems to set weighted longlines baited with up to 2 000 hooks (average = 917 hooks). The fishery operates in waters generally shallower than 100 m, and uses bottom-set gear to target predominantly soupfin sharks and smoothhound sharks. Following an initial period of adjustment to catching and marketing demersal sharks, catches of soupfin and smoothhound sharks started increasing in 2006, and reporting became more reliable. As the majority of Right Holders own additional rights in other fisheries, the number of active vessels fluctuates over the year but rarely exceeds four vessels operating at the same time. Annual landings have fluctuated widely due to variation in demand and price. Rights are due to be re-allocated during the fishing rights allocation process in 2021/2022.

The commercial-scale exploitation of sharks began in the 1930s around traditional fishing villages in the Western Cape. This fishery used handlines and targeted inshore demersal sharks for their livers to be used in the production of Vitamin A oil. By the 1940s, catches of soupfin sharks had declined (Davies 1964) as targeting shifted. To date, this Western Cape soupfin fishery has not recovered to historical catch levels. To compensate for declining catch rates of high-value line fish species, a rapid increase was seen in shark catches between 1990 and 1993. After 2000, species-specific reporting came into effect and sharks continued to constitute a large

proportion of the livelihood of these fishers around South Africa, with the establishment of a number of dedicated shark processing facilities. Shark catches by the line fishery since the 1990s have typically fluctuated in response to the availability of higher priced line fish species and market influences. Species targeted include soupfin sharks, smoothhound sharks, dusky sharks Carcharhinus obscurus, bronze whaler sharks C. brachyurus, and various skate species. Table 19 lists 2018 landings of the main demersal shark and skate species caught by line.

Table 19: Total catches per FAO area of demersal shark (2018).

Species	Catch by FAO Area (kg)			Total
	1.6	2.1	2.2	
Soupfin shark	7	2017	365	2388
Smoothhound shark	6	4244	5940	9591
Bronze shark	6	384	0	390
St. Joseph shark	0	112	33	144
Skate	0	145	444	589
Total	19	6902	6183	13103

Figure 60 shows the spatial distribution of shark-directed demersal longline catch between 2017 and 2019 in relation to the Reconnaissance Permit application area. Recent fishing activity shows effort occurs East of Cape Point, inshore of the 100 m depth contour and at least 250 km SE of the Reconnaissance Permit area at closest point. There is no overlap of the demersal longline sector with the Reconnaissance Permit area.

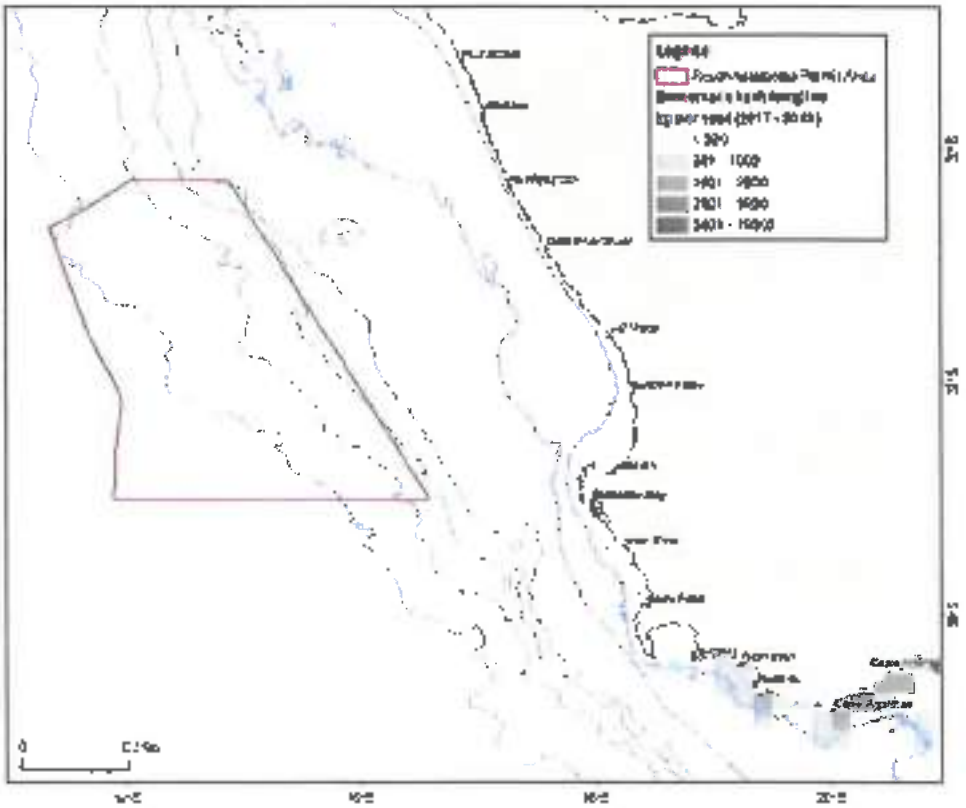

Figure 60: An overview of the spatial distribution of fishing effort expended by the shark-directed demersal longline sector in relation to the Reconnaissance Permit application area.

8.5.3.5 SMALL PELAGIC PURSE-SEINE

The pelagic-directed purse-seine fishery targets anchovy (*Engraulis encrasicolus*) and adult sardine (*Sardinops sagax*). Right Holders may also target round herring (*Etrumeus whiteheadi*) and meso pelagic species (Lantern and Lightfish combined) which have industry precautionary upper catch limits (PUCLs) – currently set at 100 000 t for round herring and 50 000 t for Lantern and Lightfish (combined). Bycatch species are mainly juvenile sardine, horse mackerel and chub mackerel. It is the largest South African fishery by volume (tons landed) and the second most important in terms of economic value. The wholesale value of catch landed by the sector during 2017 was R2.164 Billion, or 22% of the total value of all fisheries combined.

The total combined catch of anchovy, sardine and round herring landed by the pelagic fishery has decreased by 38% from 395 000 t in 2016 to just 243 000 t in 2021 (Figure 61). This is below both long-term (338 000 t) and short-term (294 000 t) averages.

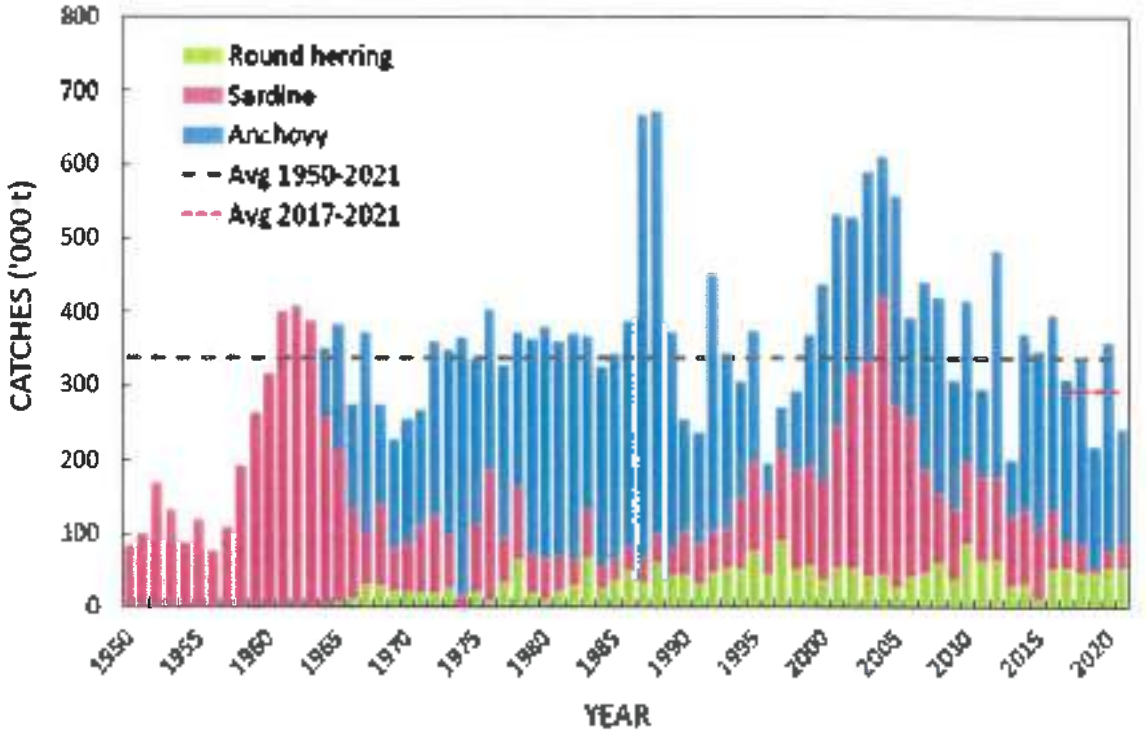

Figure 61: The annual combined catch of anchovy, sardine and round herring. Also shown is the average combined catch since the start of the fishery (1950-2021; black dashed line) and for the past five years (red solid line). Source DFFE, 2022.

The abundance and distribution of small pelagic species fluctuates considerably in accordance with the upwelling ecosystem in which they exist. Fish are targeted in inshore waters, primarily along the west and south Coasts of the Western Cape and the Eastern Cape coast, up to a maximum offshore distance of about 100 km.

The fleet consists of approximately 100 wooden, glass-reinforced plastic and steel-hulled vessels ranging in length from 11m to 48 m. The targeted species are surface-shoaling and once a shoal has been located the vessel will steam around it and encircle it with a large net, extending to a depth of 60 m to 90 m (Figure 62). Netting walls surround aggregated fish, preventing them from diving downwards. These are surface nets framed by lines: a float line on top and lead line at the bottom. Once the shoal has been encircled the net is pursed, hauled in and the fish pumped on board into the hold of the vessel. It is important to note that after the net is deployed, the vessel has no ability to manoeuvre until the net has been fully recovered on board and this may take up to 1.5 hours. Vessels usually operate overnight and return to offload their catch the following day.

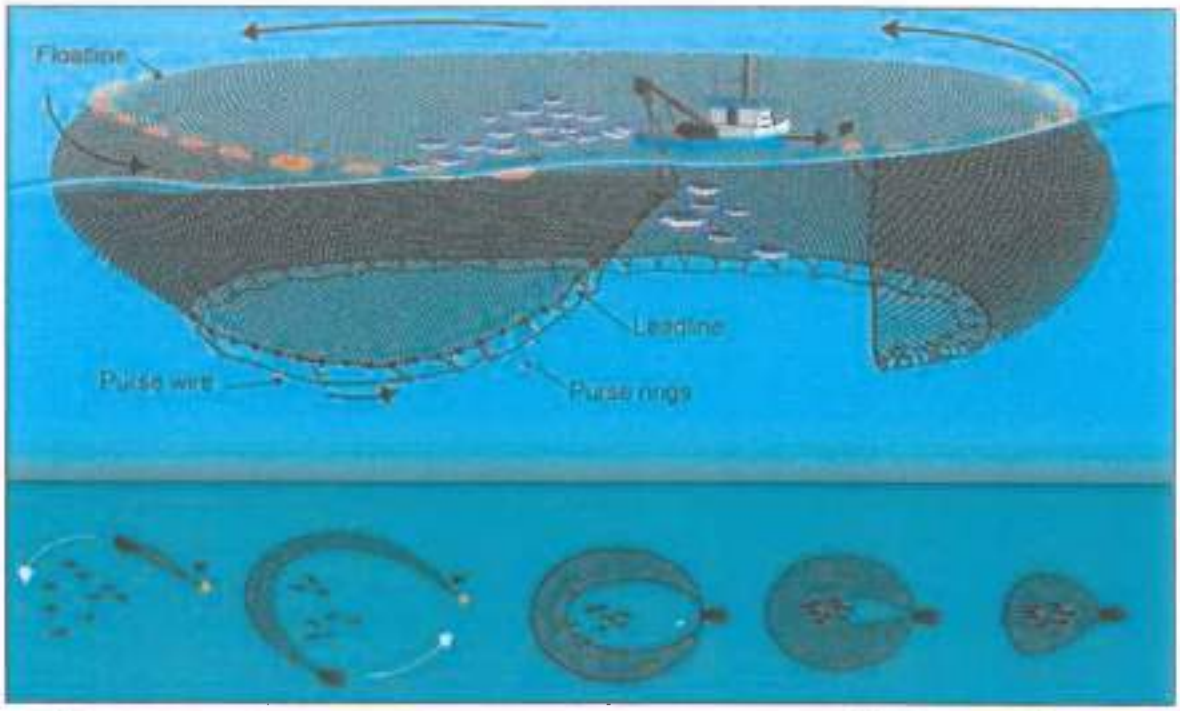

Figure 62: Typical configuration and deployment of a small pelagic purse seine for targeting anchovy, sardine and round herring as used in South African waters. Source: http://www.afma.gov.au/portfolio-item/purse-seine

The majority of the fleet operate from St Helena Bay, Lamberts Bay, Saldanha Bay and Hout Bay with fewer vessels operating on the South Coast from the harbours of Gansbaai, Mossel Bay and Port Elizabeth. Ports of deployment correspond to the location of canning factories and fish reduction plants along the coast. The geographical distribution and intensity of the fishery is largely dependent on the seasonal fluctuation and distribution of the targeted species. The sardine-directed fleet concentrates effort in a broad area extending from Lambert's Bay, southwards past Saldanha and Cape Town towards Cape Point and then eastwards along the coast to Mossel Bay and Port Elizabeth. The anchovy-directed fishery takes place predominantly on the South-West Coast from Lambert's Bay to Kleinbaai (19.5°E) and similarly the intensity of this fishery is dependent on fish availability and is most active in the period from March to September. Round herring (non-quota species) is targeted when available and specifically in the early part of the year (January to March) and is distributed from Lambert's Bay to south of Cape Point. This fishery may extend further offshore than the sardine and anchovy-directed fisheries. The catch and effort statistics for this sector are recorded by skippers on a grid block basis therefore the resolution of 10 by 10 nautical minutes.

The fishery operates throughout the year with a short seasonal break from mid-December to mid-January. Seasonality of catches is shown in Figure 63 with an increase in fishing effort and landings evident during the winter months.

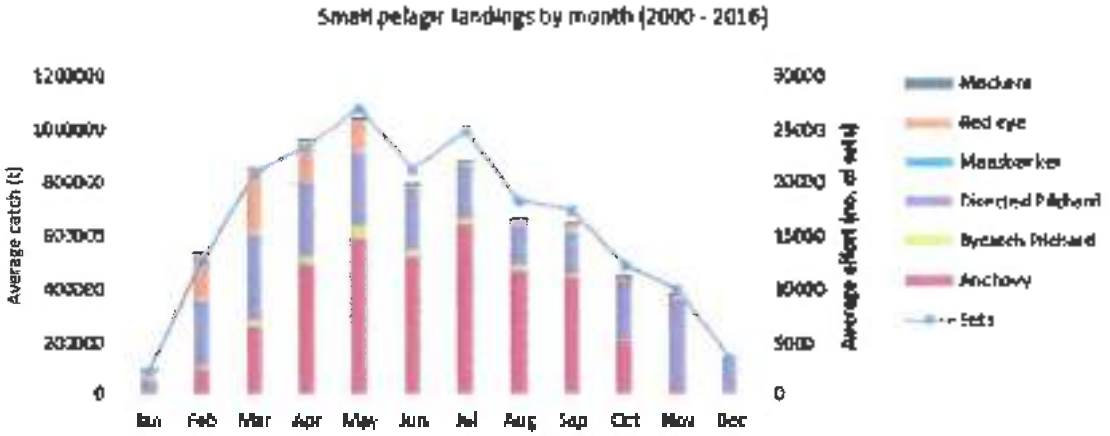

Figure 63: Graph showing monthly catch (tons) and effort (number of sets) reported for the small pelagic purse-seine fleet over the period 2000 to 2016 (cumulative).

Figure 64 shows the spatial extent of fishing grounds used by the sector over the period 2000 to 2016 in relation to the Reconnaissance Permit application area. The majority of fishing effort takes place in waters shallower than 200 m along the coastline of the Western Cape. Fishing grounds lie at least 60 km inshore of the Reconnaissance Permit application area and there is no overlap.

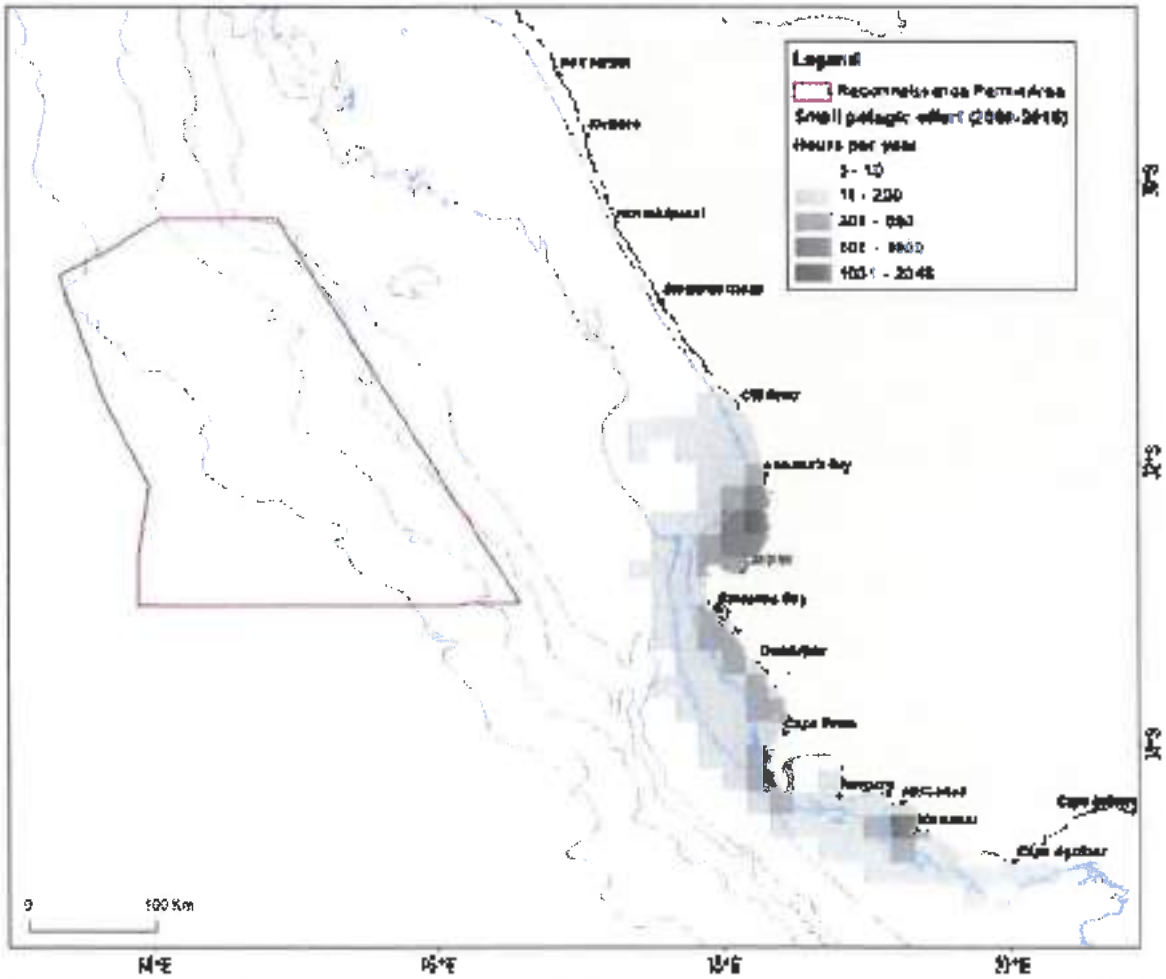

Figure 64: An overview of the spatial distribution of fishing effort recorded by the purse-seine sector targeting small pelagic species in in relation to the Reconnaissance Permit application area.

8.5.3.6 LARGE PELAGIC LONGLINE

Highly migratory tuna and tuna-like species are caught on the high seas and seasonally within the South African Exclusive Economic Zone (EEZ) by the pelagic longline and pole fisheries. Targeted species include albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*), yellowfin tuna (*T. albacares*) and swordfish (*Xiphias gladius*). The wholesale value of catch landed by the sector during 2017 was R154.2 Million, or 1.6% of the total value of all fisheries combined, with landings of 2541 tons (2017) and 2815 tons (2018). During the period 2000 to 2016, the sector landed an average catch of 4527 tons and set 3.55 million hooks per year. Catch and effort figures reported by the South African large pelagic longline fishery for the years 2000 to 2018 are shown in Figure 65. Catch by species and number of active vessels for each year from 2005 to 2018 are given in Table 20.

Catches landed by the South African fleet operating in the ICCAT region (i.e. off the West Coast) from 1998 – 2020 are shown in Figure 66.

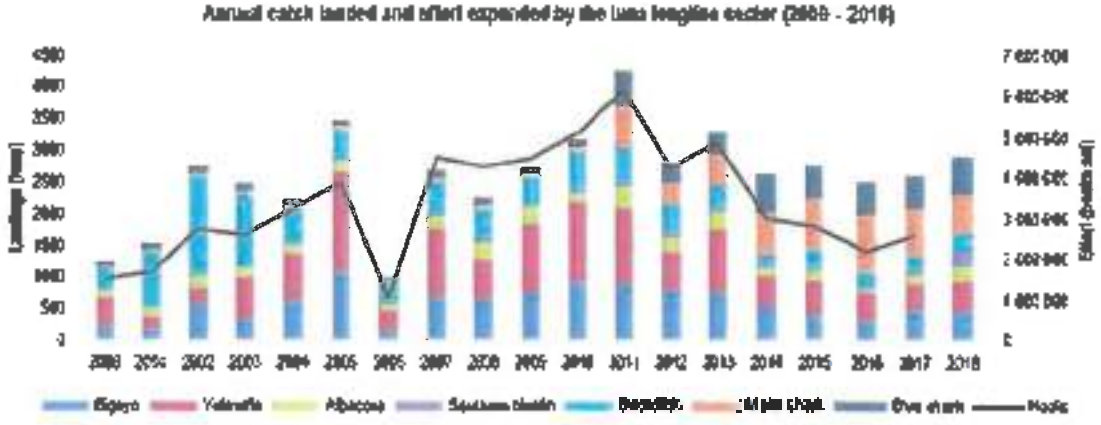

Figure 65: Inter-annual variation of catch landed and effort expended by the large pelagic longline sector in South African waters as reported to the two regional management organisations, ICCAT and IOTC (2000 - 2018).

Table 20: Total catch (t) and number of active domestic and foreign-flagged vessels targeting large pelagic species for the period 2005-2018 (Source: DEFF, 2019).

Year	Bigeye tuna	Yellowfin tuna	Albacore	Southern bluefin tuna	Swordfish	Shortfin mako shark	Blue shark	Number of active vessels	
								Domestic	Foreign-flagged
2005	1077	1603	189	27	408	700	225	15	12
2006	188	837	123	10	323	457	121	19	0
2007	677	1086	220	48	445	594	259	22	12
2008	640	630	340	43	396	471	285	15	13
2009	765	1086	309	30	378	511	286	19	9
2010	940	1262	165	24	528	881	312	19	9
2011	907	1182	339	49	584	845	542	16	15
2012	922	607	245	79	445	314	393	16	11
2013	882	1091	291	53	471	482	349	15	9
2014	544	486	114	31	223	610	573	16	4

Year	Bigeye tuna	Yellowfin tuna	Albacore	Southern bluefin tuna	Swordfish	Shortfin mako shark	Blue shark	Number of active vessels	
								Domestic	Foreign-flagged
2015	899	564	151	11	341	776	551	Fleets merged under SA flag with only a few foreign boats : up to 30 boats operating	
2016	315	439	85	18	275	883	528		
2017	497	400	172	47	286	726	529		
2018	478	478	238	208	513	615	592		

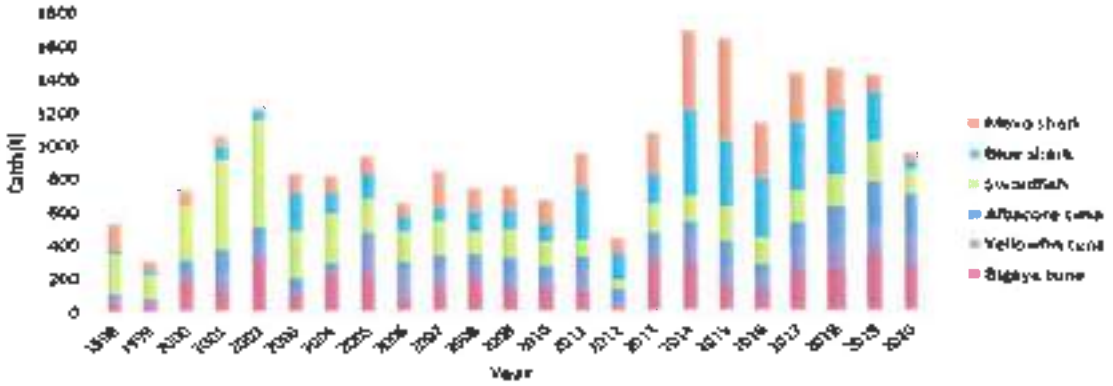

Figure 66: Inter-annual variation of catch landed by the large pelagic longline sector operating in the ICCAT region of South African waters (i.e. West of 20°E) (1998 – 2020).

Tuna, tuna-like species and billfishes are migratory stocks and are therefore managed as a "shared resource" amongst various countries under the jurisdiction of the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission (IOTC). In the 1970s to mid-1990s the fishery was exclusively operated by Asian fleets (up to 150 vessels) under bilateral agreements with South Africa. From the early 1990s these vessels were banned from South African waters and South Africa went through a period of low fishing activity as fishing rights issues were resolved. Thereafter a domestic fishery developed and 50 fishing rights were allocated to South Africans only. These rights holders now include a fleet of local longliners and several Japanese vessels fishing in joint ventures with South African companies. In 2017, 60 fishing rights were allocated for a period of 15 years. The total number of active longline vessels within South African waters is 22, 18 of which fished in the Atlantic (West of 20°E) during 2017. These were exclusively domestic vessels, with three Japanese vessels fishing exclusively in the Indian Ocean (East of 20°E) during 2017 (DAFF, 2018).

Gear consists of monofilament mainlines of between 25 km and 100 km in length which are suspended from surface buoys and marked at each end. As gear floats close to the water surface it would present a potential obstruction to surface navigation as well as a snagging risk to the gear array towed by the seismic survey vessel. The main fishing line is suspended about 20 m below the water surface via dropper lines connecting it to surface buoys at regular intervals. Up to 3500 baited hooks are attached to the mainline via 20 m long trace lines, targeting fish at a depth of 40 m below the surface. Various types of buoys are used in combinations to keep the mainline near the surface and locate it should the line be cut or break for any reason. Each end of the line is marked by a Dahn Buoy and radar reflector, which marks the line position for later retrieval. Typical configuration of set gear is shown in Figure 67.

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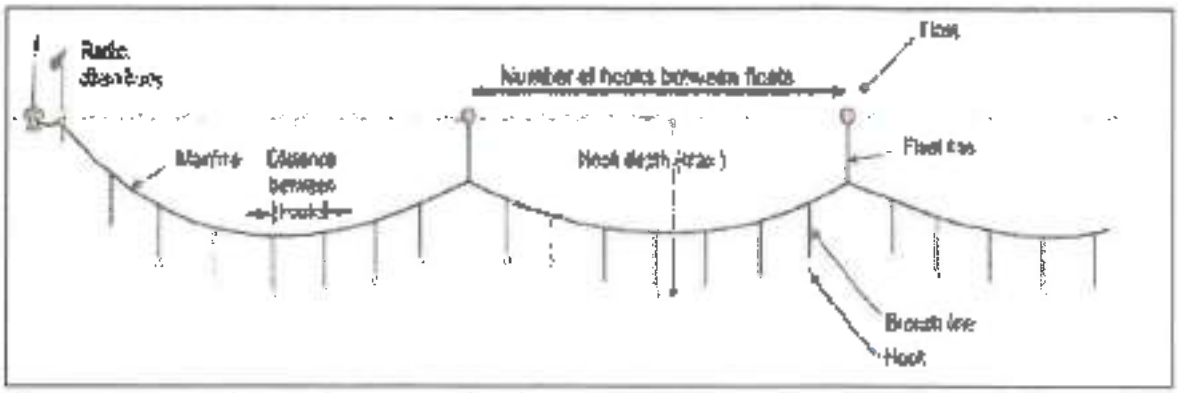


Figure 67: Schematic diagram showing typical configuration of longline gear targeting pelagic species (left), and photograph of typical high seas longline vessel (upper right).

Lines are usually set at night, and may be left drifting for a considerable length of time before retrieval, which is done by means of a powered hauler at a speed of approximately one knot. During hauling, vessel manoeuvrability is severely restricted. In the event of an emergency, the line may be dropped and hauled in at a later stage. The fishery operates year-round with a relative increase in effort during winter and spring. Catch per unit effort (CPUE) variations are driven both by the spatial and temporal distribution of the target species and by fishing gear specifications. Variability in environmental factors such as oceanic thermal structure and dissolved oxygen can lead to behavioural changes in the target species, which may in turn influence CPUE (Purnby and Nakano, 1992).

Fishing areas are subdivided into the SE Atlantic (reporting to ICCAT) and the SW Indian Ocean (reporting to IOTC) along 20°E, and the West, Southwest, South and East sampling areas are shown. Bubble size is proportional to the numbers of hooks set per line. The numbers of hooks set by foreign vessels peaked between May and October each year, whereas local vessels fished throughout the year, with marginally fewer hooks set in January and February than other months (Figure 68b). Foreign vessels ventured further southwards than local vessels, which tended to remain within the EEZ (Figure 69; Jordaan *et al.*, 2018).

Local vessels fish in all four areas, but in the East their range is limited to the northern half of the area, near a landing site at Richards Bay. Foreign vessels fished mainly in the SW Indian Ocean, with the bulk of all hooks set in the South (58%) and East (35%) areas, and the remaining 9% in the SE Atlantic (Figure 68b). Foreign vessels set an average of 2 493 ± 597 (SD) hooks per line, compared to only 1 282 ± 250 hooks per line used by local vessels.

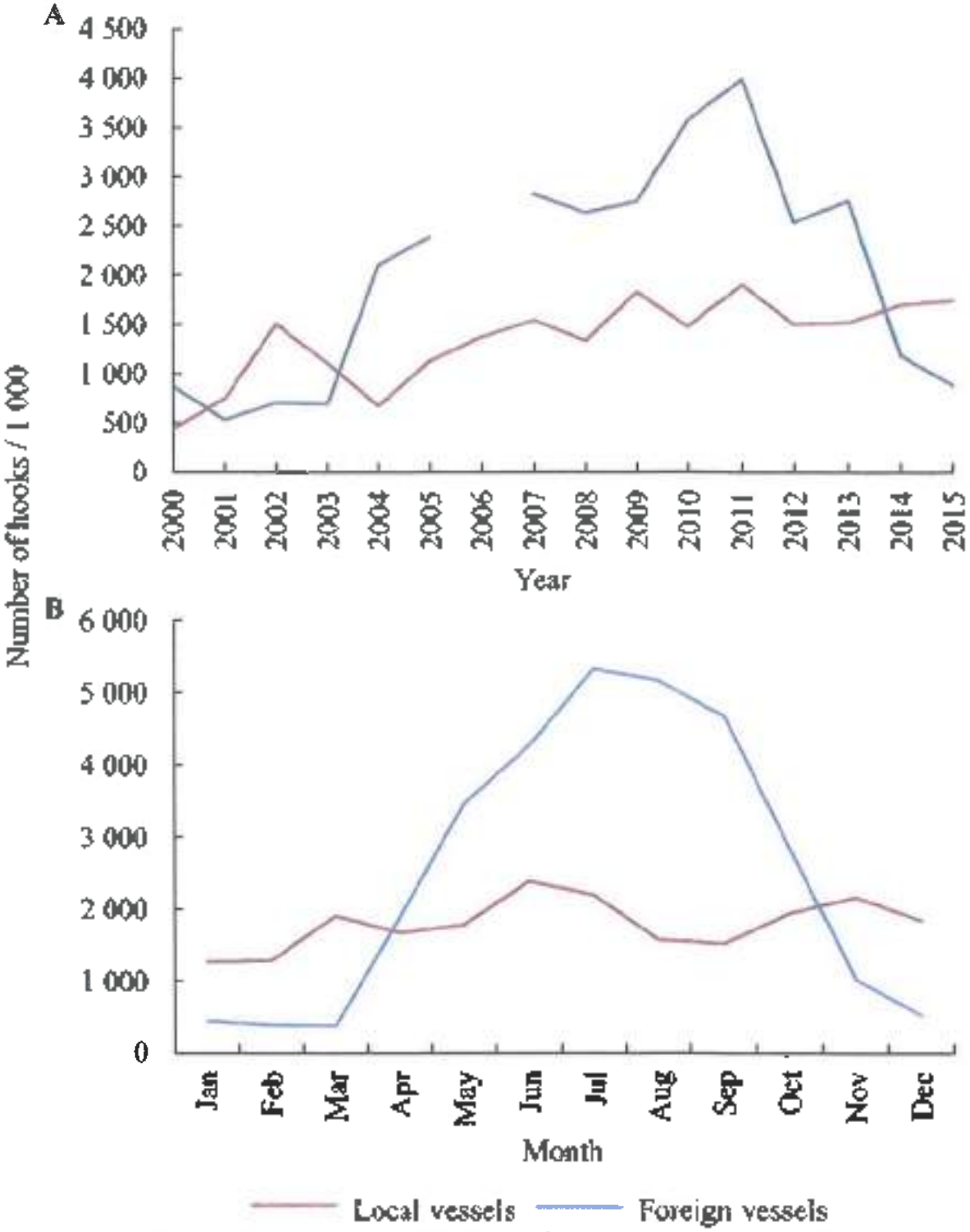


Figure 68: Numbers of hooks set per (A) year (2000–2015) and (B) per calendar month, as reported by local and foreign pelagic longliners fishing in the study area (Jordaan *et al.*, 2018).

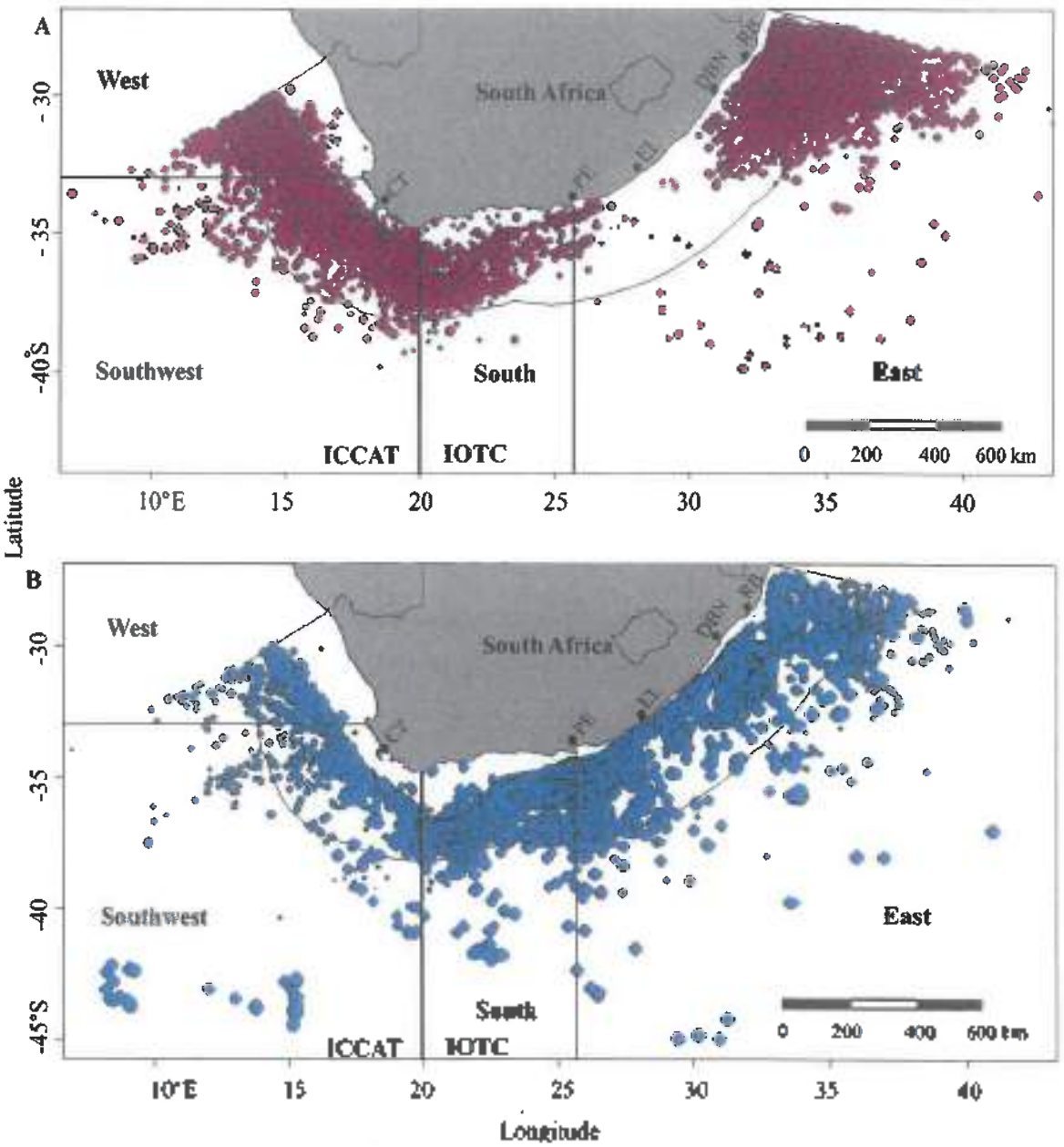


Figure 69: Geographical distribution of fishing effort by (A) local and (B) foreign pelagic longliners from 2000 to 2015, based on logbook data provided by vessel skippers (Jordaan *et al.*, 2018).

Rights Holders in the large pelagic longline fishery are required to complete daily logs of catches, specifying catch locations, number of hooks, time of setting and hauling, bait used, number and estimated weight of retained species, and data on bycatch. The fishery operates extensively within the South African EEZ, primarily along the continental shelf break and into deeper waters. The recent spatial distribution of catch (2017 to 2019) in relation to the Reconnaissance Permit area is shown in Figure 70. Over this period, an average of 423 lines per year were set within the area yielding 579 tons of catch. This is equivalent to 10.29% of the overall effort and 8.1% of the total catch reported by the sector at a national scale.

Pelagic longline fishing activity can be expected along the inshore extent of the Reconnaissance Permit area especially in the northern extent of the area. Lines of up to 100 km in length are *set* along the continental shelf break, and are left to drift in surface currents for several hours before retrieval. They therefore cover a large area whilst they drift and pose a significant risk of entanglement with a towed seismic array.

Average monthly catch and effort within the Reconnaissance Permit area is shown in Figure 71. This shows that catch is highest during the months of June and July, associated with an increase in fishing effort by the sector.

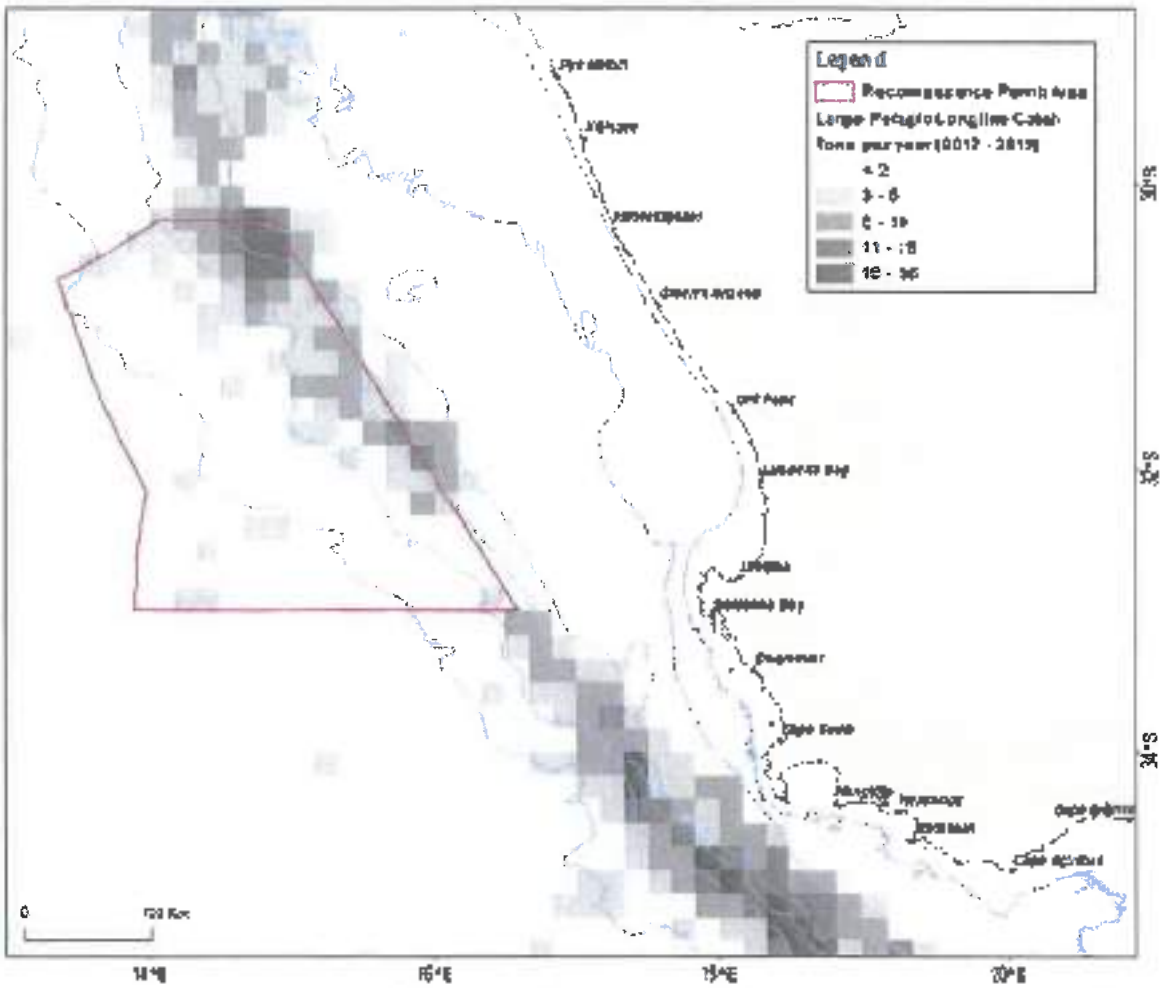


Figure 70: An overview of the spatial distribution of fishing effort expended by the longline sector targeting large pelagic fish species in relation to the Reconnaissance Permit application area.

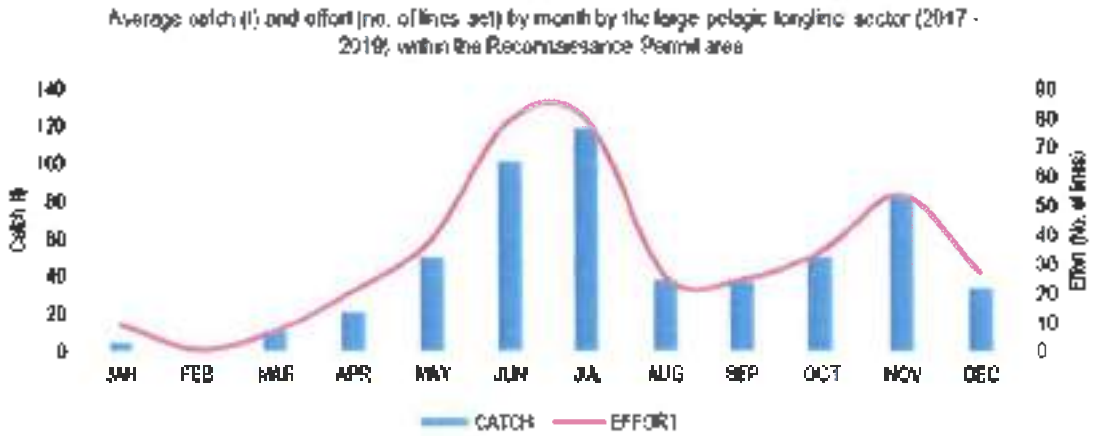


Figure 71: Average catch (t) and effort (no. of lines set) by month reported by the large pelagic longline sector in the vicinity of the Reconnaissance Licence area (2017-2019).

8.5.3.7 TUNA POLE-LINE

Poling for tuna is predominantly based on the southern Atlantic longfin tuna stock also referred to as albacore (*T. alalunga*). Other catch species include yellowfin tuna, bigeye tuna, skipjack tuna (*Katsuwonus pelamis*). The fishery is seasonal with vessels active predominantly between November and June and peak catches recorded

from November to January. Due to the seasonality of tuna in South Africa's waters the tuna pole fishery is also allowed access to snoek (*Thyrsites atun*) and yellowtail (*Seriola lalandi*). Snoek-directed fishing activity is seasonal, taking place in coastal areas during the period March to July, with a peak in activity during the months of April and May. Access to these additional species has caused conflict with the traditional linefish sector.

The reported wholesale value of the fishery in 2018 was R124 Million in 2018, or 1.2% of the total value of all fisheries combined. In 2020, landings of albacore amounted to 3941 tons. A historical time series of catch and effort reported by the South African sector operating within the Atlantic region is shown in Table 21. The total effort of 4131 catch days within the ICCAT convention area in 2019 represents an increase in effort of 9% compared to 2018. The total reported annual pole fleet catch of the main target species albacore and yellowfin tuna showed for the first-time relative increases since 2015 and 2014, respectively.

Table 21: Total number of fishing days (effort), active vessels and total catch (t) of the main species caught by South African-flagged tuna pole-line vessels in the ICCAT region (West of 20E), 2008 – 2020 (ICCAT, 2022).

	Total Effort		Catch (t)			
Year	Fishing days	Active vessels	Albacore	Yellowfin tuna	Bigeye tuna	Skipjack tuna
2008	3052	113	3083	347	8	4
2009	4431	123	4586	123	17	4
2010	4408	116	4067	177	8	1
2011	5001	118	3166	629	15	5
2012	5157	123	3483	161	11	8
2013	4114	107	3492	374	142	3
2014	4416	95	3620	1351	50	5
2015	4736	91	3838	685	57	2
2016	4908	98	2001	598	10	2
2017	3062	92	1640	235	22	7
2018	3751	92	2959	242	14	2
2019	4131	91	2190	378	91	2
2020	3975	97	3941	534	71	1

The active fleet consists of approximately 92 pole-and-line vessels (also referred to as "baitboat"), which are based at the ports of Cape Town, Hout Bay and Saldanha Bay. Vessels normally operate within a 100 nm radius of these locations with effort concentrated in the Cape Canyon area (South-West of Cape Point), and up the West Coast to the Namibian border with South Africa.

Vessels are typically small (an average length of 16 m but ranging up to 25 m). Catch is stored on ice, refrigerated sea water or frozen at sea and the storage method often determines the range of the vessel. Trip durations average between four and five days, depending on catch rates and the distance of the fishing grounds from port. Vessels drift whilst attracting and catching shoals of pelagic tunas. Sonars and echo sounders are used to locate schools of tuna. Once a school is located, water is sprayed outwards from high-pressure nozzles to simulate small baitfish aggregating near the water surface. Live bait is then used to entice the tuna to the surface (chumming). Tuna swimming near the surface are caught with hand-held fishing poles. The ends of the poles are

fitted with a short length of fishing line leading to a hook. In order to land heavier fish, lines may be strung from the ends of the poles to overhead blocks to increase lifting power (see Figure 73).

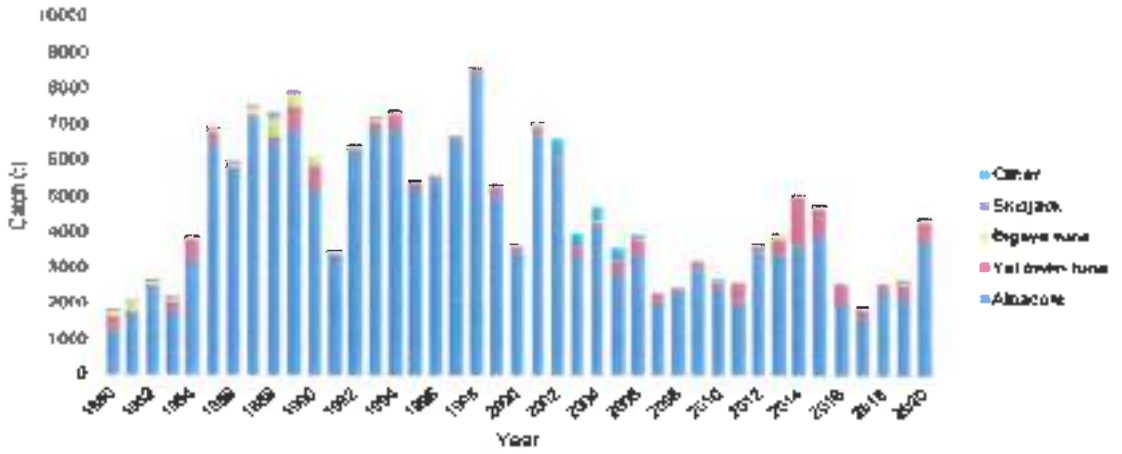


Figure 72: Catches (tons) of pelagic species by the South Africa pole-line ("Baitboat") fleet between 1980 and 2020 (ICCAT, 2022).

Figure 73: Schematic diagram of pole and line operation (Source: http://www.afma.gov.au/portfolio-item/miscc-lines).

The nature of the fishery and communication between vessels often results in a large number of vessels operating in close proximity to each other at a time. The vessels fish predominantly during daylight hours and are highly manoeuvrable. However, at night in fair weather conditions the fleet of vessels may drift or deploy drogues to remain within an area and would be less responsive during these periods.

Figure 74 shows the location of fishing activity in relation to Reconnaissance Permit application area. Fishing activity for tuna occurs along the entire West Coast beyond the 200 m bathymetric contour, along the shelf break with favoured fishing grounds including areas north of Cape Columbine and between 60 km and 120 km offshore of Saldanha Bay. Fishing records received from DFFE for the reporting period 2017 to 2019 show that tuna-directed fishing takes place inshore of the Reconnaissance Permit application area within minimal activity within the area itself. An average of 24 fishing events per year were set within the area yielding 25 tons of albacore (although it is likely that some of this activity may be errors in the reporting of fishing positions and the likelihood of fishing activity within the area is considered to be low). The catch and effort within the area is equivalent to 0.87% and 0.95%, respectively, of the overall catch and effort reported by the sector at a national scale.

Albacore-directed fishing activity within deeper waters adjacent to the Reconnaissance Permit area shows a peak during February and March (see Figure 75). Snoek-directed fishing activity is coastal and seasonal in nature – taking place inshore of the 100 m depth contour during the period March to July, with a peak in activity during

the months of April and May. Snoek-directed fishing activity is situated at least 140 km inshore of the application area and there is therefore no overlap of the survey expected with snoek-directed fishing activity.

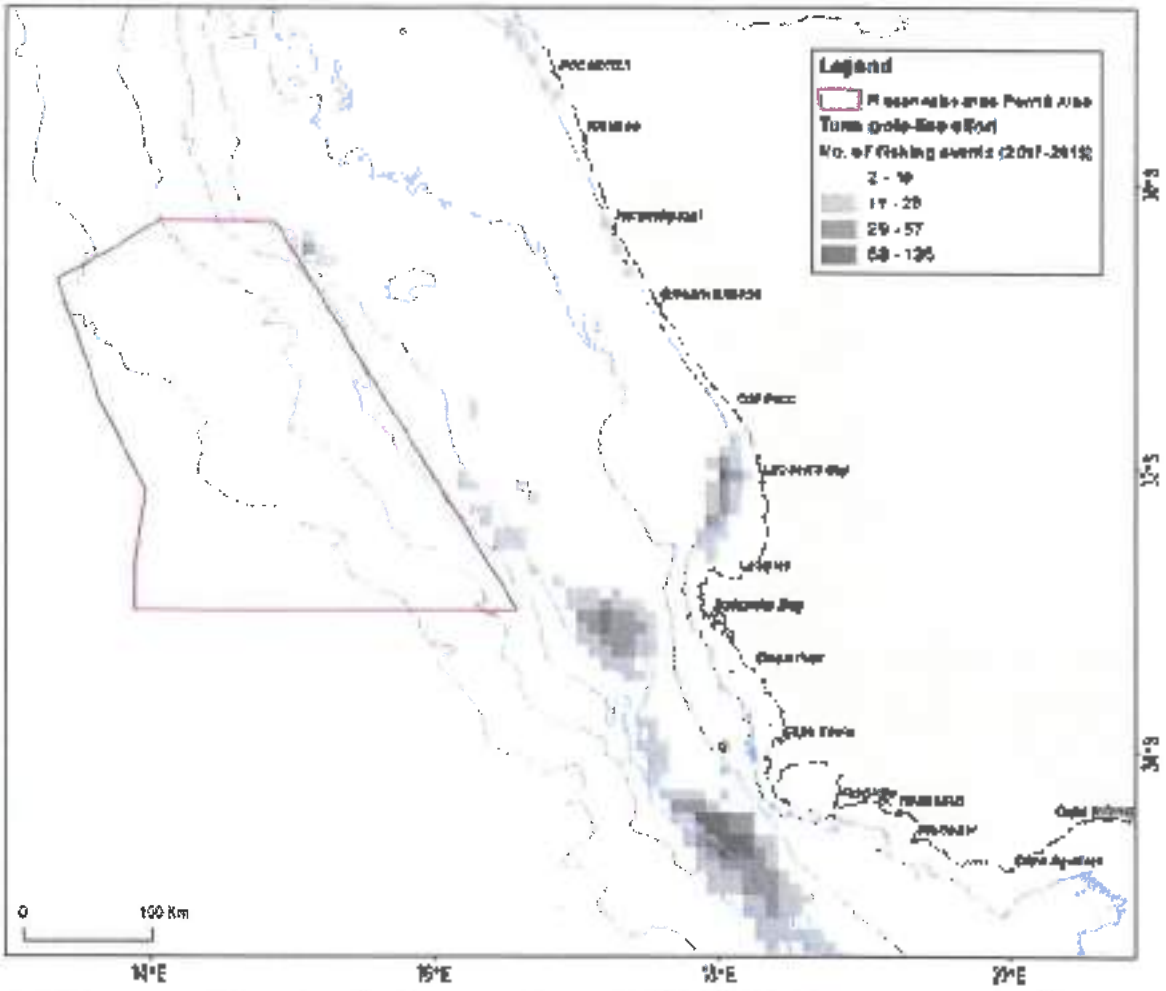


Figure 74: An overview of the spatial distribution of fishing effort expended by the pole- line sector targeting pelagic tuna (offshore areas) and snoek (inshore areas) in relation to the Reconnaissance Permit application area.

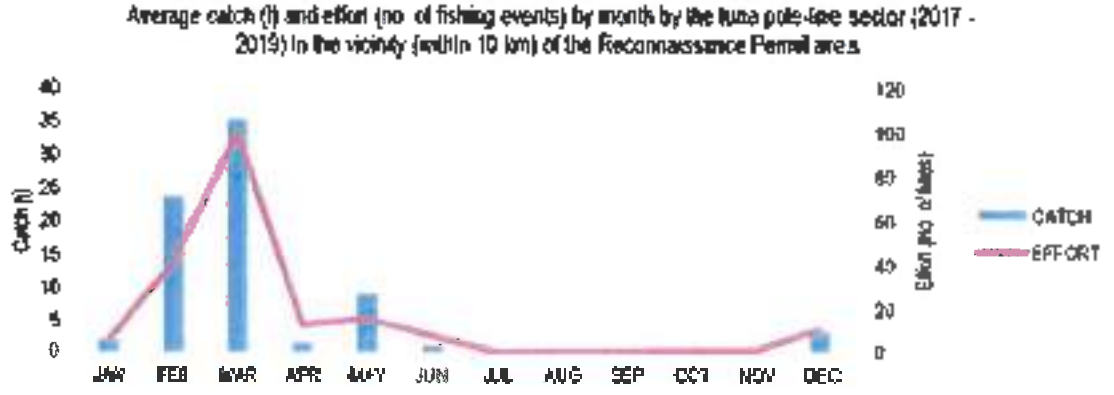


Figure 75: Average catch (t) and effort (no. of fishing events) by month reported by the tuna pole-line sector in the vicinity (within 10 km) of the Reconnaissance Licence area (2017-2019).

8.5.3.8 TRADITIONAL LINEFISH

The commercial linefish sector has its origins from the recreational sector. Essentially recreational linefishers commercialised resulting in a systematic decline in the "linefish" stocks. The Minister of Fisheries in the 1980's reformed the sector. This was done by creating a small commercial linefish sector, as well as introducing a moratorium on exploiting many species that were collapsed or near collapse. The commercial linefish sector now only allows a limited number of key species to be exploited.

Of all South African marine fisheries, the line fishery is the most vulnerable to external impacts. Linefish resources are at risk of overcapacity as they are directly or indirectly exploited by other sectors, including the recreational, small-scale line fishery, inshore and offshore trawl fisheries, tuna pole-line fishery, the inshore net fishery and the demersal shark longline fishery (DEFF, 2020). The increased expectation of commercial access to linefish resources combined with the localised anticipation of community ownership by small-scale fishers may impact linefish stocks.

The traditional line fishery is the country's third most important fishery in terms of tonnage landed and economic value. It is a long-standing, nearshore fishery based on a large assemblage of different species using hook and line, but excludes the use of longliners. Within the Western Cape the predominant catch species is snoek (*Thyrsites atun*) while other species such as Cape bream (hottentot) (*Pachymetopon blochii*), geelbek (*Atractoscion aequidens*), kob (*Argyrosomus japonicus*) and yellowtail (*Seriola lalandi*) are also important. Towards the East Coast the number of catch species increases and includes resident reef fish (Sparidae and Serranidae), pelagic migrants (Carangidae and Scombridae) and demersal migrants (Sciaenidae and Sparidae). Table 22 lists the catch of important linefish species for the years 2010 to 2022.

Figure 76 shows the variability in catches of the eight most importance species by the line fishery over the period 1985 to 2021.

Table 22: Annual catch (t) of the eight most important linefish species for the period 2010 to 2021 (DEFF, 2022).

Year	Snoek	Yellowtail	Kob	Carpenter	Slinger	Hottentot seabream	Geelbek	Santer	Total catch
2010	6980	171	419	283	180	144	406	69	19688
2011	6205	204	312	369	214	216	285	62	12530
2012	4809	382	221	500	240	180	337	82	11455
2013	6490	712	157	481	200	179	269	84	9142
2014	3868	986	144	522	201	192	212	74	6849
2015	2045	594	121	519	175	142	298	68	4421
2016	1648	474	135	690	211	209	246	65	4289
2017	2055	377	111	844	218	204	158	74	4891
2018	2089	654	219	723	173	218	214	68	5904
2019	1879	439	454	804	215	188	132	78	N/A*
2020	2956	548	635	533	183	222	158	66	N/A*
2021	1747	239	352	441	186	151	88	64	N/A*

*Total catches unavailable at date of this report

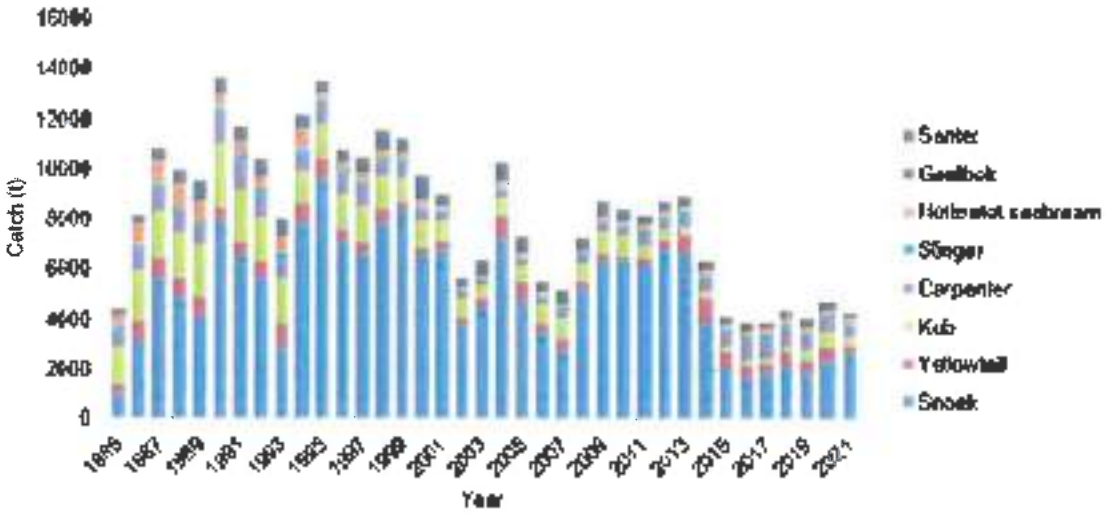


Figure 76: Annual catch (t) of the eight most important finefish species for the period 1985-2021 (DFFE, 2022).

The traditional commercial line fishery is a relatively low-cost and labour-intensive industry, therefore important from an employment and human livelihood point of view. Although the commercial line fishery has the largest fleet, it contributes only 6% of the total estimated value of all South African marine fisheries (DFFE, 2020). In 2017, the wholesale value of catch was reported as R122.1 million.

The commercial line fishery is a nearshore boat-based activity which is currently managed through a total allowable effort (TAE) allocation, based on boat and crew numbers. Since December 2000 it has consisted of 3450 crew operating from 455 commercial vessels. The number of rights holders is 425 (valid rights until 31 December 2020 and subsequently extended until 31 December 2021[4]). For the 2019/2020 fishing season, 395 vessels and 3007 crew was apportioned to commercial fishing, whilst 60 vessels and 443 crew was apportioned to small-scale fishing. DFFE proposed an increase in the apportionment of TAE to small-scale fishing from 13% to 50% commencing in 2021 in order to boost economic possibilities for coastal communities.

Annual catches prior to the reduction of the commercial effort were estimated at 16 000 tons for the traditional commercial line fishery. Almost all of the traditional line fish catch is consumed locally. The fishery is widespread along the country's shoreline from Port Nolloth on the West Coast to Cape Vidal on the East Coast. Effort is managed geographically with the spatial effort of the fishery divided into three zones. Zone A extends from Port Nolloth to Cape Infanta, Zone B extends from Cape Infanta to Port St Johns and Zone C covers the KwaZulu-Natal region.

Table 23 lists the annual Total Allowable Effort (TAE) and activated effort per line fish management zone from 2007 to 2019. Most of the catch (up to 95%) is landed by the Cape commercial fishery, which operates on the continental shelf from the Namibian border on the West Coast to the Kei River in the Eastern Cape.

Table 23: Annual total allowable effort (TAE) and activated commercial line fish effort per management zone from 2008 to 2019 (DEFF, 2020).

Total TAE boats (fishers). Upper limit: 455 boats or 3450 crew			Zone A: Port Nolloth to Cape Infanta		Zone B: Cape Infanta to Port St Johns		Zone C: KwaZulu-Natal	
Allocation	455 (3182)		301 (2196)		103 (692)		51 (354)	
Year	Allocated	Activated	Allocated	Activated	Allocated	Activated	Allocated	Activated
2008	455	372	301	239	103	82	51	51

[4] Extension to existing rights until DFFE has concluded a Fishing Rights Allocations Process ("FRAP") which, at the time of this report is still underway.

Total TAE boats (fishers). Upper limit: 455 boats or 3450 crew			Zone A: Port Nolloth to Cape Infanta		Zone B: Cape Infanta to Port St Johns		Zone C: KwaZulu-Natal	
2010	455	544	300	222	104	78	51	44
2010	455	335	298	210	105	82	51	43
2011	455	328	298	207	105	75	51	46
2012	455	296	298	191	105	62	51	42
2013	455	289	301	189	109	62	51	38
2014**	455	999	340	288	64	58	51	48
2015**	455	356	340	291	64	61	51	45
2016**	455	278	340	274	64	59	51	45
2017**	455	329	340	232	64	60	51	37
2018**	455	324	340	232	64	50	51	42
2019**	465	306	340	218	64	50	51	38

** In the finalisation of the 2013 commercial Traditional Linefish appeals, the effort apportioned for the small-scale fisheries sector was allocated to the commercial sector. All the small-scale fights were considered to be activated on allocation

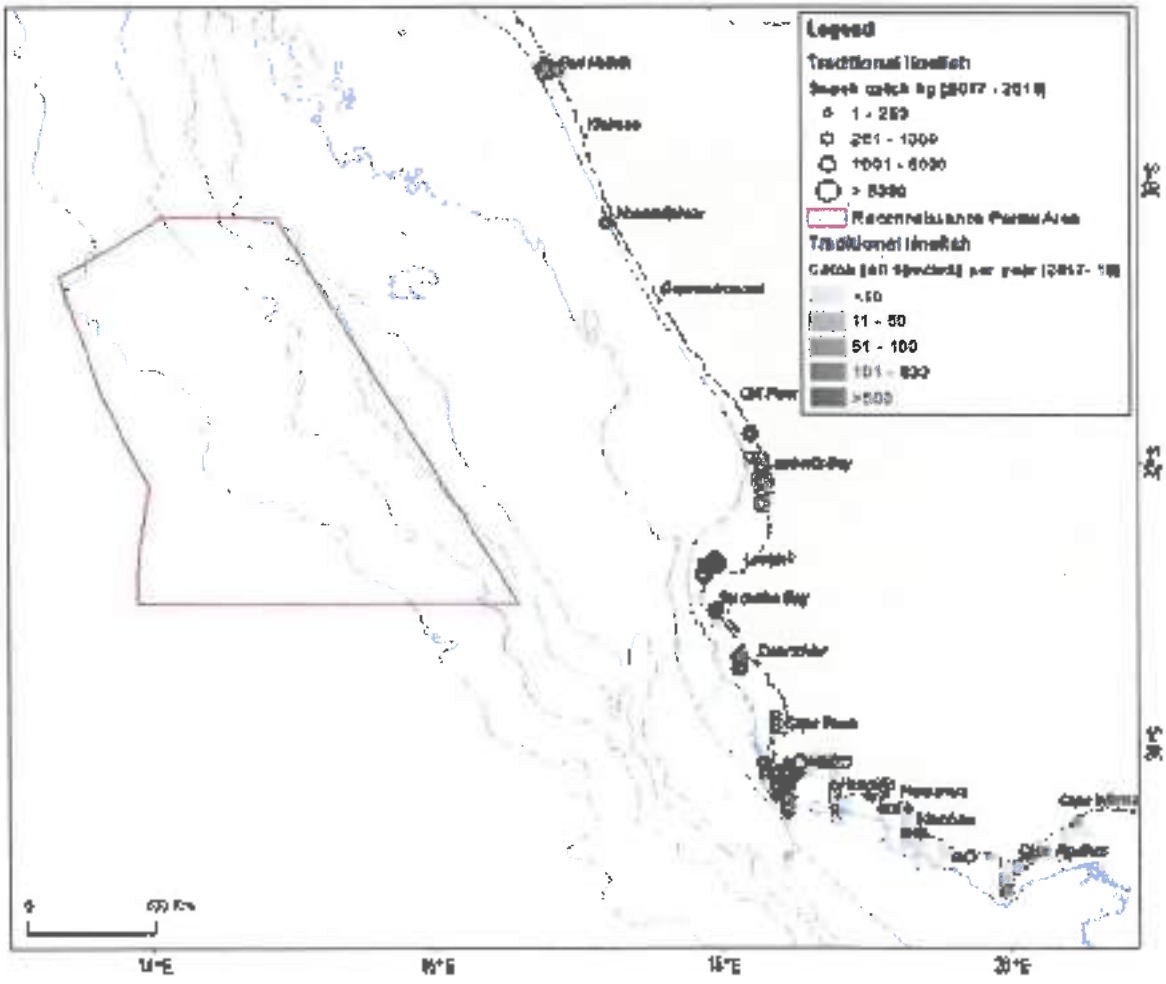
Crew use hand line or rod-and-reel to target approximately 200 species of marine fish along the full 3 000 km coastline, of which 50 species may be regarded as economically important. To distinguish between line fishing and long lining, line fishers are restricted to a maximum of 10 hooks per line. Target species include resident reef-fish, coastal migrants and nomadic species. Many species allocated to the small-scale fisheries "baskets" are primary targets of the commercial and recreational linefish sectors, and these shared resources must be carefully monitored given the increased fishing pressure expected. A revision of the linefish management protocol (LMP) is also underway to ensure the future sustainability of linefish stocks.

Vessels range in length between 4.5 m and 11 m and the offshore operational range is restricted by vessel category to 40 nautical miles (75 km). Fishing effort at this outer limit is sporadic. Operating ranges vary greatly but most of the activity is conducted within 15 km of a launch site. Fishing takes place throughout the year but there is some seasonality in catches.

Snoek is an important linefish species as it makes up the largest annual catch in terms of biomass, contributing more than 80% to the total catch west of Cape Infanta. Snoek spawning occurs offshore during winter-spring, along the shelf break (150-400 m) of the western Agulhas Bank and the South African west coast. Prevailing currents transport eggs and larvae to a primary nursery ground north of Cape Columbine and to a secondary nursery area to the east of Danger Point; both shallower than 150 m. Juveniles remain on the nursery grounds until maturity, growing to between 33 and 44 cm in the first year (3.25 cm/month). Onshore-offshore distribution (between 5- and 150-m isobaths) of juveniles is determined largely by prey availability and includes a seasonal inshore migration in autumn in response to clupeoid recruitment. Adults are found throughout the distribution range of the species, and although they move offshore to spawn - there is some southward dispersion as the spawning season progresses - longshore movement is apparently random and without a seasonal basis (Griffiths, 2002). Snoek are caught within the inshore zone along most of the South African coastline with the majority of catches being made along the West and South-West Coast of South Africa. Although snoek can be caught year-round, during the snoek seasonal migration (between April and July) when they shoal nearshore, they are caught more frequently using handlines by the line fishery. Snoek are not distributed offshore of the 1000 m depth contour and therefore not targeted or caught by the commercial line fishery in the Reconnaissance Permit area.

Spatial mapping of effort and catches in the line fishery is less accurate than in other sectors because of the reporting structure implemented by DFFE. Fishing locations are described by skippers in relation to numbered sections along the coast and estimated distance offshore. No bearings are given, and no GPS data are recorded. Furthermore, due to the large number of vessels, associated reporting complexities and also the unwillingness of local fisherman to share fishing locations, inaccuracies in the spatial representation are to be expected[5]. This fishery's operational footprint may at times be limited by operating costs and is sensitive to local reports of fish availability. Further, in regard to migratory species, such as longfin tuna and snoek, economic and regulatory aspects relating to distances fished offshore is pertinent [i.e. such as the requirements of the South African Maritime Safety Authority (SAMSA)] in particular that "B" class certified vessels can operate up to 40 nm offshore.

Figure 77 shows the spatial extent of traditional linefish grounds in relation to the Reconnaissance Permit application area. Snoek-directed fishing effort is coastal, with vessels operating in waters shallower than 100 m. However, there are records of fishing up to an offshore distance of 55 km off Saldanha Bay where tuna are targeted in the vicinity of Cape Canyon. Note that small-scale fishers are not permitted to target tuna (i.e. the species is not part of the basket allocation), thus would not be expected to operate at the Cape Canyon. There is no overlap of fishing grounds with the Reconnaissance Permit application area, which is situated at least 120 km offshore and at least 100 km from fishing grounds targeted by the linefish sector.



[5] Inaccuracies in reported fishing positions are unlikely to impact on the validity of the current assessment as a precautionary approach has already been adopted in assessing the maximum range of fishing grounds offshore with respect to the Reconnaissance Permit application area.

Figure 77: An overview of the spatial distribution of catch taken by the linefish sector in relation to the Reconnaissance Permit application area. The inset component of catch is shown as well as total catch of all species.

8.5.3.9 WEST COAST ROCK LOBSTER

The West Coast rock lobster (*Jasus lalandii*) is a valuable resource found off the South African West Coast and consequently an important income source for West Coast fishermen providing employment for about 4200 people. The resource occurs inside the 200 m depth contour along the West Coast from Namibia to East London on the East Coast of South Africa. Fishing grounds stretch from the Orange River mouth to east of Cape Hangklip in the South-Eastern Cape although the commercial viability is focused mainly southwards from Management Zone B (see Figure 80).

The fishery is comprised of four sub-sectors – commercial offshore, commercial nearshore, small-scale and recreational, all of which have to share from the same notional TAC. The 2021/22 TAC was set at 600 tonnes and apportionment of TAC by sub-sector is listed in Table 24. The TAC for the 2021/2022 fishing season was reduced by 28% from the previous fishing season (2020/2021). The updated stock assessment for the resource has indicated that it is further depleted than was thought to be the case two years ago, and poaching[4] is one of the major contributors to the recently exacerbated depleted status of the resource. The resource has over recent decades been at about 2.5% of the pristine level, but that over the last few years this had dropped to about 1.5%.

Annual TAC and average monthly landings over the period 2006 to 2020 are shown in Figure 78 and Figure 79, respectively. A historical time-series of TACs and landings is listed in Table 25.

Table 24: Apportionment of TAC of rock lobster by sub-sector (modified DFFE, 2021).

Description	2019/2020 TAC (t)	2020/2021 TAC (t)	2021/2022 (t)
Commercial fishing (offshore)	563.91	435.38	301.28
Commercial fishing (nearshore)	170.25	191.03	100.92
Recreational fishing	38.76	30.08	21.57
Subsistence (interim relief measures) fishing	170.25	191.03	100.92
Small-scale fishing sector (nearshore)			
Small-scale fishing sector (offshore)	140.83	208.97	75.32
Total	1084	837.0	600

Table 25: Total allowable catch, fishing sector landings and total landings for West Coast rock lobster (DEFF, 2020).

Season	Global TAC	Offshore allocation	Nearshore allocation	Interim Relief	Recreational	Total catch[4]
2000/01	2 018	1610		230	174	2154
2001/02	2 353	2151			202	2410

[4] In 2017, the poached rock lobster was estimated at 2 747 tonnes.

Season	Global TAC	Offshore allocation	Nearshore allocation	Interim Relief	Recreational	Total catch[3]
2002/03	2 957	2713		[1]	244	2706
2003/04	3 396	2422	594	[1]	320	3258
2004/05	3 527	2614	593	[1]	320	3221
2005/06	3 174	2294	560	[1]	320	2291
2006/07	2 857	1997	560	[2]	300	3964
2007/08	2 571	1754	560	[2]	257	2298
2008/09	2 340	1632	451	[2]	257	2483
2009/10	2 389	1632	451	180	129	2619
2010/11	2 286	1528	451	200	107	2208
2011/12	2 428	1541	451	251	188	2175
2012/13	2 276	1391	451	251	183	2308
2013/14	2 167	1356	451	276	83	1891
2014/15	1 800	1130	376	235	69	1688
2015/16	1 924	1243	378	235	69	1524
2016/17	1 924	1204	376	274	69	1564
2017/18	1 924	994	305	564	69	1355
2018/19	1 084	564	170	170	39	
2019/20	1 084	564	170	170	39	
2020/21	837	486	131	131	30	
2021/22	600	301	101	101	22	

1 No interim Relief allocated; 2 Interim Relief accommodated under Recreational allocation; 3 Total catch by all sectors.

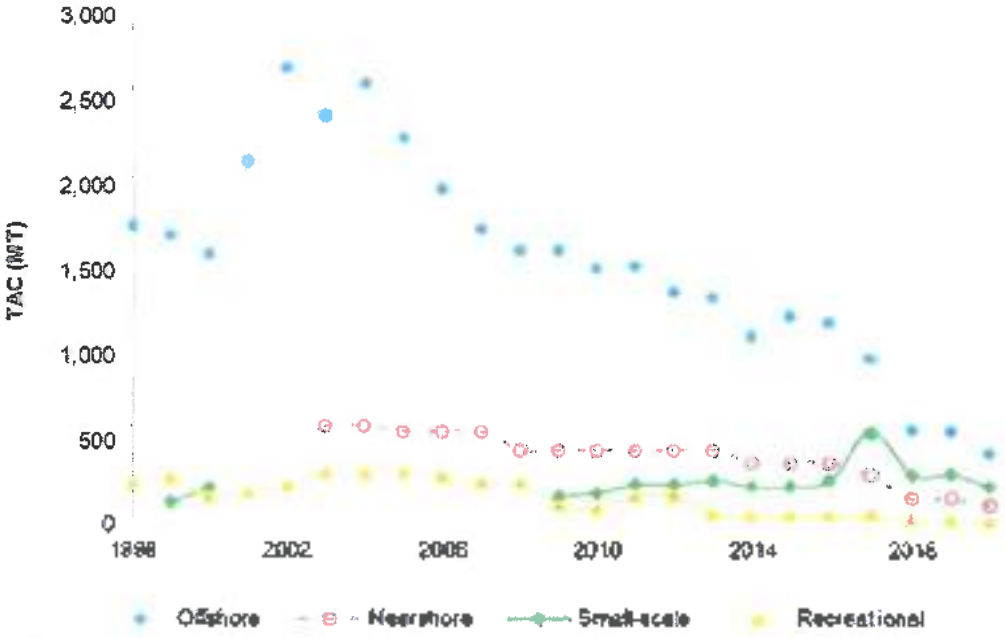


Figure 78: Graph showing the total allowable catch (TAC) of west coast rock lobster.

Figure 79: Graph showing the average monthly catch (tonnes) and effort (number of traps hauled) reported by the offshore (trapboat) and inshore (bakkie) rock lobster sectors over the period 2006 to 2020.

The resource is managed geographically, with TACs set annually for different management areas. The commercial and small-scale fishing sectors are authorised to undertake fishing for four months in each management zone therefore closed seasons are applicable to different management zones. The start and end dates for the 2021/22 fishing season per sector and zone are shown in Table 26.

Table 26: Start and end dates for the fishing season 2021/22 by management zone. Special Project Report on the review of the TAC for West Coast Rock Lobster for the 2021/22 fishing season by the Consultative Advisory Forum for Marine Living Resources.

Area	Commercial nearshore, interim relief, small-scale: nearshore	Commercial offshore, small-scale: offshore
Area 1 + 2	15 Oct, Nov, Dec, Jan, 15 Feb	
Area 3 + 4	15 Nov, Dec, Jan, Feb, 15 Mar	15 Nov, Dec, Jan, Feb, 15 Mar

Area	Commercial nearshore, interim relief, small-scale: nearshore	Commercial offshore, small-scale: offshore
Area 5 + 6	15 Nov, Dec, Jan, Feb, 15 Mar	
Area 7		Dec, Jan, Feb, Mar
Areas 8 and 11	15 Nov, Dec, Jan, Feb, 15 Mar	Jan, Mar, Apr, May
Area 8 (deep water)		Jun, Jul
Areas 12, 13 and 14	15 Nov, Dec, Jan, Feb, 15 Mar	

The commercial offshore sector operates at a depth range of approximately 90 m to 100 m, making use of traps consisting of rectangular metal frames covered by netting. These traps are set at dusk and retrieved during the early morning. Approximately 138 vessels participate in the offshore sector.

The commercial nearshore sector makes use of hoop nets to target lobster at discrete suitable reef areas along the shore at a water depth of up to 15 – 30 m. These are deployed from a fleet of small dinghies/bakkies which operate from the shore and coastal harbours. Approximately 653 boats participate in the sector.

The delineation of management zones is shown in Figure 80. The five super-areas are: areas 1–2, corresponding to zone A; areas 3–4, to zone B; areas 5–6, to zone C; area 7, being the northernmost area within zone D; and area 8+, comprising area 8 of zone D as well as zones E and F.

Figure 81 shows rock lobster catch by management zone for the commercial offshore and nearshore sub-sectors. The Reconnaissance Permit area is situated at least 115 km from the closest rock lobster fishing grounds and there is no spatial overlap (see Figure 82).

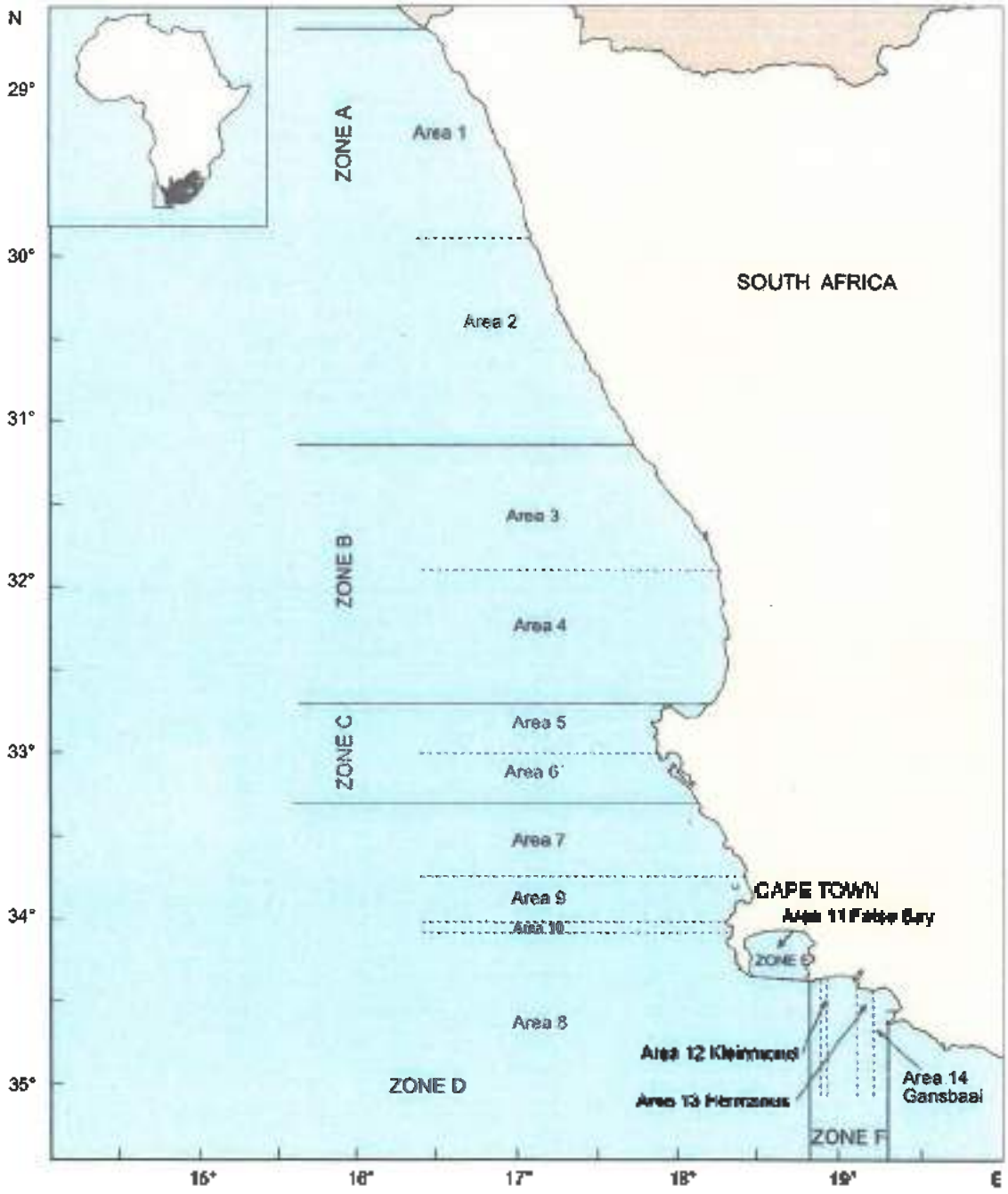


Figure 80: West Coast rock lobster fishing zones and areas. The five super-areas are: areas 1–2, corresponding to zone A; areas 3–4, to zone B; areas 5–6, to zone C; area 7, being the northernmost area within zone D; and area 8+, comprising area 8 of zone D as well as zones E and F.

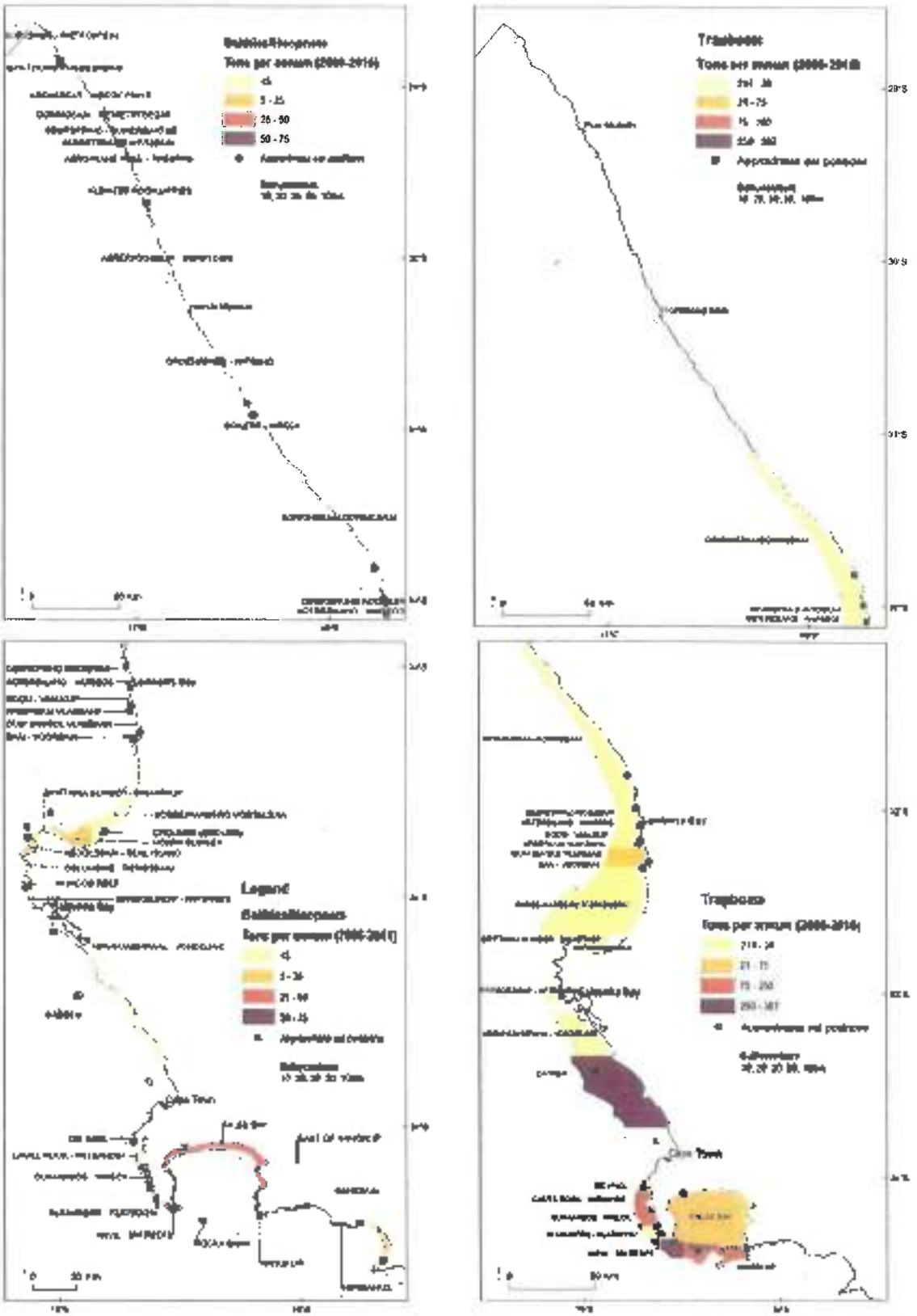


Figure 81: An overview of the spatial distribution of fishing effort expended by the west coast rock lobster inshore (bakkies/hoopnets) (left panel) and offshore (trapboat) (right panel) sectors within demarcated lobster management zones.

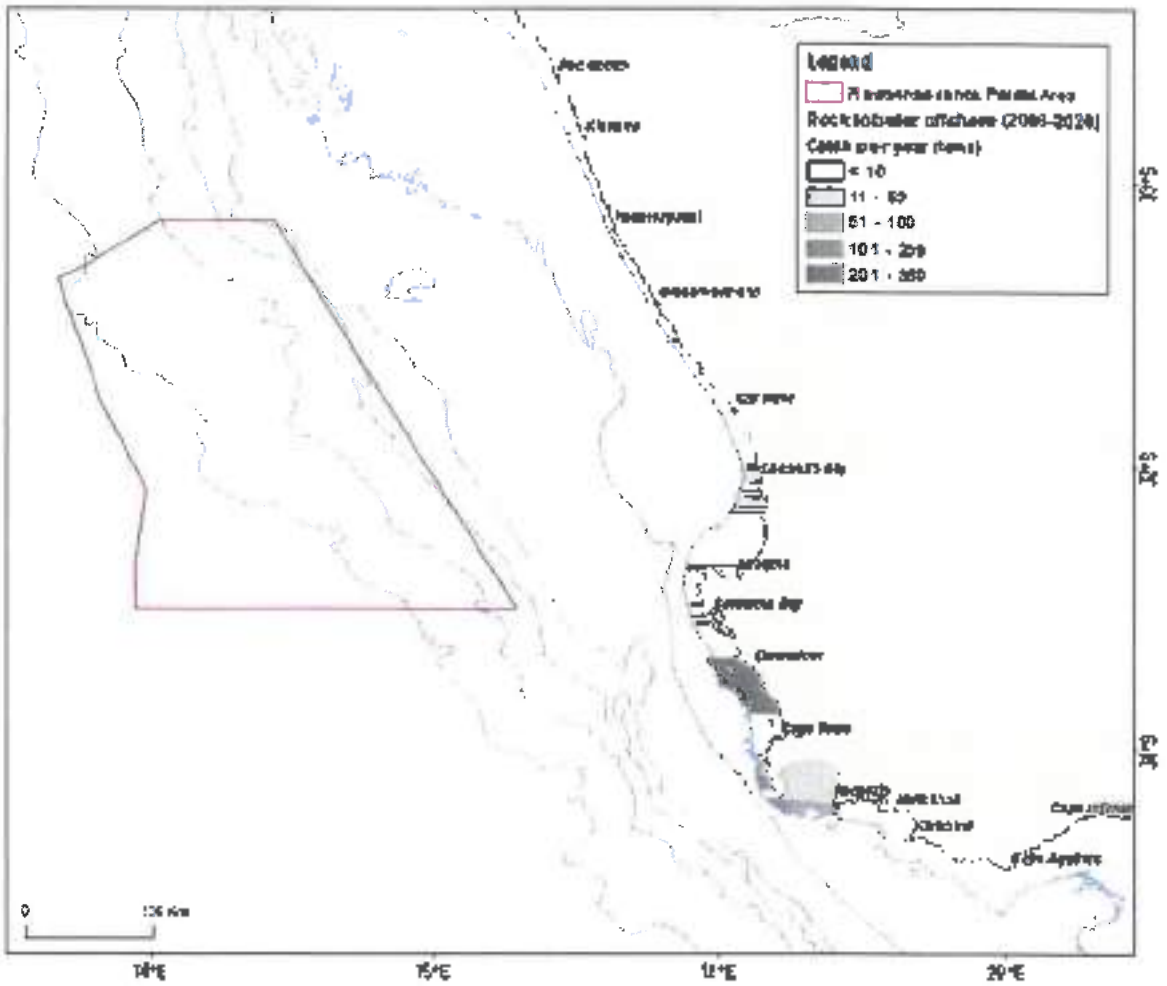


Figure 82: Spatial distribution of fishing effort expended by the west coast rock lobster offshore (trapboat) sector in relation to the Reconnaissance Permit application area.

8.5.3.10 SMALL-SCALE FISHERIES

The concept of Small-Scale Fisheries (SSF)[7] is a relatively new addition to the fisheries complexity in South Africa. The concept has its origin in a global initiative supported by the Food and Agricultural Organisation of the United Nations (FAO). In South Africa, there is a long history of coastal communities utilizing marine resources for various purposes. Many of these communities have been marginalized through apartheid practices and previous fisheries management systems. In 2007 government was compelled through an equality court order to redress the inequalities suffered by these traditional fishers[8]. The development of a SSF sector aims in part to compensate previously disadvantaged fishing communities that have been displaced either politically, economically or by the development of large-scale commercial fisheries. This led to the development of the Small-Scale Fisheries Policy (SSFP), the aim of which is to redress and provide recognition of the rights of small-scale fishers (DAFF, 2015). The SSFP was gazetted in May 2019 under the Marine Living Resources Act, 1998 (Act No. 18 of 1998). It is only now (2021/2022) in an advanced process of implementation. It is a challenging process that has been exacerbated by the conflict and overlap with another fisheries-related process of fishing rights allocations (known as Fishery Rights Allocation Process or "FRAP"). As of February 2022, neither process has been concluded and the issues at stake are highly politicised. The SSF overlaps other historical fisheries in South Africa, leading to legal challenges where the SSF rights allocations are in conflict with other established

[7] In regard to SSF, this assessment is guided by several key documents, namely the Marine Living Resources Act of 1998 (as amended); the Small Scale Fisheries Policy (2016) and in particular the Small Scale Fisheries Regulations of 2016. See also : Small-Scale Policy Implementation Plan available at http://www.smallscalefisheries.co.za/useful-resources

[8] See also the Thesis of Presentus, G. (2022)

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commercial fishing sectors, most notably the commercial squid fishing sector. SSF is defined as a fishery although specific operations and dynamics are not yet fully defined as they are subject to an ongoing process by DFFE. The SSF regulations (DAFF, 2016) do however define the fishing area for SSF as ""near-shore", meaning "the region of sea (including seabed) within close proximity to the shoreline". The regulations further specify under Schedule 5 Small-scale fishing areas and zones in which "5. (1) In order to facilitate the establishment of areas where smallscale fishers may fish, the Department must set up a procedure to engage and consult with the small-scale fishing community in proposing demarcated areas that may be established as areas where small-scale fishers may fish" and which under section 5 (2)b. "take into account the mobility of each species in the allocated basket of species with sessile species requiring smaller fishing areas while nomadic and migratory species requiring larger area".

Small-scale fishers fish to meet food and basic livelihood needs, but may also directly be involved in fishing for commercial purposes[9]. These fishers traditionally operate on nearshore fishing grounds to harvest marine living resources on a full-time, part-time or seasonal basis. Fishing trips are usually of short-duration and fishing/harvesting techniques are labour intensive[10].

Small-scale fishers are an integral part of the rural and coastal communities in which they reside and this is reflected in the socio-economic profile of such communities. In the Eastern Cape, KwaZulu-Natal and the Northern Cape, small scale fishers live predominantly in rural areas while those in the Western Cape live mainly in urban areas (Harris et. al. 2002; Sunde & Pedersen C. 2007; Sunde 2016.).

Many communities living along the coast have, over time, developed local systems of rules to guide their use of coastal lands, forests and waters. These local rules are part of their systems of customary law. Rights to access, use, and own different natural resources arise from local customary systems of law. These systems of law are not written down as in Western law, but are passed down from generation to generation through practice (https://www.masifundise.org/wp-content/uploads/2011/06/vissernet-eng-news-3-final.pdf). South Africa's Constitution recognises customary law together with common law and state law. Section 39 (3) makes provision for a community that has a system of customary rights arising from customary law to be recognised as long as these rights comply with the Bill of Rights. In line with this, the SSFP also recognises rights arising in terms of customary law. Customary fishers are normally associated with discrete groups (tribes or communities with unique identities and associations with the sea) who may be defined by traditions and beliefs (see also Pretorius, 2022). These traditions are increasingly being challenged as stocks and marine resources have been depleted. This would include, for example, intertidal harvesting of seaweed, mussels, oysters, cephalopods and virtually any species available to these communities. These fishers are generally localised and do not range far beyond the areas in which they live[11].

SSF resources are managed in terms of a community-based co-management approach that aims to ensure that harvesting and utilisation of the resource occurs in a sustainable manner in line with the ecosystems approach. The SSF is to be implemented along the coast in series of community co-operatives. Only a co-operative is deemed to be a suitable legal entity for the allocation of small-scale fishing rights[12]. Applicants for small-scale fishing rights must have a historical involvement in traditional fishing operations, including the catching, processing or marketing of fish for a cumulative period of at least 10 years. They also need to show a historical dependence on deriving the major part of their livelihood from traditional fishing operations.

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[9] There is no formal designation of artisanal (or traditional/subsistence) fishing in South Africa, which is generally considered as fishing or resource extraction for own use. As fisheries have evolved and the commercial benefits realised, subsistence fishers have increasingly moved to commercialisation aimed at supporting their livelihoods. This group can now, therefore, also include shore and boat-based anglers and spear-fishers who target a wide range of line fish species, some of which are also targeted by commercial operations, skin divers who collect rock lobsters and other subtidal invertebrates, bait collectors (mussels, limpets, red bait) and non-subsistence collectors of intertidal organisms. The high value of many intertidal and subtidal resources (e.g. rock lobster, abalone and mussels) has resulted in an increase in their production through aquaculture and small-scale harvesting in recent years (Clark et. al. 2010).

[10] The equipment used by small scale fishers includes rowing boats in some areas, motorised boats on the south and west coast and simple fishing gear including hands, feet, screw drivers, hand lines, prawn pumps, rods with reels, gaffs, hoop nets, gill nets, seine/beach nets and semi-permanently fixed legal traps.

[11] It can include foot-fishers, but also boat fishers who may have difficult or restricted options for launching sites. Note that in some areas fishers are increasingly using more sophisticated technology such as fish finders and larger motorised boats. This ability means their activities may be increasingly commercialised and may overlap with more established commercial fishery sectors.

[12] A co-operative is jointly owned and democratically controlled by small-scale fishers.

More than 270 communities have registered an Expressions of Interest (EOI) with the Department. DFFE has split SSF by communities into district municipalities and local municipalities. The location of these coastal communities and the number of fishers per community are shown in Figure 3.41.

- In the Northern Cape, there are 103 fishers registered in the Namakwa district, comprising the Richtersveld and Kamiesberg local municipalities.
- Western Cape districts include 1) West Coast (Berg River, Saldanha Bay, Cederberg, Matzikama and Swartland local municipalities; 2) Cape Metro; 3) Overberg (Overstrand and Cape Agulhas); and 4) Eden (Knysna, Bitou and Hessequa). In total there are 1748 fishers registered in the province.
- In the Eastern Cape, the communities are again split up, broadly as 1) Nelson Mandela Bay, 2) Sarah Baartman, 3) Buffalo City, 4) Amathole, 5) O.R. Tambo and 6) Alfred Nzo. There are 5154 fishers registered in the province.
- KwaZulu-Natal has 2008 registered small-scale fishers divided by district into 1) Ugu, 2) Ethekwini Metropolitan, 3) Iembe, 4) King Shwatshayo/Uthungulu, and 5) Umkhanyakude.

Approximately 10 000 small-scale fishers have been identified around the coast. The licence block is situated offshore of the West Coast, City of Cape Town and Overberg municipal districts. Between Saldanha Bay and Cape Agulhas, 68 communities have been registered for small-scale fishing rights, these co-operatives comprise a total of 2031 fishers. At this point in time, no discreet co-operatives are active, except for on the West Coast in Port Nolloth.

The SSFP requires a multi-species approach to allocating rights, which enable the allocation of rights for a basket of species that may be harvested or caught within particular designated areas[13]. Section 6 of the regulations covers access Management of the rights of access and includes amongst other parts

Co-operatives can only request access to species found in their local vicinity. DFFE recommends five basket areas: 1. Basket Area A – The Namibian border to Cape of Good Hope – 57 different resources 2. Basket Area B – Cape of Good Hope to Cape Infanta – 109 different resources 3. Basket Area C – Cape Infanta to Tsitsikamma – 107 different resources 4. Basket Area D – Tsitsikamma to the Pondoland MPA – 138 different resources 5. Basket Area E – Pondoland MPA to the Mozambican border – 127 different resources.

The mix of species to be utilised by small-scale fishers includes species that are exploited nearshore by existing commercial sectors viz; traditional linefish, west coast rock lobster, squid, hake handline[14], abalone, KZN beach seine, netfish (gillnet and beach-seine), seaweed and white mussel. An apportionment of TAE/TACs for these species will be transferred from existing commercial rights to SSF[15], whereas white mussels will become the exclusive domain of SSF. Species nominated for commercial use will be subject to TAE and/or TAC allocation. Species nominated for own use will be available to all members of a particular co-operative, but subject to output controls.

The small-scale fishery rights cover the nearshore area (defined in section 19 of the MLRA as being within close proximity of shoreline). Small-scale fishermen along the Northern Cape and Western Cape coastlines are typically involved in the traditional line, west coast rock lobster and abalone fisheries, whereas communities on the South Coast would be involved in traditional line, squid jig and oyster harvesting. The small-scale communities on the West Coast, with long family histories of subsistance fishing, prioritise the harvest of nearshore resources (using boats) over the intertidal and subtidal resources (Clark, Hauck *et al.* 2002, Harris, Salo, & Russell 2010).

Snoek (*Thyrsites atun*), Cape bream / hottentot (*Pachymetopon blochii*) and yellowtail (*Seriola lalandi*) are important linefish species that are targeted by small-scale fishers operating nearshore along the West and

[13] Under the SSF regulations the species that may be included in the "basket" are provided in Annexures 2, 3 & 4 that includes fish species that are listed on the non-saleable list, and those that it shall only be caught for own consumption within the corresponding limits.

[14] Hake handline is a small subsector of the hake fishery and requires a fishing right apportionment. The fishery has in recent years not been active because of resource availability. It is perceived as having potential for allocation as part of the SSF and as part of their "basket".

[15] DFFE proposes that, commencing January 2021, 50% of the overall TAE and TAC for the traditional linefish and abalone sectors, respectively, will be apportioned to small-scale fishing whereas 25% of the overall TAE for squid will be apportioned to small-scale fishing (DFFF 2020).

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South-West Coast of South Africa. Snoek are targeted by small-scale fishers during the snoek seasonal migration between April and June, during which time they shoal nearshore and are therefore available to handline fishermen[16]. Snoek availability coincides with peaks in the availability of other small pelagic species, notably anchovy and sardine (Nepgen, 1979). As shown by Crawford *et al.* (1987) [17,18] snoek stay inshore on their southward migration (i.e. April through to June and then move offshore into deeper waters to spawn[18] in July and August (and are not available to line fishers).

Small-scale fishers also target west coast rock lobster (Jasus lalandii) using hoopnets set by small "bakkies" on suitable reefs at a water depth of less than 30 m. Fishing activity may range up to 100 m water depth by the larger vessels that participate in the offshore commercial rock lobster trap sector.

Small-scale fishermen along the Northern Cape and Western Cape coastlines are unlikely to range beyond 20 km from the coastline; thus, inshore of the Reconnaissance Permit area (refer to

Figure 83). This assessment is however cognisant of the ongoing issues related to the perceived areas fished and species targeted by SSF off the West Coast of South Africa[20] e.g. that cultural practice of SSF may occur to 55 km offshore. While SSF regulations clearly specify that fishing is required to take place "nearshore" the actual differentiation between SSF and other fishing operations that might include SSF, such as the commercial "traditional linefish" and "pole and line" and the extent to which these commercial fisheries might include SSF, remains unclear. As such the offshore extent to which SSF may operate requires a precautionary approach in this assessment and consideration that the possibility exists (albeit a remote possibility that cannot be verified through the information made available on these fisheries), that SSF may have occurred historically and potentially in the future further offshore than suggested by the information made available for this assessment i.e. there is a remote possibility that some SSF may have targeted certain species (of which tuna and snoek are the main candidate species) further offshore than 20 km. The distance fished offshore by SSF and the associated risks determined in this assessment further necessarily considers practical aspects, notably that bottom fishing is impractical in waters deeper than 100 m and as such any bottom fishing, whether SSF or commercial, is highly unlikely beyond a precautionary depth being the 100 m depth contour. Further, in regard to migratory species, such as longfin tuna and snoek, economic and regulatory aspects relating to distances fished offshore is pertinent (i.e. such as the requirements of the South African Maritime Safety Authority (SAMSA)) in particular that most SSF are not likely to be "B" class certified (i.e. can operate up to 40 nm offshore and are longer than 9 m) are likely limited to "C" class being mainly vessels of <9 m[21] permitted to only operate < 15 nm offshore.

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[16] Snoek are known to undertake migrations in a southward direction from the waters of the northern Benguela into the southern Benguela towards the cape west and southern coasts. These migrations have certainly been long taken advantage of by fishers, including traditional linefishers and commercials along the west coast. Commercial fishers as well as the Small Scale Fishery (SSF) sector capitalise on the inshore availability, but this opportunity is lost once the snoek move offshore in mid-winter and start their northward migration. Snoek are primarily a "winter" fish, moving systematically southwards in autumn and commercial linefish, recreational and community-based boats exploit this shoaling species mostly in the nearshore. Snoek are also caught by the hake trawl fleets in significant numbers at times as snoek may undertake diurnal migrations feeding or spawning in deeper waters (and are not accessible to surface line fishers or these times). There is however no definitive description of snoek migrations with regard to their exact spatial and temporal movements.

[17] The Benguela ecosystem : Part IV. pgs 488

[18] See also Nepgen (1979) in Fish. Bull. S Afr. 12:35-43

[18] Snoek spawning occurs offshore during winter-spring, along the shelf break (150-600 m) of the western Agulhas Bank and the South African west coast. Prevailing currents transport eggs and larvae to a primary nursery ground north of Cape Columbine and to a secondary nursery area to the east of Danger Point; both shallower than 150 m. Juveniles remain on the nursery grounds until maturity, growing to between 38 and 44 cm in the first year (3.25 cm/month). Onshore-offshore distribution (between 5- and 150-m isobaths) of juveniles is determined largely by prey availability and includes a seasonal inshore migration in autumn in response to clupeoid recruitment. Adults are found throughout the distribution range of the species, and although they move offshore to spawn - there is some southward dispersion as the spawning season progresses - longshore movement is apparently random and without a seasonal basis (Griffiths, 2002).

[20] On 22/08/22 the Western Cape High Court ruled that the process of designating SSF in the Western Cape had been "unlawful" and had to be redone.

[21] See https://www.samsa.org.za/Marine%20Notices/2011/MN%2013%20of%202011%20Small%20vessels%20Policy.pdf

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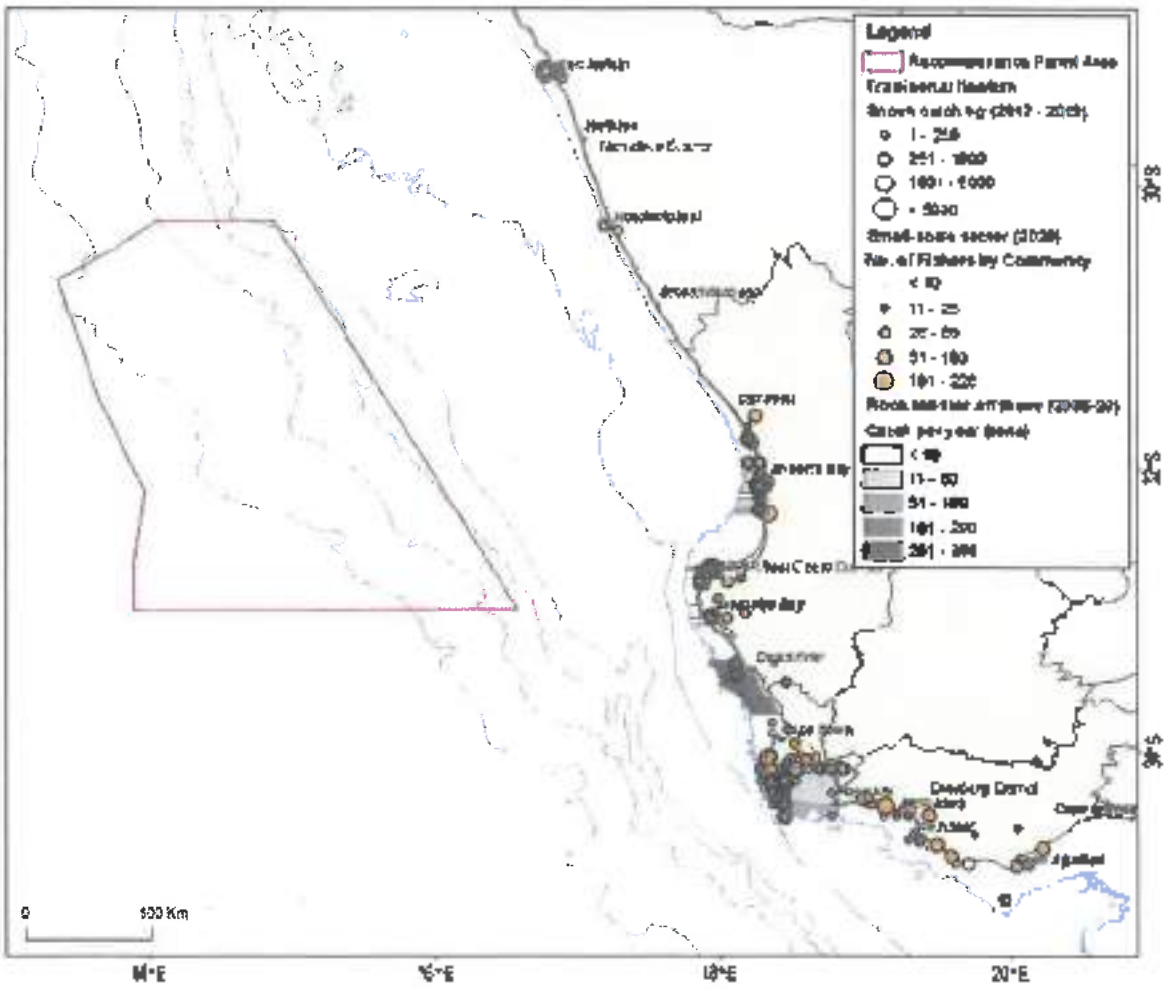

Figure 83: Overview of spatial distribution of small-scale fishing communities and number of participants per community along the South African west coast. The location of snoek catches reported by the linefish sector for the period 2017 to 2019 are shown.

8.5.3.21 BEACH-SEINE AND GILLNET FISHERIES (NETFISH)

There are a number of active beach-seine and gillnet operators throughout South Africa (collectively referred to as the "netfish" sector). Initial estimates indicate that there are at least 7 000 fishermen active in fisheries using beach-seine and gillnets, mostly (86%) along the West and South coasts. These fishermen utilise 1 373 registered and 458 illegal nets and report an average catch of about 1 600 tons annually, constituting 60% harders (also known as mullet, *Chelon richardsonii*), 10% St Joseph shark (*Callorhinchus capensis*) and 30% "bycatch" species such as galjoen (*Dichistius capensis*), yellowtail (*Seriola lalandi*) and white steenbras (*Lithognathus lithognathus*). Catch-per-unit-effort declines eastwards from 294 and 115 kg-net-day-1 for the beach-seine and gill-net fisheries respectively off the West Coast to 48 and 5 kg-net-day-1 off KwaZulu-Natal. Consequently, the fishery changes in nature from a largely commercial venture on the West Coast to an artisanal/subsistence fishery on the East Coast (Lamberth *et al.* 1997).

The fishery is managed on a Total Allowable Effort (TAE) basis with a fixed number of operators in each of 15 defined areas (see Table 27 for the number of rights issued and Figure 84 for the fishing areas). The number of Rights Holders operating on the West Coast from Port Nolloth to False bay is listed as 28 for beach-seine and 162 for gillnet (DEFF, 2020). Permits are issued solely for the capture of harders, St Joseph and species that appear on the 'bait list'. The exception is False Bay, where Right Holders are allowed to target linefish species that they traditionally exploited.

Table 27: Recommended Total Allowable Effort (TAE, number of rights and exemption holders) and rights allocated in 2016-17 for each netfish area. Levels of effort are based on the number of fishers who could maintain a viable income in each area (DAFF 2017).

Area	Locality	Beach-seine	Gill/drift	Total	Rights allocated
A	Port Nolloth	3	4	7	4
B	Hondeklipbaai	0	2	2	0
C	Olifantshelmmond-Wadrifsoutpansmond	2	8	10	4
D	Wadrifsoutpansmond-Elandsbaai-Dwarshoek	3	6	9	6
E	Dwarshoek, (Rocherpan)-Cape Columbine, including Paternoster	4	80	84	84
F	Saldhana Bay	1	5	6	5
G	Langebaan Lagoon	0	10	10	10
H	Yzerfontein	2	2	4	1
I	Bokpunt (Melkbos)-Milnerton	3	0	3	1
J	Houtbay beach	2	0	2	0
K	Longbeach-Scarborough	3	0	3	1
L	Smitswinkel Bay, Simonstown, Fishoek	2	0	2	2
M	Muizenberg-Strandfontein	2	0	2	2
N	Macassar*	0	0	0	(1)
OE	Olifants Rivier Estuary	0	45	45	45

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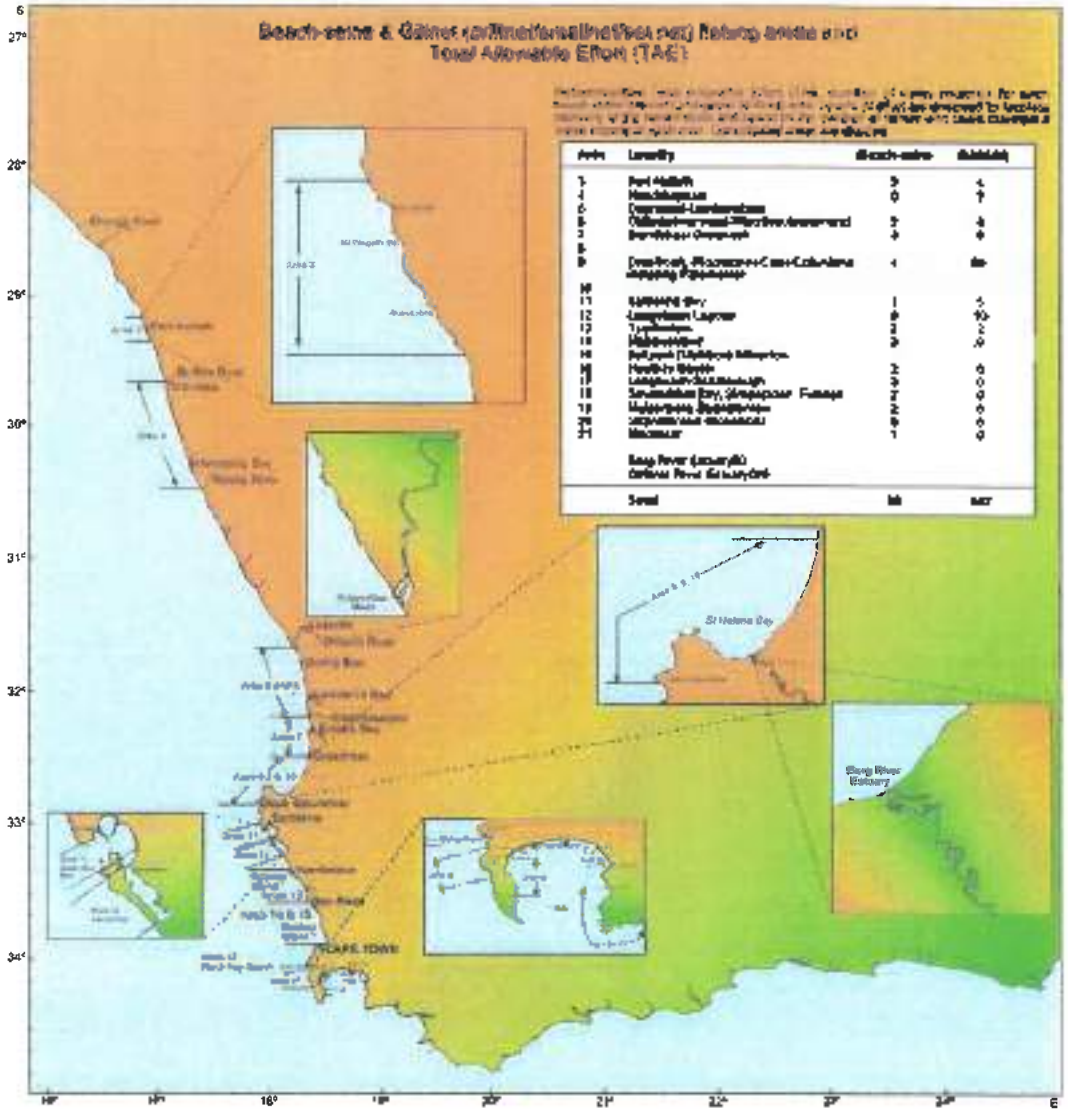

Figure 84: Beach-seine and gillnet fishing areas and TAE (DAFF, 2014)

The beach-seine fishery operates primarily on the West Coast of South Africa between False Bay and Port Nolloth (Lamberth 2006) with a few permit holders in KwaZulu-Natal targeting mixed shoaling fish during the annual winter migration of sardine (Fréon *et al.* 2010). Beach-seining is an active form of fishing in which woven nylon nets are rowed out into the surf zone to encircle a shoal of fish. They are then hauled shorewards by a crew of 6–30 persons, depending on the size of the net and length of the haul. Nets range in length from 120 m to 275 m. Fishing effort is coastal and net depth may not exceed 10 m (DAFF 2014b).

The gillnet fishery operates from Yzerfontein to Port Nolloth on the West Coast. Surface-set gillnets (targeting mullet) are restricted in size to 75 m x 5 m and bottom-set gillnets (targeting St Joseph shark) are restricted to 75 m x 2.5 m (da Silva *et al.* 2015) and are set in waters shallower than 50 m. The spatial distribution of effort is represented as the annual number of nets per kilometre of coastline.

The range of gillnets (50 m) and that of beach-seine activity (20 m) will not overlap with Reconnaissance Permit area. Figure 85 shows the expected range of gillnet fishing activity off the west coast of South Africa, situated at least 220 km from the Reconnaissance Permit area.

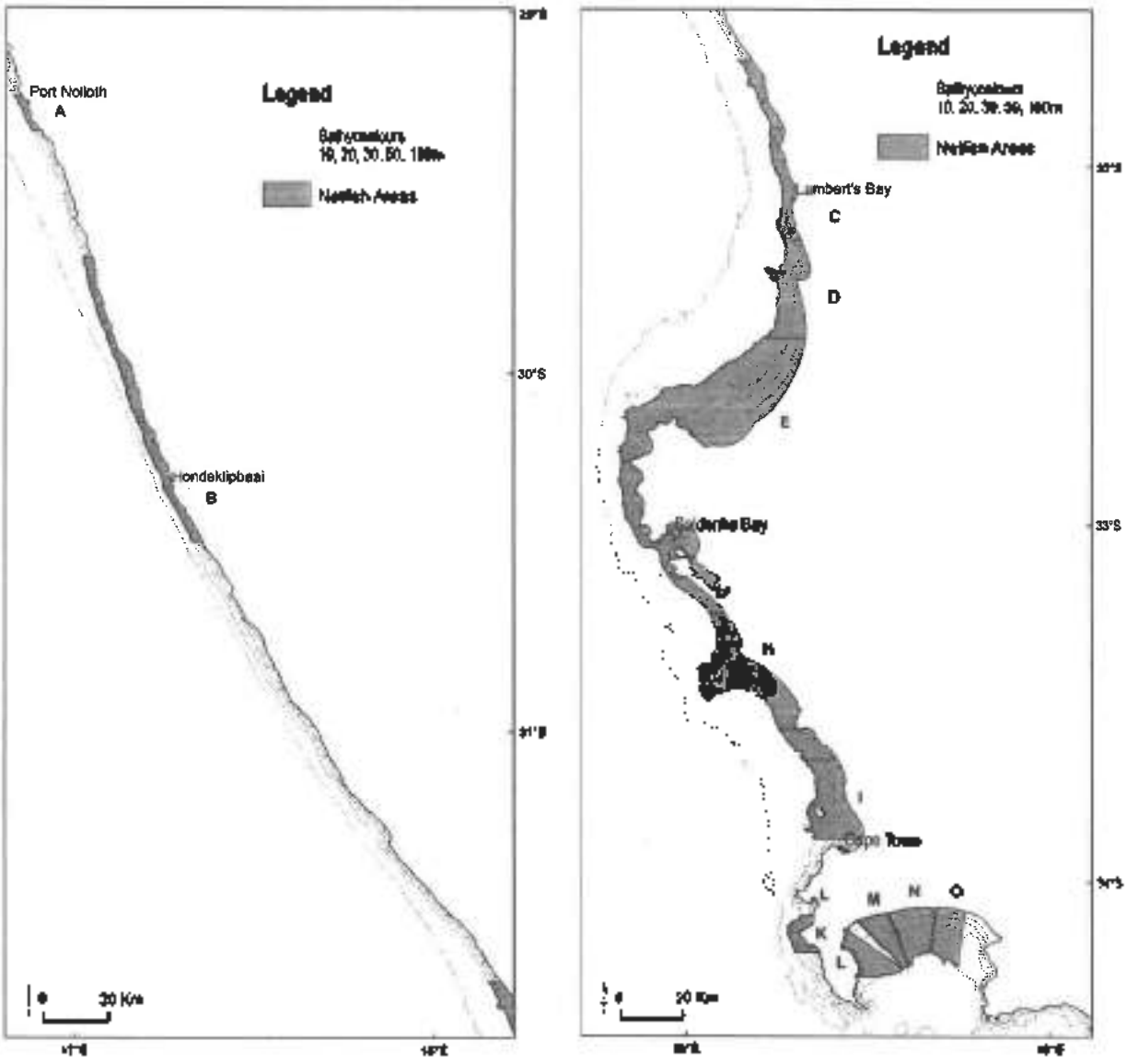

Figure 85: Netfish (gillnet and beach-seine) fishing areas (DAFF, 2016/17)

8.5.3.12 FISHERIES RESEARCH

Swept-area trawl surveys of demersal fish resources are carried out twice a year by DAFF in order to assess stock abundance. Results from these surveys are used to set the annual TACs for demersal fisheries. First started in 1965, the West Coast survey extends from Cape Agulhas (20°E) to the Namibian maritime boarder and takes place over the duration of approximately one month during January/February. The survey of the Southeast coast (20°E – 27°E longitude) takes place in April/May. Following a stratified, random design, bottom trawls are conducted to assess the biomass, abundance and distribution of hake, horse mackerel, squid and other demersal trawl species on the shelf and upper slope of the South African coast. Trawl positions are randomly selected to cover specific depth strata that range from the coast to the 1 000 m isobath. On occasion, trawls are targeted in waters deeper than 1 000 m. Figure 86 shows the distribution of research trawls undertaken in relation to the Reconnaissance Permit area, with several deepwater trawls having been undertaken within the area.

The biomass of small pelagic species is assessed bi-annually by an acoustic survey. The first of these surveys is timed to commence in mid-May and runs until mid-June while the second starts in mid-October and runs until mid-December. The timing of the demersal and acoustic surveys is not flexible, due to restrictions with availability of the research vessel as well as scientific requirements. During these surveys the survey vessels

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travel pre-determined transects (perpendicular to bathymetric contours) running offshore from the coastline to approximately the 200 m isobaths, but selected transect run to the to 1 000 m contour in places. The surveys are designed to cover an extensive area from the Orange River on the West Coast to Port Alfred on the East Coast and the DFFE survey vessel progresses systematically from the Northern border Southwards, around Cape Agulhas and on towards the east. Figure 86 shows the research effort undertaken off the West Coast during the November 2020 spawner biomass survey and May 2021 recruitment survey of small pelagic species. The Reconnaissance Permit area is situated at least 60 km offshore of the deepwater extent of research survey transects and there is no spatial overlap expected.

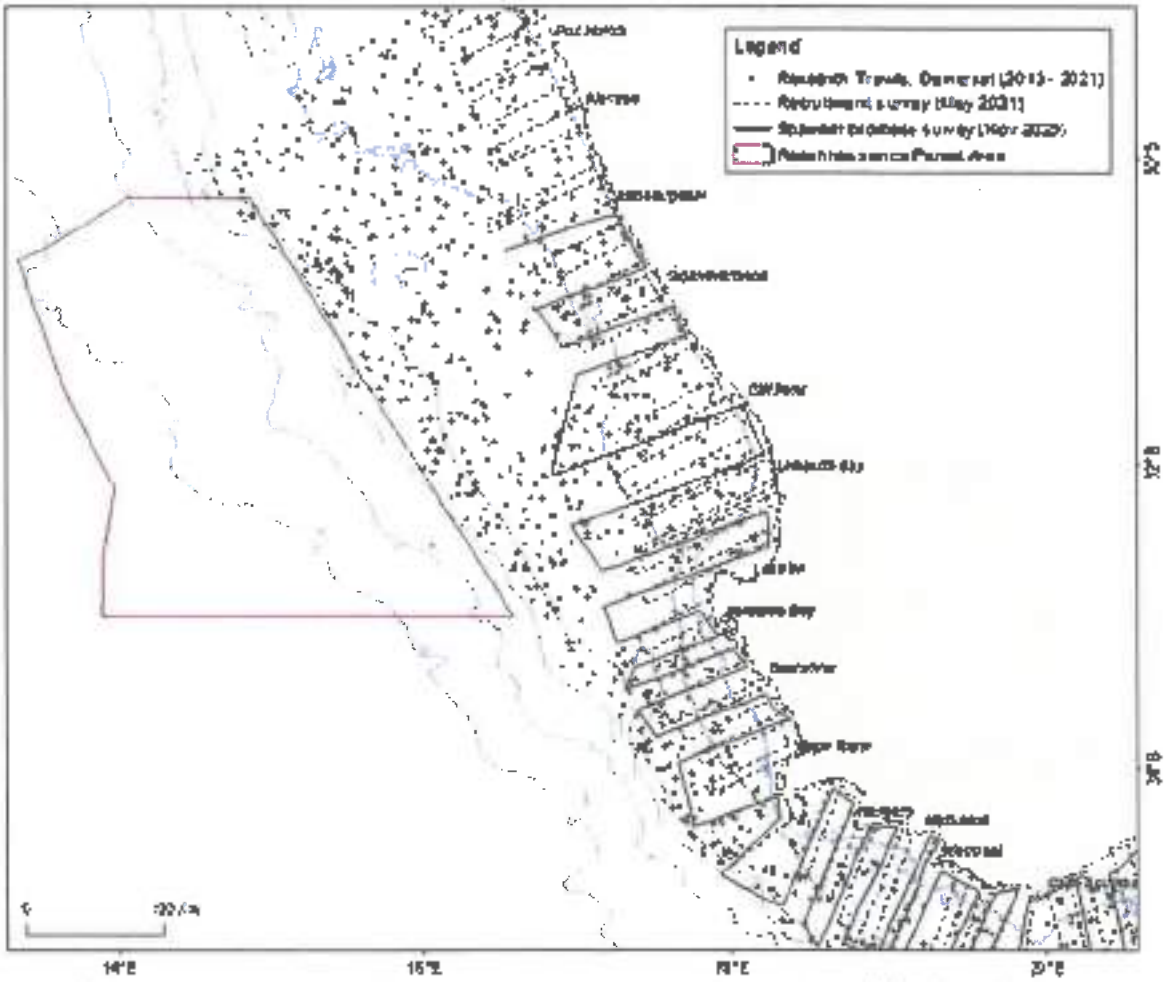

Figure 86: Spatial distribution of trawl start positions undertaken by DFFE from 2013 to 2021 to assess the biomass of demersal fish species along the West Coast. Also shown are the survey transects of recruitment and spawner biomass research surveys undertaken by DFFE in May 2021 and November 2020, respectively, in relation to the Reconnaissance Permit application area.

8.5.4 SUMMARY OF SEASONALITY IN FISHERIES

The seasonality of each of the main commercial fishing sectors that operate off the west coast (west of 20°E) of South Africa is indicated in Table 3.13. Fishing intensity within the Reconnaissance Permit application area is presented for each sector in Table 3.14.

Table 28: Summary table showing seasonal variation in fishing effort expended by each of the main commercial fisheries sectors operating off the West Coast of South Africa.

Sector	Fishing Intensity by Month (H = High; M = Low to Moderate; N = None)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Demersal Trawl	M	M	M	M	M	M	M	M	M	M	M	M

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Sector	Fishing Intensity by Month (H = high; M = Low to Moderate; N = None)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Midwater Trawl	H	H	H	H	H	H	H	H	H	H	H	H
Demersal Longline	M	H	H	H	H	H	H	H	H	H	H	H
Small Pelagic Purse-Seine	M	H	H	H	H	H	H	H	H	H	H	M
Large Pelagic Longline	M	M	M	M	H	H	H	H	H	H	H	M
Tuna Pole-Line	H	H	H	H	H	M	M	M	M	M	H	H
Traditional Linefish	H	M	M	M	M	M	M	M	M	M	M	H
West Coast Rock Lobster	H	H	H	H*	H*	H*	M*	N	N	M	M	H
Small-scale (linefish & rock lobster sectors)	M	M	M	H	H	H	M	M	M	M	M	M
Research survey (trawl)	M	M	M	H	H	H	N	N	N	N	N	N
Research survey (acoustic)	N	N	N	H	M	M	N	N	N	M	M	M

*Areas 8 and 11 only; # Area 8 only

Table 29: Summary table showing seasonal variation in relative intensity of fishing effort by fisheries sector within the Reconnaissance Permit application area.

Sector	Fishing Intensity by Month (H = high; M = Low to Moderate; N = None)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Demersal Trawl	N	N	N	N	N	N	N	N	N	N	N	N
Midwater Trawl	N	N	N	N	N	N	N	N	N	N	N	N
Demersal Longline	N	N	N	N	N	N	N	N	N	N	N	N
Small Pelagic Purse-Seine	N	N	N	N	N	N	N	N	N	N	N	N
Large Pelagic Longline	M	M	M	M	M	H	H	M	M	M	M	M
Tuna Pole-Line	M	H	H	M	M	M	N	N	N	N	N	
Traditional Linefish	N	N	N	N	N	N	N	N	N	N	N	N
West Coast Rock Lobster	N	N	N	N	N	N	N	N	N	N	N	N
Small-scale (linefish & rock lobster nearshore sectors)	N	N	N	N	N	N	N	N	N	N	N	N
Research survey (trawl)	M	M	M	N	N	N	N	N	N	N	N	N
Research survey (acoustic)	N	N	N	N	N	N	N	N	N	N	N	N

8.6 OTHER USES OF THE AREA

This section provides a description of the other uses of the application area. The information has been sourced from the Marine Ecological Study undertaken by Pisces Environmental Services (Pty) Ltd included in Appendix 3.

8.6.1 BENEFICIAL USES

The Application Area is located well offshore beyond the 1 000 m depth contour. Other users of the offshore areas include the commercial fishing industry (see CapMarine 2022 – Fisheries Specialist Study), with marine diamond mining concessions being located well inshore of the eastern portion of the Reconnaissance Permit Area (Figure 88). Recreational activities along the coastline north of St Helena Bay are limited to the area around Lambert's Bay, Hondeklip Bay and Port Nolloth.

On the Namaqualand coast marine diamond mining activity is restricted to nearshore, diver-assisted operations from small, converted fishing vessels working in the a-concessions, which extend to 1 000 m offshore of the high-water mark. No deep-water diamond mining is currently underway in the South African offshore concession areas, although prospecting activities are ongoing. In Namibian waters, deep-water diamond mining by De Beers Marine Namibia is currently operational in the Atlantic 1 Mining Licence Area, immediately to the northeast of the Reconnaissance Permit Area.

These mining operations are typically conducted to depths of 150 m from fully self-contained mining vessels with on board processing facilities, using either large-diameter drill or seabed crawler technology. The vessels operate as semi-mobile mining platforms, anchored by a dynamic positioning system, commonly on a three to four anchor spread (Figure 87). Computer-controlled positioning winches enable the vessels to locate themselves precisely over a mining block of up to 400 m x 400 m. These mining vessels thus have limited manoeuvrability and other vessels should remain at a safe distance.

Other industrial uses of the marine environment include the intake of feedwater for mariculture, or diamond-gravel treatment, submarine telecommunications cables, ammunition dumps and hydrocarbon wellheads (Figure 88). None of these activities should in any way be affected by 3D seismic survey activities offshore.

Figure 87: Typical crawler-vessel (left) and drillship (right) operating in the Atlantic 1 Mining Licence Area (Photos: De Beers Marine).

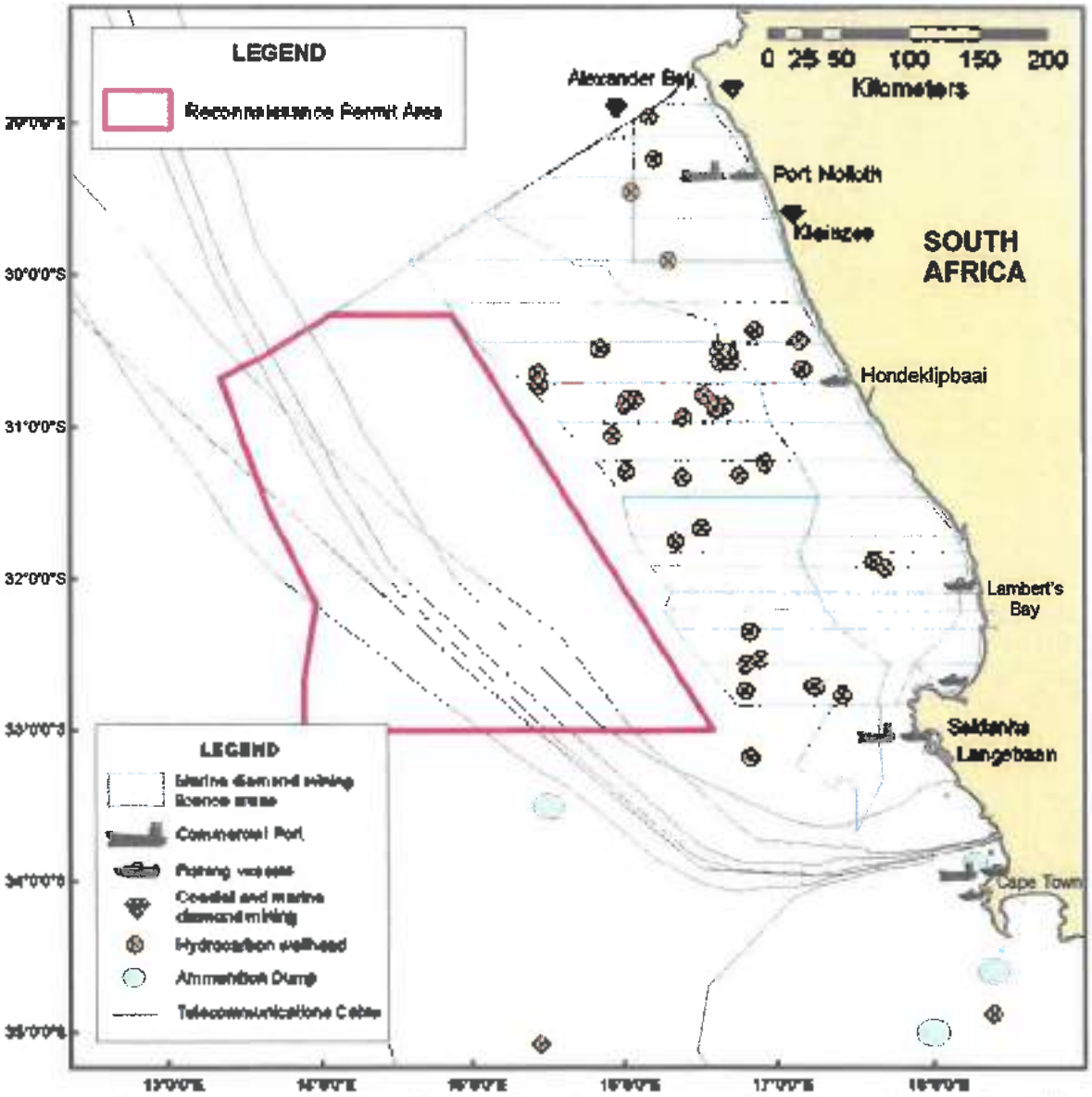

Figure 68: The Reconnaissance Permit Area (red polygon) in relation to project - environment interaction points on the West Coast, illustrating the location of marine diamond mining concessions and ports for commercial and fishing vessels. Existing hydrocarbon wellheads, telecommunications cables and ammunition dumps are also shown.

8.6.2 CONSERVATION AREAS AND MARINE PROTECTED AREAS

Numerous sanctuaries, marine protected area (MPA) exist offshore and along the coastline of the West coast, although none of them overlap with the Reconnaissance Permit Area. For the sake of completeness, these are described in more detail below.

8.6.2.1 SANCTUARIES

Sanctuaries are considered a type of management area within South Africa's multi-purpose expanded MPA network in which access and/or resource use is prohibited. Sanctuaries in the vicinity of the project area in which restrictions apply are the McDougall's Bay, Stompneusbaai, Saldanha Bay, Table Bay and Hout Bay rock lobster sanctuaries, which are closed to commercial exploitation of rock lobsters. These sanctuaries were originally proclaimed early in the 20th century under the Sea Fisheries Act of 1988 as a management tool for the protection of the West Coast rock lobster (Mayfield *et al.* 2005). They lie well inshore or to the south of the Reconnaissance Permit Area.

8.6.2.2 **MARINE PROTECTED AREAS**

'No-take' MPAs offering protection of the Namaqua biozones (sub-photic, deep-photic, shallow-photic, intertidal and supratidal zones) are absent northwards from Cape Columbine (Emanuel *et al.* 1992, Lombard *et al.* 2004). This resulted in substantial portions of the coastal and shelf-edge marine biodiversity in the area being assigned a threat status of 'Critically Endangered', 'Endangered' or 'Vulnerable' in the 2011 National Biodiversity Assessment (NBA) (Lombard *et al.* 2004; Sink *et al.* 2012). Using biodiversity data mapped for the 2004 and 2011 NBAs a systematic biodiversity plan was developed for the West Coast (Majiedt *et al.* 2013) with the objective of identifying both coastal and offshore priority areas for MPA expansion. Potentially vulnerable marine ecosystems (VMEs) that were explicitly considered during the planning included the shelf break, seamounts, submarine canyons, hard grounds, submarine banks, deep reefs and cold water coral reefs. To this end, nine focus areas were identified for protection on the West Coast between Cape Agulhas and the South African – Namibian border. These focus areas were carried forward during Operation Phakisa, which identified potential offshore MPAs. A network of 20 MPAs was gazetted on 23 May 2019, thereby increasing the ocean protection within the South African Exclusive Economic Zone (EEZ) to 5%. The approved MPAs within the broad project area are shown in Figure 89. There are six offshore Marine Protected Areas (MPAs) that fall within the broader project area, namely the Orange Shelf Edge MPA, Child's Bank MPA, Benguela Muds MPA, Cape Canyon MPA, Robben Island MPA and the Southeast Atlantic Seamounts MPA. These are described briefly below.

The **Orange Shelf Edge MPA** covers depths of between 250 m and 1 500 m and is unique as it has to date never been trawled. Proclaimed in 2019, this MPA provides a glimpse into what a healthy seabed should look like, what animals live there and how the complex relationships between them support important commercial fish species such as hake, thereby contributing fundamentally towards sustainable fisheries development. This MPA also protects the pelagic habitats that are home to predators such as blue sharks, as well as surface waters where thousands of seabirds such as Atlantic yellow-nosed albatrosses feed. The MPA lies ~10 km to the north of the northern boundary of the Reconnaissance Permit Area.

The 1 335 km^2 **Child's Bank MPA**, located 27 km inshore of the Reconnaissance Permit Area at its closest point, supports seabed habitats inhabited by a diversity of starfish, brittle stars and basket stars, many of which feed in the currents passing the bank's steep walls. Although trawling has damaged coral in the area, some pristine coral gardens remain on the steepest slopes. The Child's Bank area was first proposed for protection in 2004 but was only proclaimed in 2019, after reducing its size to avoid petroleum wellheads and mining areas. The MPA provides critical protection to these deep sea habitats (180 - 450 m) as they allow for the recovery of important nursery areas for young fish.

The **Benguela Muds MPA** is the smallest of the South African offshore MPAs. At only 72 km^2 the muddy habitats located in this area are created by sediment washed down the Orange River and out to sea. These mud habitats are of limited extent and were considered 'critically endangered' on South Africa's deep continental margin of the west coast (Sink *et al.* 2014). The MPA represents the least trawled stretch of muddy seabed on the west coast. This MPA is located 28 km east of the southern portion of the Reconnaissance Permit Area.

The **Cape Canyon** is a deep and dramatic submarine canyon carved into the continental shelf and extending to a maximum depth of 3,600 m. The 580 km^2 MPA was proclaimed in 2019 and protects the upper part of the canyon where depths range from 180 to 500 m. Underwater footage has revealed a rich diversity of sea fans, hermit crabs and mantis shrimps, with hake, monk and John dory resident on the soft canyon floor. Rocky areas in the west of the canyon support fragile rocky habitat, but the area also includes sandy and muddy habitats, which have been trawled in the past. Interaction of nutrient-rich bottom water with a complex seascape results in upwelling, which in turn provides productive surface waters in which seabirds, humpback whales and Cape fur seals feed. The MPA lies 78 km east of the south-eastern corner of the Reconnaissance Permit Area.

The **Namaqua Fossil Forest MPA**, which lies ~173 km inshore of the Reconnaissance Permit Area, provides evidence of age-old temperate yellowwood forests from a hundred million years ago when the sea-level was more than 200 m below what it is today; trunks of fossilised yellowwood trees covered in delicate corals. These unique features stand out against surrounding mud, silt and gravel habitats. The fossilized trees are not known to be found anywhere else in our oceans and are valuable for research into past climates. In 2014 this area was recognised as globally important and declared as an Ecologically and Biologically Significant Area (EBSA). The 1 200 km^2 MPA protects the unique fossil forests and the surrounding seabed ecosystems and including a new species of sponge previously unknown to science.

The **Namaqua National Park MPA** provides the first protection to habitats in the Namaqua bioregion, including several 'critically endangered' coastal ecosystem types. The area is a nursery area for Cape hakes, and the coastal areas support kelp forests and deep mussel beds, which serve as important habitats for the West Coast rock lobster. This 500 km² MPA was proclaimed in 2019, both to boost tourism to this remote area and to provide an important baseline from which to understand ecological changes (e.g. introduction of invasive alien marine species, climate change) and human impacts (harvesting, mining) along the West Coast. Protecting this stretch of coastline is part of South Africa's climate adaptation strategy.

The 612 km² **Robben Island MPA** was proclaimed in 2019 to protect the surrounding kelp forests - one of the few areas that still support viable stocks of abalone. The island harbours the 3rd largest penguin colony, with the breeding population peaking in 2004 at 8 524, but declining since. The island also holds the largest numbers of breeding Bank Cormorant in the Western Cape (120 pairs in 2000) and significant populations of Crowned Cormorant, African Black Oystercatcher (85 breeding pairs in 2000), Hartlaub's Gull and Swift Tern.

The **Rocher Pan MPA**, which stretches 500 m offshore of the high water mark of the adjacent Rocher Pan Nature Reserve, was declared in 1966. The MPA primarily protects a stretch of beach important as a breeding area to numerous waders.

The **West Coast National Park**, which was established in 1985 incorporates the Langebaan Lagoon and Sixteen Mile Beach MPAs, as well the islands Schaapen (29 ha), Marcus (17 ha), Malgas (18 ha) and Jutten (43 ha). Langebaan Lagoon was designated as a Ramsar site in April 1988 under the Convention on Wetlands of International Importance especially as Waterfowl Habitat. The lagoon is divided into three different utilization zones namely: wilderness, limited recreational and multi-purpose recreational areas. The wilderness zone has restricted access and includes the southern end of the lagoon and the inshore islands, which are the key refuge sites of the waders and breeding seabird populations respectively. The limited recreation zone includes the middle reaches of the lagoon, where activities such as sailing and canoeing are permitted. The mouth region is a multi-purpose recreation zone for power boats, yachts, water-skiers and fishermen. However, no collecting or removal of abalone and rock lobster is allowed. The length of the combined shorelines of Langebaan Lagoon MPA and Sixteen Mile Beach is 66 km. The uniqueness of Langebaan lies in its being a warm oligotrophic lagoon, along the cold, nutrient-rich and wave exposed West Coast.

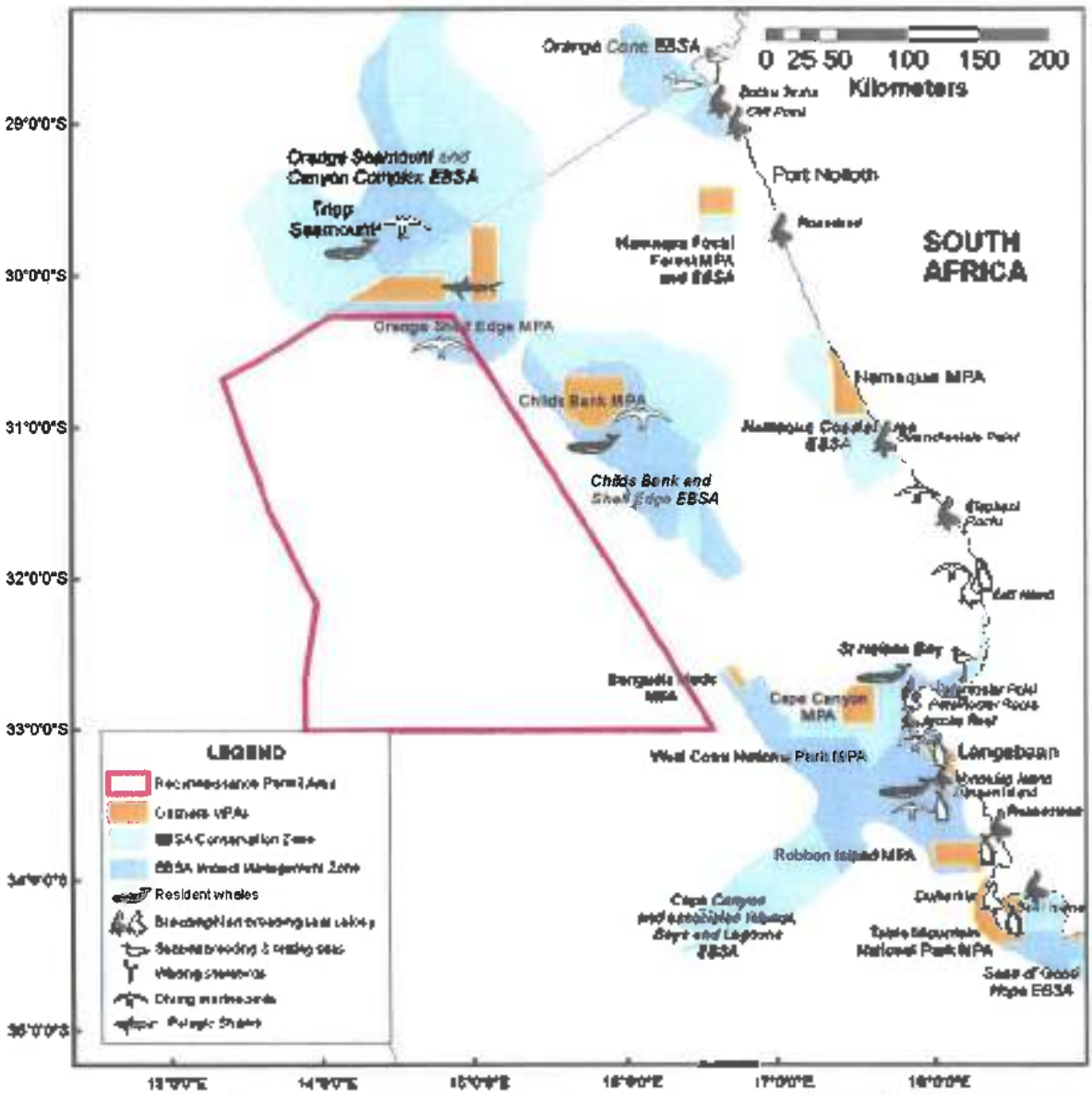

Figure 89: The Reconnaissance Permit Area (red polygon) in relation to project - environment interaction points on the West Coast, illustrating the location of seabird and seal colonies and resident whale populations. Marine Protected Areas (MPAs) and Ecologically and Biologically Significant Areas (EBSAs).

8.6.2.3 SENSITIVE AREAS

Despite the development of the offshore MPA network a number of 'Endangered' and 'Vulnerable' ecosystem types (i.e. Orange Cone Inner Shelf Mud Reef Mosaic, Orange Cone Muddy mid Shelf, Namaqua Muddy Sands, Southern Benguela Outer Shelf Mosaic, Southern Benguela Shelf Edge Mosaic and Southeast Atlantic Lower Slope) are currently 'not well protected' and further effort is needed to improve protection of these threatened ecosystem types (Sink *et al.* 2019) (Figure 90). Ideally, all highly threatened ('Critically Endangered' and 'Endangered') ecosystem types should be well protected. Currently, however, most of the Southern Benguela Sandy Shelf Edge and Southeast Atlantic Upper- and Mid-Slope are poorly protected receiving only 0.2-10% protection, whereas the Southeast Atlantic Lower Slope receives no protection at all (Sink *et al.* 2019). Expanding the size of the Orange Shelf Edge MPA to form a single MPA along the South African Border could improve protection of these threatened habitats. Most of the ecosystem types in the Application Area are either poorly protected or not protected.

8.6.2.4 ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT AREAS

As part of a regional Marine Spatial Management and Governance Programme (MARISMA 2014-2020) the Benguela Current Commission (BCC) and its member states have identified a number of Ecologically or Biologically Significant Areas (EBSAs) both spanning the border between Namibia and South Africa and along the South African West, South and East Coasts (see Figure 89), with the intention of implementing improved conservation and protection measures within these sites. South Africa currently has 11 EBSAs solely within its national jurisdiction with a further four having recently been proposed. It also shares five trans-boundary EBSAs with Namibia (3) and Mozambique (2). The principal objective of these EBSAs is identification of features of higher ecological value that may require enhanced conservation and management measures. They currently carry no legal status. The impact management and conservation zones within the EBSAs are under review and currently constitute a subset of the biodiversity priority areas map (see next section); EBSA conservation zones equate to Critical Biodiversity Areas (CBAs), whereas impact management zones equate to Ecological Support Area (ESAs). The relevant sea-use guidelines accompanying the CBA areas would apply.

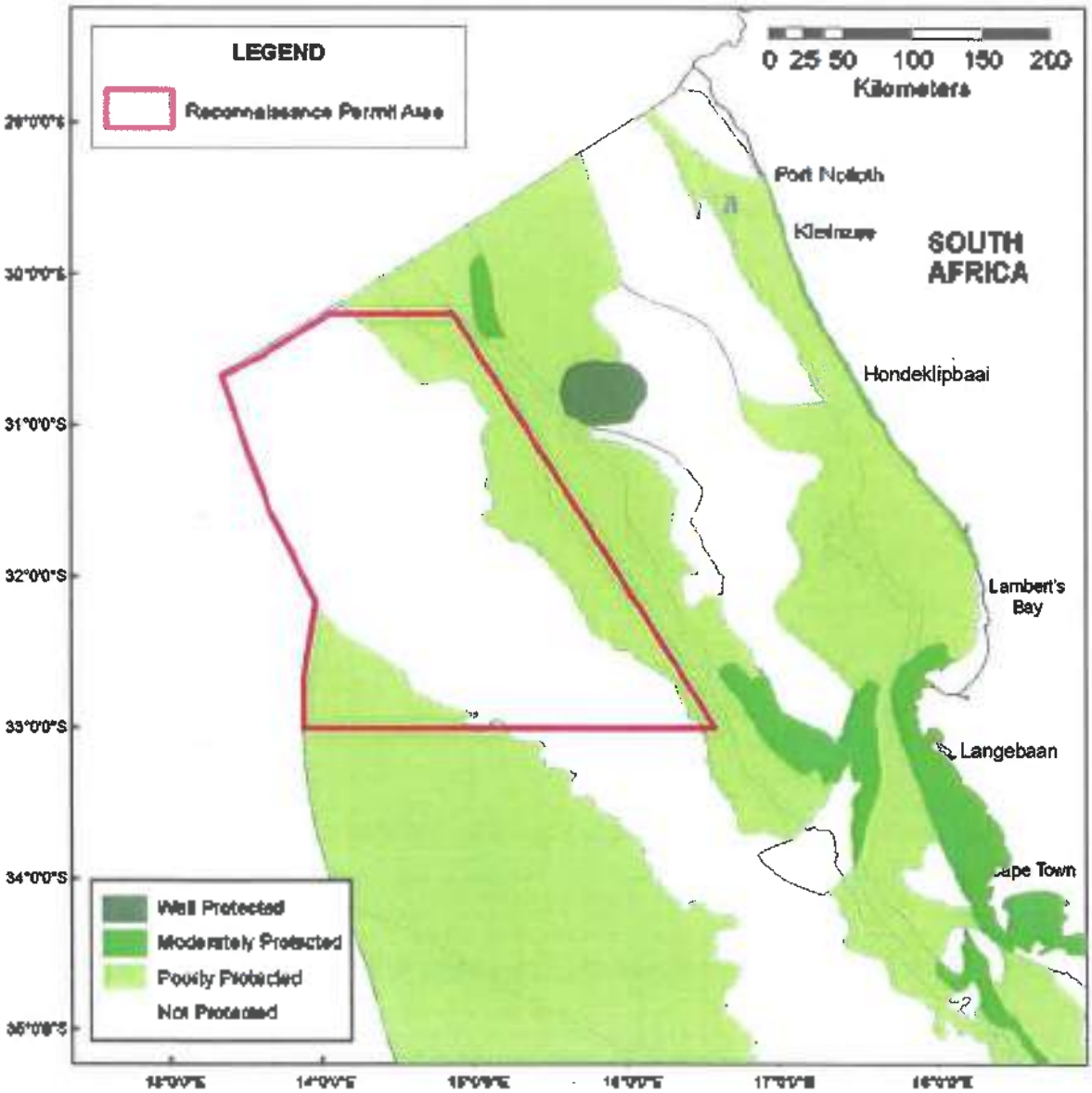

Figure 90: The Reconnaissance Permit Area (red polygon) in relation to protection levels of 150 marine ecosystem types as assessed by Sink *et al.* (2019).

The following summaries of the EBSAs in the Reconnaissance Permit area are adapted from http://cmr.mandela.ac.za/EBSA-Portal/Namibia/.

The Orange Seamount and Canyon Complex, occurs at the western continental margin of southern Africa, spanning the border between South Africa and Namibia. On the Namibian side, it includes Tripp Seamount and a shelf-indenting canyon. The EBSA comprises shelf and shelf-edge habitat with hard and unconsolidated substrates, including at least eleven offshore benthic habitat types of which four habitat types are 'Threatened', one is 'Critically endangered' and one 'Endangered'. The Orange Shelf Edge EBSA is one of few places where these threatened habitat types are in relatively natural/pristine condition. The local habitat heterogeneity is also thought to contribute to the Orange Shelf Edge being a persistent hotspot of species richness for demersal fish species. Although focussed primarily on the conservation of benthic biodiversity and threatened benthic habitats, the EBSA also considers the pelagic habitat, which is characterized by medium productivity, cold to moderate Atlantic temperatures (SST mean = 18.3°C) and moderate chlorophyll levels related to the eastern limit of the Benguela upwelling on the outer shelf. There is an slight overlap of the Reconnaissance Permit Area with this EBSA.

The Orange Cone transboundary EBSA lies well inshore of the Reconnaissance Permit Area and spans the mouth of the Orange River. The estuary is biodiversity-rich but modified, and the coastal area includes many 'Critically endangered', 'Endangered' and 'Vulnerable' habitat types (with the area being particularly important for the 'Critically Endangered' Namaqua Sandy Inshore, Namaqua Inshore Reef and Hard Grounds and Namaqua Intermediate and Reflective Sandy Beach habitat types). The marine environment experiences slow, but variable currents and weaker winds, making it potentially favourable for reproduction of pelagic species. An ecological dependence for of river outflow for fish recruitment on the inshore Orange Cone is also likely. The Orange River Mouth is a transboundary Ramsar site and falls within the Tsau//Khaeb (Sperrgebiet) National Park. It is also under consideration as a protected area by South Africa, and is an important Bird and Biodiversity Area.

The Namaqua Fossil Forest EBSA, which lies inshore of the Reconnaissance Permit Area, is a small seabed outcrop composed of fossilized yellowwood trees at 135-140 m depth, approximately 30 km offshore on the west coast of South Africa. A portion of the EBSA comprised the Namaqua Fossil Forest MPA. The fossilized tree trunks form outcrops of laterally extensive slabs of rock have been colonized by fragile, habitat-forming scleractinian corals and a newly described habitat-forming sponge species. The EBSA thus encompasses a unique feature with substantial structural complexity that is highly vulnerable to benthic impacts.

The Childs Bank and Shelf Edge EBSA, which lies ~ 17 km east of the Reconnaissance Permit Area at its closest point, is a unique submarine bank feature rising from 400 m to ~180 m on the western continental margin on South Africa. This area includes five benthic habitat types, including the bank itself, the outer shelf and the shelf edge, supporting hard and unconsolidated habitat types. Childs Bank and associated habitats are known to support structurally complex cold-water corals, hydrocorals, gorgonians and glass sponges; species that are particularly fragile, sensitive and vulnerable to disturbance, and recover slowly.

The Namaqua Coastal Area EBSA, which lies well inshore of the Reconnaissance Permit Area and encompasses the Namaqua Coastal Area MPA, is characterized by high productivity and community biomass along its shores. The area is important for several threatened ecosystem types represented there, including two 'Endangered' and four 'Vulnerable' ecosystem types, and is important for conservation of estuarine areas and coastal fish species.

The Cape Canyon and Associated Islands EBSA lies ~ 20 km inshore of the southern portion of the Reconnaissance Permit Area at its closest point. The EBSA includes the Benguela Muds MPA and the Cape Canyon, which is thought to hosts fragile habitat-forming species. The area is considered important for pelagic fish, foraging marine mammals and several threatened seabird species and serves to protect nine 'Endangered' and 12 'Vulnerable' ecosystem types, and two that are 'Near Threatened'. There are several small coastal MPAs within the EBSA.

The proposed Seas of Good Hope EBSA is located at the coastal tip of Africa, wrapping around Cape Point and Cape Agulhas. It extends from the coast to the inner shelf, and includes key islands (Seal Island, Dyer Island And Geyser Rocks), two major bays (False Bay and Walker Bay), and is of key importance for threatened species and habitats. The threatened habitats include coastal, inshore and inner shelf ecosystem types. The important life-history stages supported by the area are breeding and/or foraging grounds for a myriad of top predators, including sharks, whales, and seabirds, some of which are threatened species. This EBSA is also the place where the Benguela and Agulhas Currents meet.

The Benguela Upwelling System is a transboundary EBSA is globally unique as the only cold-water upwelling system to be bounded in the north and south by warm-water current systems, and is characterized by very high

primary production (>1 000 mg C.m^{-2}.day^{-1}). It includes important spawning and nursery areas for fish as well as foraging areas for threatened vertebrates, such as sea- and shorebirds, turtles, sharks, and marine mammals. Another key characteristic feature is the diatomaceous mud-belt in the Northern Benguela, which supports regionally unique low-oxygen benthic communities that depend on sulphide oxidising bacteria.

8.6.2.5 BIODIVERSITY PRIORITY AREAS

The National Coastal and Marine Spatial Biodiversity Plan[22] comprises a map of Critical Biodiversity Areas (CBAs), Ecological Support Area (ESAs) and accompanying sea-use guidelines. The CBA Map presents a spatial plan for the marine environment, designed to inform planning and decision-making in support of sustainable development. The sea-use guidelines enhance the use of the CBA Map in a range of planning and decision-making processes by indicating the compatibility of various activities with the different biodiversity priority areas so that the broad management objective of each can be maintained. The intention is that the CBA Map (CBAs and ESAs) and sea-use guidelines inform the MSP Conservation Zones and management regulations, respectively.

The Application Area overlaps with areas mapped as Critical Biodiversity Area 1 (CBA 1): Natural and Critical Biodiversity Area 2: (CBA 2) Natural. Approximately 32.25 % of the proposed 3D acquisition area is covered by CBA 1 and CBA 2 Natural, 0.22% by CBA 1 and CBA 2 Restore, and 1.75% by ESA (see Figure 91). CBA 1 indicates irreplaceable or near-irreplaceable sites that are required to meet biodiversity targets with limited, if any, option to meet targets elsewhere, whereas CBA 2 are "best design sites" and there often alternative areas where feature targets can be met; however, these will be of higher cost to other sectors and / or will be larger areas.

Regardless of how CBAs are split, CBAs are generally areas of low use and with low levels of human impact on the marine environment, but can also include some moderately to heavily used areas with higher levels of human impact. Given that some CBAs are not in natural or near-natural ecological condition, but still have very high biodiversity importance and are needed to meet biodiversity feature targets, CBA 1 and CBA 2 were split into two types based on their ecological condition. CBA Natural sites have natural / near-natural ecological condition, with the management objective of maintaining the sites in that natural / near natural state; and CBA Restore sites have moderately modified or poorer ecological condition, with the management objective to improve ecological condition and, in the long-term, restore these sites to a natural/near-natural state, or as close to that state as possible. ESAs include all portions of EBSAs that are not already within MPAs or CBAs, and a 5-km buffer area around all MPAs (where these areas are not already CBAs or ESAs), with the exception of the eastern edge of Robben Island MPA in Table Bay where a 1.5-km buffer area was applied (Harris *et al.* 2022).

Activities within these management zones are classified into those that are "compatible", those that are "not compatible", and those that have "restricted compatibility". Non-invasive (e.g. seismic surveys) and invasive (e.g. exploration wells) exploration activities are classified as having "restricted compatibility". Activities with restricted compatibility require a detailed assessment to determine whether the recommendation is that they should be permitted (general – as is the case for this assessment), permitted subject to additional regulations (consent), or prohibited, depending on a variety of factors. Petroleum production is, however, classified as "not compatible" in CBAs, but may be compatible, subject to certain conditions, in ESAs (Harris *et al.* 2022).

[22] The latest version of National Coastal and Marine Spatial Biodiversity Plan (v3.2 was released in April 2022) (Harris *et al.* 2022). The Plan is intended to be used by managers and decision-makers in those national government departments whose activities occur in the coastal and marine space, e.g., environment, fishing, transport (shipping), petroleum, mining, and others. It is relevant for the Marine Spatial Planning Working Group where many of these departments are participating in developing South Africa's emerging marine spatial plans. It is also intended for use by relevant managers and decision-makers in the coastal provinces and coastal municipalities, EIA practitioners, organisations working on the coast and ocean, civil society, and the private sector.

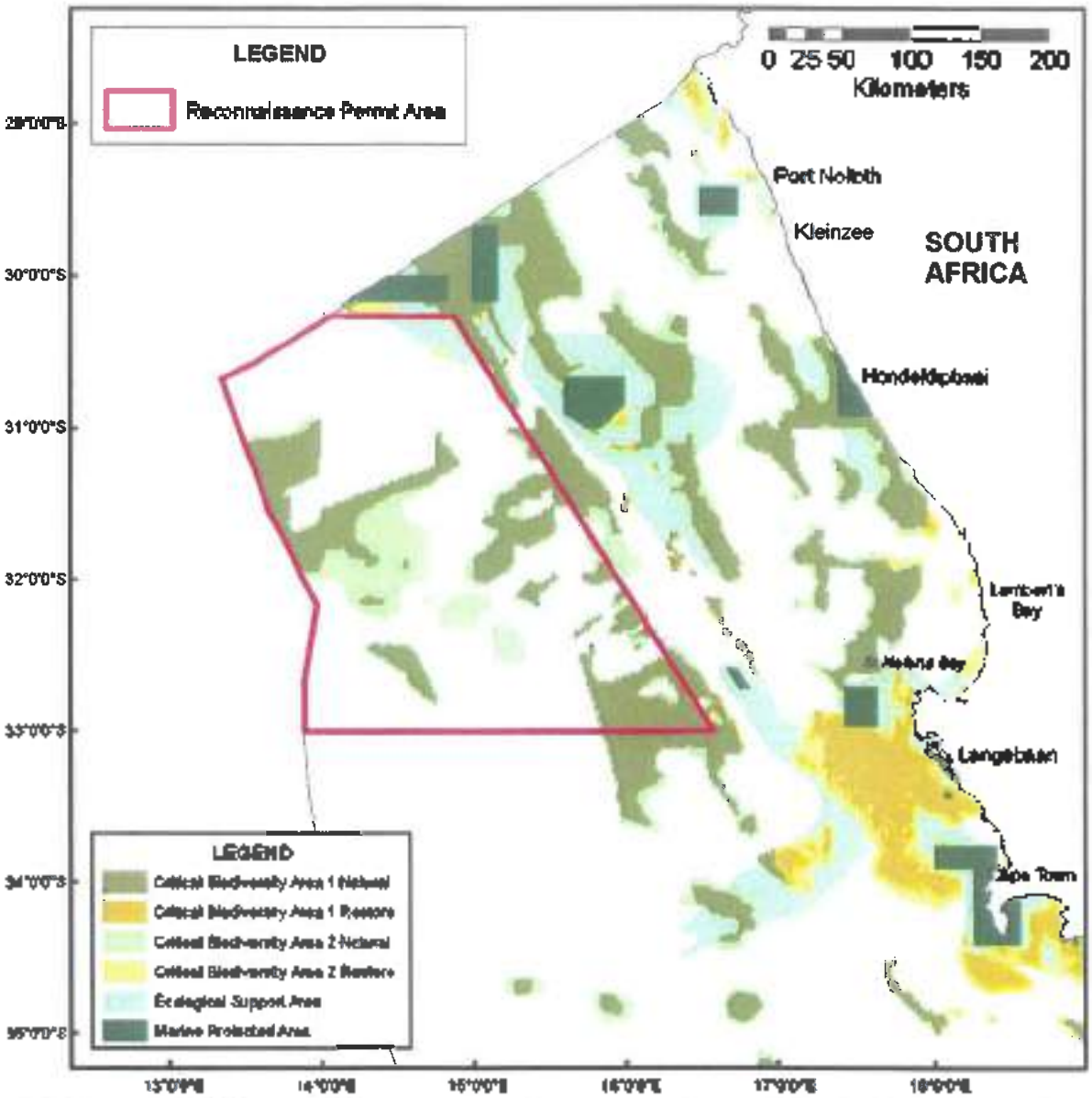

Figure 91: The Reconnaissance Permit Area (red polygon) in relation to Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) (Version 1.2 April 2022).

8.6.2.6 IMPORTANT BIRD AREAS (IBAS)

There are numerous coastal Important Bird Areas (IBAs) in the general project area (Table 30) (www.http://datazone.birdlife.org/). These are all located well inshore of the Reconnaissance Permit area and should in no way be directly affected by the proposed seismic surveys.

Table 30: List of Important Bird Areas (IBAs) and their criteria listings. RAMSAR sites are bolded.

Site Name	IBA Criteria
Orange River Mouth Wetlands (ZA023)	**A1, A3, A4i, A4iii**
Olifants River Estuary (ZA078)	A3, A4i
Verlorenvlei Estuary (ZA082)	**A4i**
Berg River Estuary (ZA083)	**A4i**

Site Name	IBA Criteria
West Coast National Park and Saldanha Bay Islands (ZA 084) (incorporating Langebaan RAMSAR site)	A1, A4i, A4ii, A4iii
Dassen Island (ZA088)	A1, A4i, A4ii, A4iii
Robben Island (ZA089)	A1, A4i, A4ii, A4iii
Rietvlei Wetland: Table Bay Nature Reserve (ZA090)	A1, A4i
Boulders Beach (ZA096)	A1
False Bay Nature Reserve (ZA095)	A1, A4i, A4iii

A1. Globally threatened species; A2 Restricted-range species; A3 Biome-restricted species;

A4. Congregations: i. applies to "waterbird" species; ii. This includes those waterbird species not covered under i; iii. modelled on criterion 6 of the Ramsar Convention for identifying wetlands of international importance. The use of this criterion is discouraged where quantitative data are good enough to permit the application of A4i and A4ii.

The Orange River Mouth wetland located ~235 km to the northeast of the Reconnaissance Permit Area provides an important habitat for large numbers of a great diversity of wetland birds and is listed as a Global IBA (www.http://datazone.birdlife.org/). The area was designated a Ramsar site in June 1991, and processes are underway to declare a jointly-managed transboundary Ramsar reserve.

Various marine IBAs have also been proposed in South African and Namibian territorial waters, with a candidate trans-boundary marine IBA suggested off the Orange River mouth and a further candidate marine IBA suggested in international waters west of the Cape Peninsula (Figure 92). There is no overlap of the Reconnaissance Permit Area with any of these Marine IBAs.

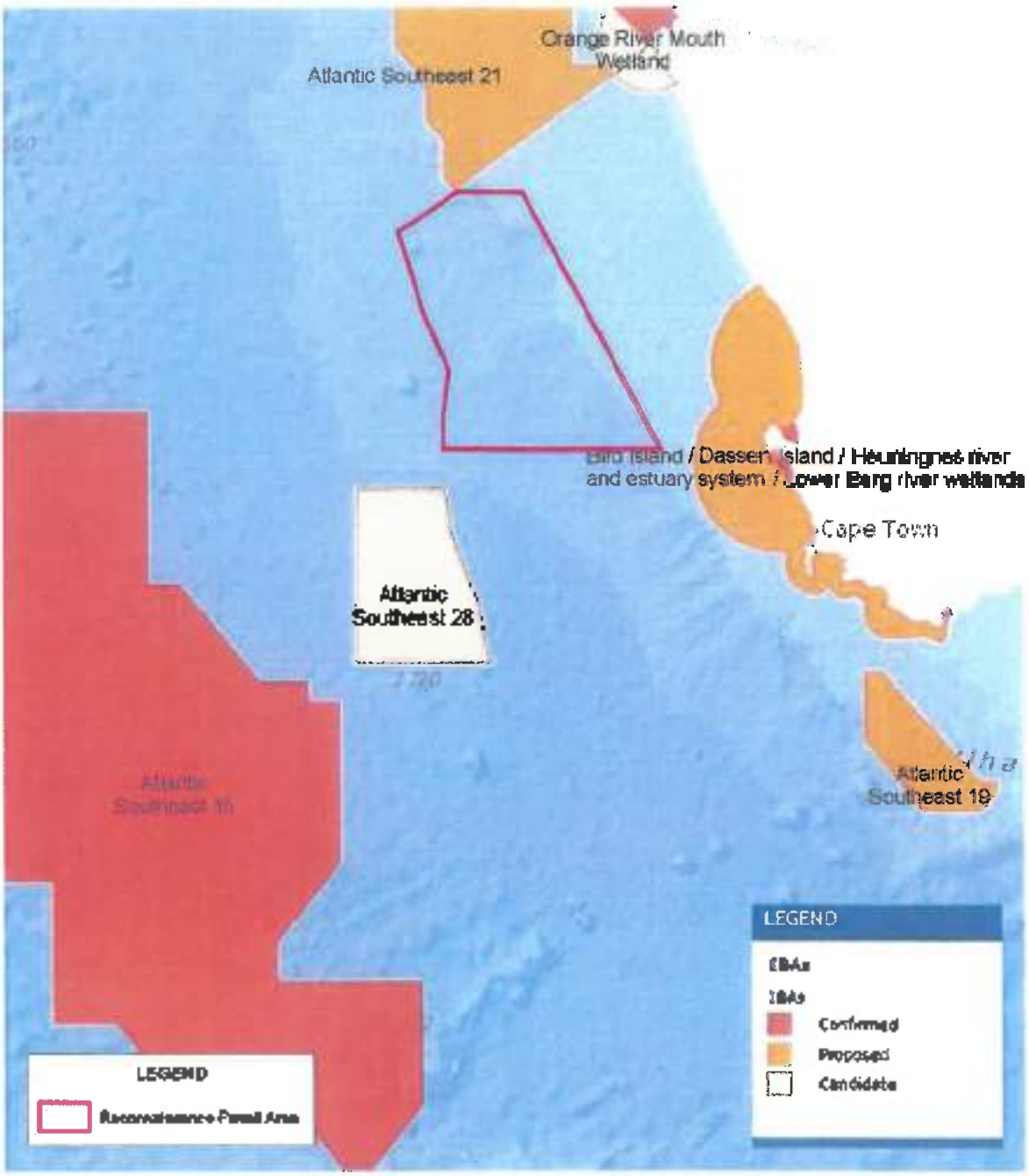

Figure 92: The Reconnaissance Permit Area (red polygon) in relation to coastal and marine IBAs in Namibia (Source: https://maps.birdlife.org/marineIBAs).

8.6.2.7 IMPORTANT MARINE MAMMAL AREAS (IMMAS)

Important Marine Mammal Areas (IMMAs) were introduced in 2016 by the IUCN Marine Mammal Protected Areas Task Force to support marine mammal and marine biodiversity conservation. Complementing other marine spatial assessment tools, including the EBSAs and Key Biodiversity Areas (KBAs), IMMAs are identified on the basis of four main scientific criteria, namely species or population vulnerability, distribution and abundance, key life cycle activities and special attributes. Designed to capture critical aspects of marine mammal biology, ecology and population structure, they are devised through a biocentric expert process that is independent of any political and socio-economic pressure or concern. IMMAs are not prescriptive but comprise an advisory, expert-based classification of areas that merit monitoring and place-based protection for marine mammals and broader biodiversity.

Modelled on the BirdLife International process for determining IBAs, IMMAs are assessed against a number of criteria and sub-criteria, which are designed to capture critical aspects of marine mammal biology, ecology and population structure. These criteria are:

- **Criterion A – Species or Population Vulnerability**
    - Areas containing habitat important for the survival and recovery of threatened and declining species.
- **Criterion B – Distribution and Abundance**
    - Sub-criterion B1 – Small and Resident Populations: Areas supporting at least one resident population, containing an important proportion of that species or population that are occupied consistently.
    - Sub-criterion B2 – Aggregations: Areas with underlying qualities that support important concentrations of a species or population.
- **Criterion C – Key Life Cycle Activities**
    - Sub-criterion C1 – Reproductive Areas: Areas that are important for a species or population to mate, give birth, and/or care for young until weaning.
    - Sub-criterion C2 – Feeding Areas: Areas and conditions that provide an important nutritional base on which a species or population depends.
    - Sub-criterion C3 – Migration Routes: Areas used for important migration or other movements, often connecting distinct life-cycle areas or the different parts of the year-round range of a non-migratory population.
- **Criterion D – Special Attributes**
    - Sub-criterion D1 – Distinctiveness: Areas which sustain populations with important genetic, behavioural or ecologically distinctive characteristics.
    - Sub-criterion D2 – Diversity: Areas containing habitat that supports an important diversity of marine mammal species

Although much of the West Coast of South Africa has not yet been assessed with respect to its relevance as an IMMA, the coastline from the Olifants River mouth on the West Coast to the Mozambiquan border overlaps with three declared IMMAs (Figure 93) namely the following:

- Southern Coastal and Shelf Waters of South Africa IMMA (156 700 km^2),
- Cape Coastal Waters IMMA (6 359 km^2), and
- South East African Coastal Migration Corridor IMMA (47 060 km^2).

These are described briefly below based on information provided in IUCN-Marine Mammal Protected Areas Task Force (2021) (www.marinemammalhabitat.org).

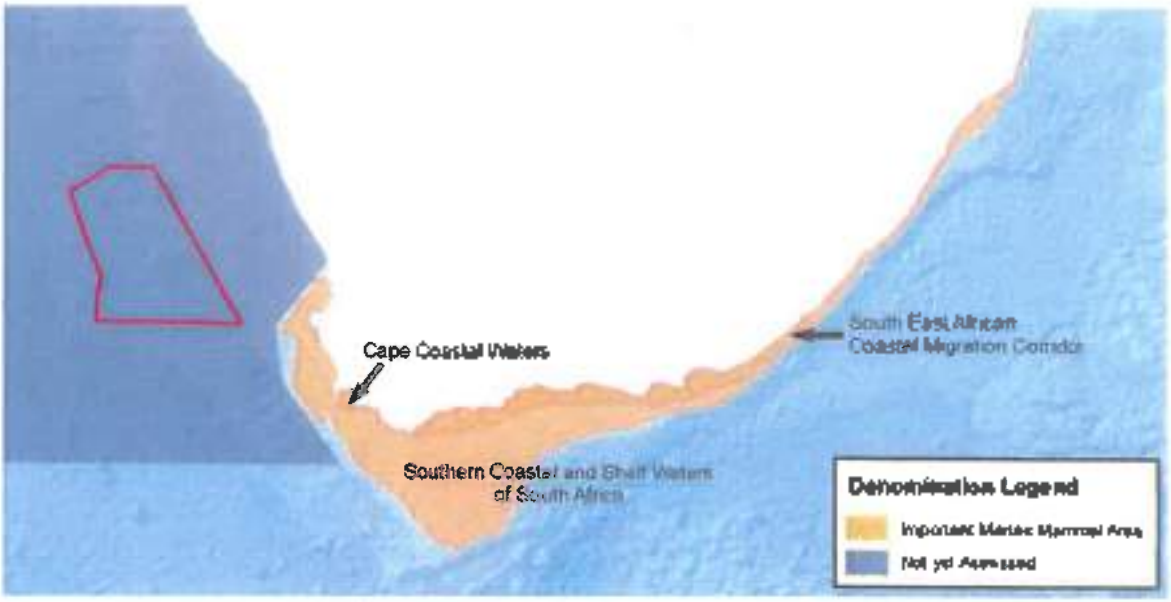

Figure 93: Reconnaissance Permit Area (red polygon) in relation to coastal and marine IMMAs (Source: www.marinemammalhabitat. org/imma-eatlas/).

The 166 700 km² Southern Coastal and Shelf Waters of South Africa IMMA extends from the Olifants River mouth to the mouth of the Cintsa River on the Wild Coast. Qualifying species are the Indian Ocean Humpback dolphin (Criterion A, B1), Bryde's whale (Criterion C2), Indo-Pacific bottlenose dolphin (Criterion B1, C3, D1), Common dolphin (Criterion C2) and Cape fur seal (criterion C2). The IMMA covers the area supporting the important 'sardine run' and the marine predators that follow and feed on the migrating schools (Criterion C2) as well as containing habitat that supports an important diversity of marine mammal species (Criterion D2) including the Indian Ocean humpback dolphin, the inshore form of Bryde's whale, Indo-Pacific bottlenose dolphin, common dolphin, Cape fur seal, humpback whales, killer whales and southern right whales.

The Cape Coastal Waters IMMA extends from Cape Point to Woody Cape at Algoa Bay and extends over some 6 359 km². It serves as one of the world's three most important calving and nursery grounds for southern right whales, which occur in the extreme nearshore waters (within 3 km of the coast) from Cape Agulhas to St. Sebastian Bay between June and November (Criterion B2, C1). Highest densities of cow-calf pairs occur between Cape Agulhas and the Duiwenhoks River mouth (Struisbaai, De Hoop, St Sebastian Bay), while unaccompanied adult densities peak in Walker Bay and False Bay. The IMMA also contains habitat that supports an important diversity of marine mammal species including the Indian Ocean humpback dolphin and Indo-Pacific bottlenose dolphin.

The South East African Coastal Migration Corridor IMMA extends some 47 060 km² from Cape Agulhas to the Mozambiquan border and serves as the primary migration route for C1 substock of Southern Hemisphere humpback whales (Criterion C3). On their northward migration between June and August, they are driven closer to shore due to the orientation of the coast with the Agulhas Current, whereas during the southward migration from September to November, they remain further offshore (but generally within 15 km of the coast) utilising the southward flowing Agulhas Current as far west as Knysna. The IMMA also contains habitat that supports an important diversity of marine mammal species including the Indian Ocean humpback dolphin, Common dolphin, Indo-Pacific bottlenose dolphin, Spinner dolphin, Southern Right whale, and killer whale.

There is no overlap of the Reconnaissance Permit Area with these IMMAs as it falls within the area along the West Coast of South Africa that has not yet been assessed.

8.7 SOCIO-ECONOMIC

This section provides and overview of the socio-economic environment for the study area. The majority of this information has been sourced from the Social Impact Assessment undertaken by Equispectives (Pty) Ltd, included in Appendix 3.

8.7.1 POPULATION

The baseline description of the population will take place on three levels, namely provincial, district and local. Impacts can only truly be comprehended by understanding the differences and similarities between the different levels. The baseline description will focus on the municipal areas along the west coast that are most likely to be affected by the proposed project.

8.7.1.1 POPULATION AND HOUSEHOLD SIZES

According to the Community Survey 2016, the population of South Africa is approximately 55,7 million and has shown an increase of about 7.5% since 2011. The household density for the country is estimated on approximately 3.29 people per household, indicating an average household size of 3-4 people (leaning towards 3) for most households, which is down from the 2011 average household size of 3.58 people per household. Smaller household sizes are in general associated with higher levels of urbanisation.

The greatest increase in population since 2011 has been in the Swartland and Saldanha Bay Local Municipalities (Table 31) and the increases were well above the national average. The Richtersveld Local Municipality where Port Nolloth is located is the only one of the coastal municipalities in the Northern Cape that showed an increase in population. The Kamiesberg Local Municipality where Hondeklip Bay is located, saw the greatest decrease in population between 2011 and 2016. Population density refers to the number of people per square kilometre and the population density on a national level has increased from 42.45 people per km^2 in 2011 to 45.63 people per km^2 in 2016. The City of Cape Town had the highest population density in 2016, and the Kamiesberg Local Municipality the lowest. Figure 94 gives a comparison of the population density. The municipalities in the rural areas in the Northern Cape are the least densely populated, while the metropolitan areas in Cape Town have the highest population density.

Figure 95 shows the number of people per ward. The wards in the rural areas tend to have less people spread over a greater area, while in the urban areas there are more people in a much smaller area.

Table 31: Population density and growth estimates (sources: Census 2011, Community Survey 2016)

Area	Size in km^2	Population 2011	Population 2016	Population density 2011	Population density 2016	Growth in population (%)
Northern Cape	372,889	1,145,861	1,193,780	3.07	3.20	4.18
Namakwa DM	126,836	115,842	115,488	0.91	0.91	-0.31
Richtersveld LM	8,008	11,982	12,487	1.25	1.30	4.21
Nama Khoi LM	17,990	47,041	46,512	2.61	2.59	-1.12
Kamiesberg LM	14,208	10,187	9,605	0.72	0.68	-5.71
Western Cape	129,462	5,822,734	6,279,730	44.96	48.51	7.85
West Coast DM	31,118	391705	436,405	12.59	14.02	11.39
Matzikama LM	12,961	67147	71,045	5.17	5.47	5.81
Cederberg LM	8,007	49,768	52,949	6.22	6.61	6.39
Bergrivier LM	4,407	61,897	67,474	14.05	15.31	9.01
Saldanha Bay LM	2,015	99,193	111,179	49.23	55.17	12.08
Swartland LM	3,708	113,762	193,762	30.68	56.07	17.58
City of Cape Town Metropolitan	2,442	3,740,026	4,004,799	1,532.17	2,640.64	7.08

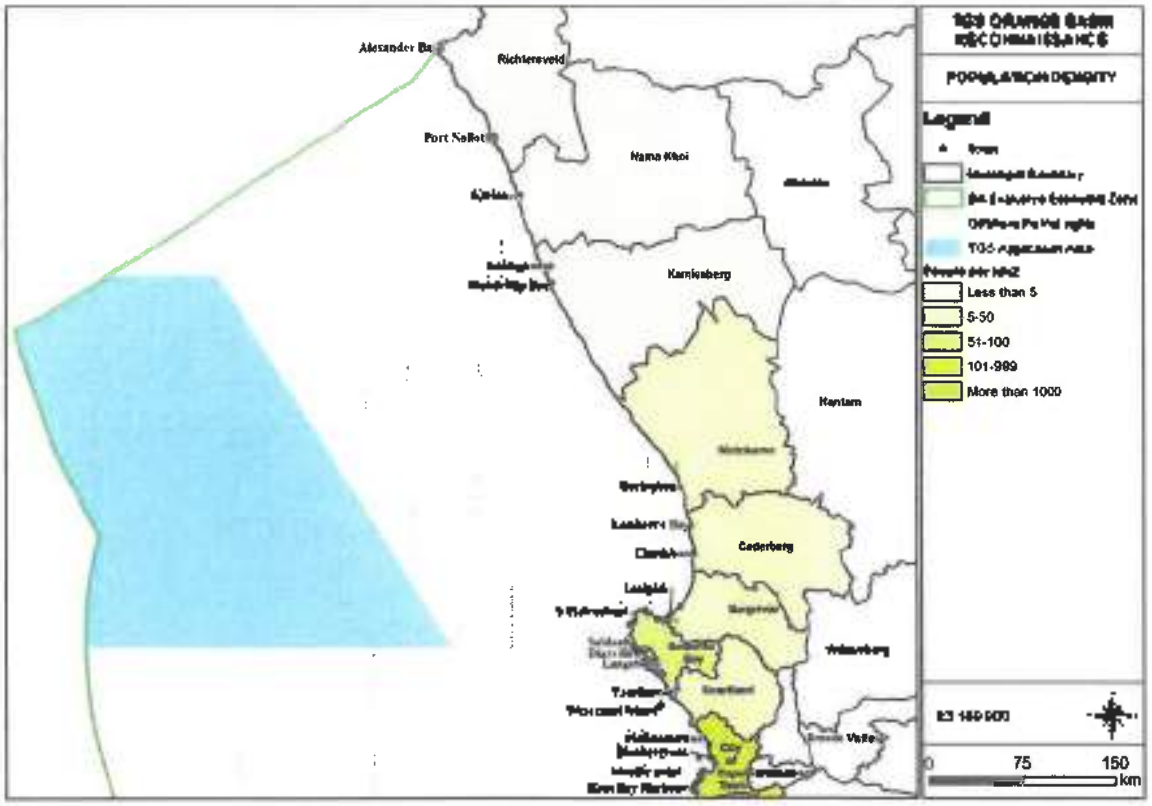

Figure 94: Population density (source: Community Survey 2016)

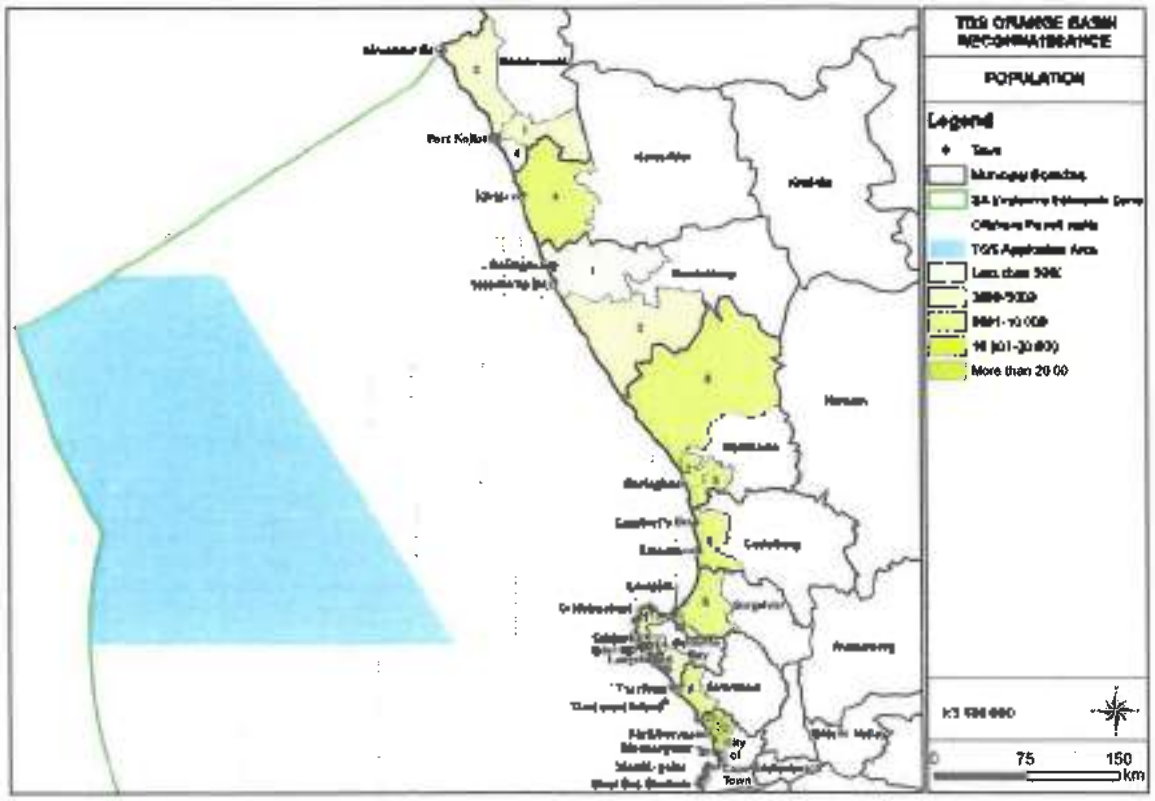

Figure 95: People per ward (source: Census 2011)

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The number of households in the study area has increased on all levels (Table 32). The proportionate increase in households were greater than the increase in population on all levels. The greatest proportional increases in households were in the Swartland and Saldanha Bay Local Municipalities. The average household size has shown a decrease on all levels, which means there are more households, but with less members.

Table 32: Household sizes and growth estimates (sources: Census 2011, Community Survey 2016)

Area	Households 2011	Households 2016	Average household size 2011	Average household size 2016	Growth in households (%)
Northern Cape	301,485	353,709	3.80	3.38	17.35
Namakwa DM	33,456	37,669	3.42	3.07	11.26
Richtersveld LM	3,545	4,211	3.38	2.97	18.85
Nama Khoi LM	18,199	14,546	3.57	3.20	10.26
Kamiesberg LM	3,143	3,319	3.24	2.89	5.60
Western Cape	1,834,080	1,933,876	3.56	3.25	18.35
West Coast DM	106,781	129,862	3.67	3.36	21.62
Matzikama LM	18,835	20,821	3.57	3.41	10.54
Cederberg LM	13,513	15,279	3.68	3.47	13.07
Bergrivier LM	16,279	19,072	3.60	3.34	17.19
Saldanha Bay LM	28,895	35,550	3.44	3.13	23.29
Swartland LM	29.324	39.139	3.69	3.42	33.47
City of Cape Town Metropolitan	1,066,573	1,264,849	3.50	3.27	18.57

Figure 96 shows the number of households per ward. The wards in the Kamiesberg Local Municipality have the fewest people per ward.

The total dependency ratio is used to measure the pressure on the productive population and refer to the proportion of dependents per 100 working-age population. As the ratio increases, there may be an increased burden on the productive part of the population to maintain the upbringing and pensions of the economically dependent. A high dependency ratio can cause serious problems for a country as the largest proportion of a government's expenditure is on health, social grants and education that are most used by the old and young population.

The Kamiesberg Local Municipality has the highest total dependency ratio (Table 33), while in the Richtersveld Local Municipality have the lowest. Employed dependency ratio refers to the proportion of people dependent on the people who are employed, and not only those of working age. The employed dependency ratio for the Kamiesberg and Nama Khoi Local Municipalities are the highest. This suggests high levels of poverty in these areas. Figure 97 and Figure 98 show the total and employed dependency ratios on a ward level.

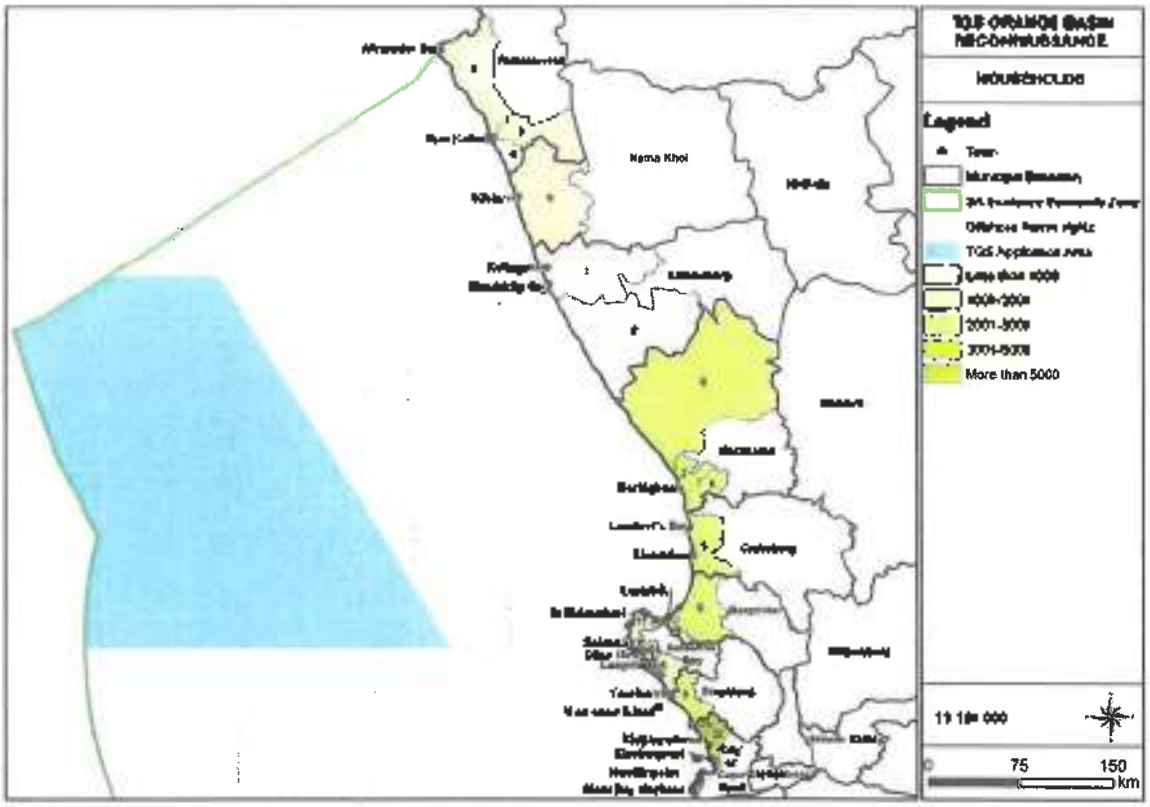

Figure 96: Households per ward (source: Census 2011)

Table 33: Total dependency ratios (source: Census 2011).

Area	Total dependency	Youth dependency	Aged dependency	Employed dependency
Northern Cape	55.75	46.94	8.80	78.82
Namakwa DM	51.13	39.01	12.22	70.81
Richtersveld LM	42.51	33.96	8.55	61.36
Ward 2	36.82	32.89	3.93	56.70
Ward 3	39.54	32.95	6.59	64.57
Ward 4	48.60	35.93	12.67	68.98
Nama Khoi LM	49.45	37.16	12.29	73.74
Ward 9	45.05	35.41	9.63	76.99
Kamiesberg LM	57.89	41.84	16.05	78.37
Ward 1	54.81	40.19	14.62	79.04
Ward 2	48.90	33.04	15.86	69.06
Western Cape	44.96	36.44	8.52	68.47
West Coast DM	45.82	37.14	8.78	63.98
Matzikama LM	49.39	40.05	9.34	64.55
Ward 2	48.80	38.55	10.24	67.26
Ward 5	46.38	33.96	12.41	59.82
Ward 6	53.71	41.14	12.57	71.99
Cederberg LM	46.99	37.59	9.40	62.75

Area	Total dependency	Youth dependency	Aged dependency	Employed dependency
Ward 5	51.76	38.06	13.70	69.48
Bergrivier LM	46.89	36.62	10.27	61.61
Ward 6	46.60	37.11	9.49	65.02
Ward 7	55.44	23.94	31.50	68.70
Saldanha Bay LM	43.86	36.42	7.54	65.36
Ward 1	39.71	36.79	2.91	68.76
Ward 3	28.02	23.68	5.35	74.04
Ward 5	39.22	27.63	11.66	54.89
Ward 6	59.99	25.93	34.06	61.44
Ward 11	44.91	32.19	12.73	63.50
Ward 12	45.16	41.60	3.56	67.57
Ward 14	42.82	34.92	7.90	64.68
Swartland LM	44.68	36.21	8.47	64.27
Ward 3	50.76	33.31	17.44	58.03
City of Cape Town Metropolitan	43.61	35.65	7.97	65.88
Ward 4	35.95	31.80	4.16	52.38
Ward 21	38.49	26.93	11.56	47.29
Ward 29	47.25	40.95	6.30	69.98
Ward 32	44.89	41.04	3.85	68.39
Ward 54	39.01	16.17	22.84	51.04
Ward 55	41.63	26.22	15.41	56.16
Ward 74	40.68	33.04	7.63	58.62
Ward 107	40.60	28.96	11.64	46.30
Ward 113	36.71	26.07	10.64	47.93
Ward 115	26.92	14.93	12.00	60.94

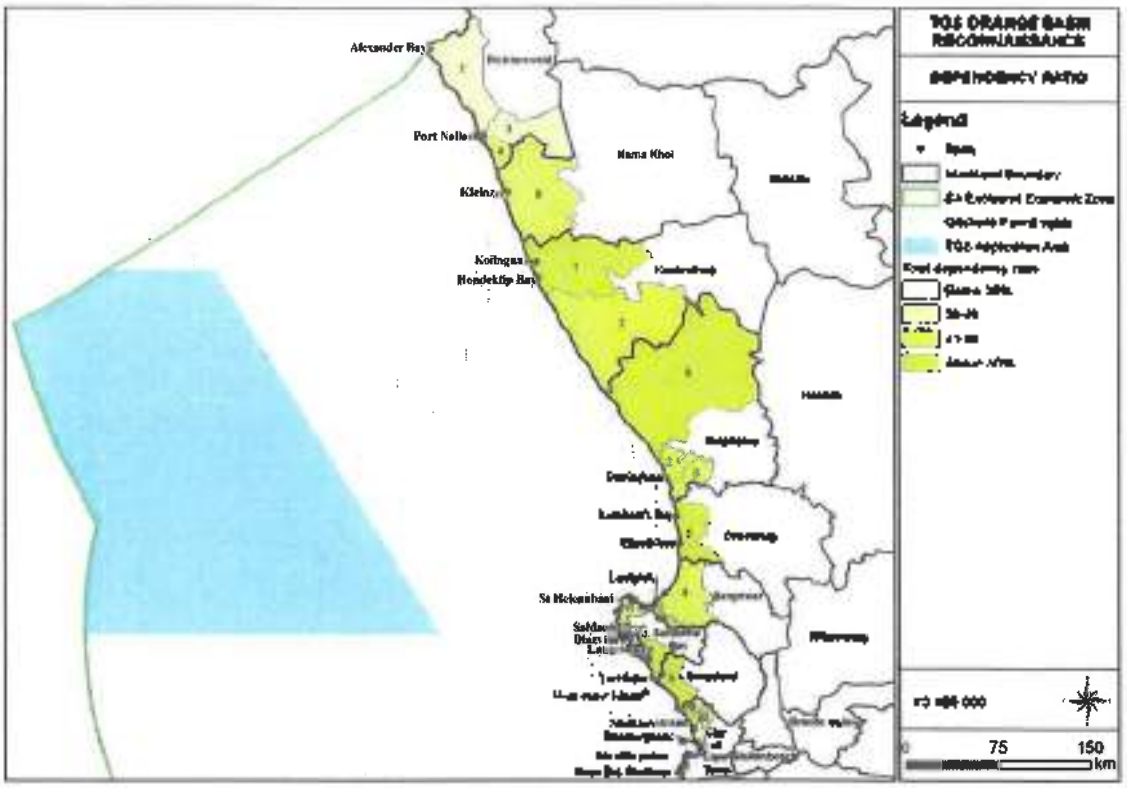

Figure 97: Total dependency ratios (source: Census 2011)

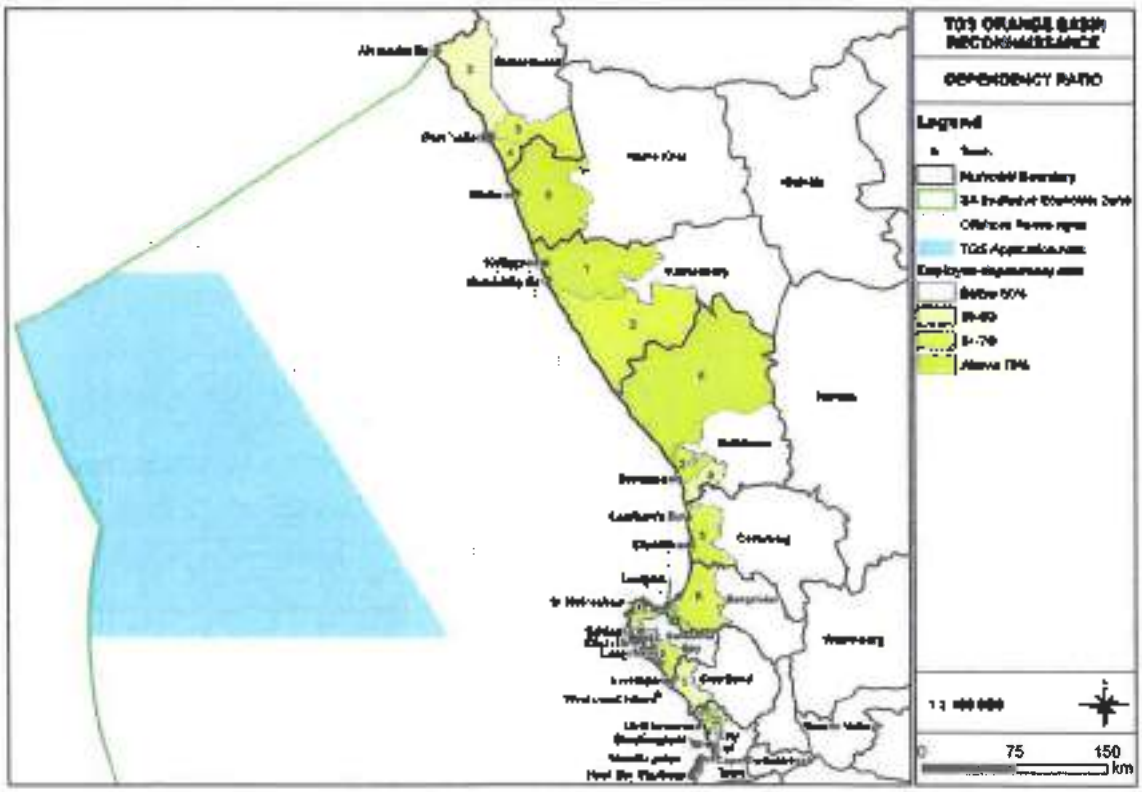

Figure 98: Employed dependency ratio (source: Census 2011).

Poverty is a complex issue that manifests itself in economic, social, and political ways and to define poverty by a unidimensional measure such as income or expenditure would be an oversimplification of the matter. Poor people themselves describe their experience of poverty as multidimensional. The South African Multidimensional Poverty Index (SAMPI) (Statistics South Africa, 2014) assess poverty on the dimensions of health, education, standard of living and economic activity using the indicators child mortality, years of schooling, school attendance, fuel for heating, lighting, and cooking, water access, sanitation, dwelling type, asset ownership and unemployment.

The poverty headcount refers to the proportion of households that can be defined as multi-dimensionally poor by using the SAMPI's poverty cut-offs (Statistics South Africa, 2014). The poverty headcount has increased on all levels since 2011 (Table 34), indicating an increase in the number of multi-dimensionally poor households.

The intensity of poverty experienced refers to the average proportion of indicators in which poor households are deprived (Statistics South Africa, 2014). The intensity of poverty has increased slightly on all levels. The intensity of poverty and the poverty headcount is used to calculate the SAMPI score. A higher score indicates a very poor community that is deprived on many indicators. The SAMPI score has decreased in the Northern Cape (Table 34) as well as the Northern Cape municipalities included in the study. In the Nama Khoi Local Municipality, the score remained the same although there was a slight increase in the intensity of the poverty. In the Western Cape the SAMPI score decreased on a provincial level, but in the West Coast District Municipality it has increased.

Table 34: Poverty and SAMPI scores (sources: Census 2011 and Community Survey 2016).

Area	Poverty headcount 2011 (%)	Poverty intensity 2011 (%)	SAMPI 2011	Poverty headcount 2016 (%)	Poverty intensity 2016 (%)	SAMPI 2016
Northern Cape	7.1	42.1	0.030	6.6	42	0.028
Namakwa DM	3.2	40.2	0.013	2.8	41.6	0.012
Richtersveld LM	5.1	39.9	0.012	1.9	38.3	0.007
Nama Khoi LM	2.5	40.4	0.010	2.5	41.7	0.010
Kamiesberg LM	5.1	40	0.020	3	39	0.012
Western Cape	3.8	42.6	0.015	2.7	40.1	0.011
West Coast DM	2	41.8	0.008	2.9	44.9	0.013
Matzikama LM	3.4	42.0	0.014	0.8	42.5	0.003
Cederberg LM	7.8	42.9	0.032	3.6	45.7	0.016
Bergrivier LM	1	43.7	0.004	1.6	41.5	0.007
Saldanha Bay LM	2.2	41	0.009	6.7	45.4	0.030
Swartland LM	1	40.8	0.004	0.9	38.9	0.004
City of Cape Town Metropolitan	3.9	42.8	0.017	3.6	39.3	0.010

8.7.1.2 POPULATION COMPOSITION, AGE, GENDER AND HOME LANGUAGE

The majority of the people living in wards adjacent to the ocean are classified as belonging to the Coloured population group (Figure 99). The Coloured population group include Khoe and San people who in general find this classification offensive and they do not identify as such.

The Kamiesberg Local Municipality has the highest average age (33.17 years) while the Saldanha Bay Local Municipality has the lowest (29.86 years). Average age varies on a ward level. The gender distribution is more or less equal in most municipal areas, except for the Richtersveld Local Municipality where there is a bias towards males. This is most likely due to mining activities that are taking place in the area. On a ward level, most people have Afrikaans as home language (Figure 100).

JCB

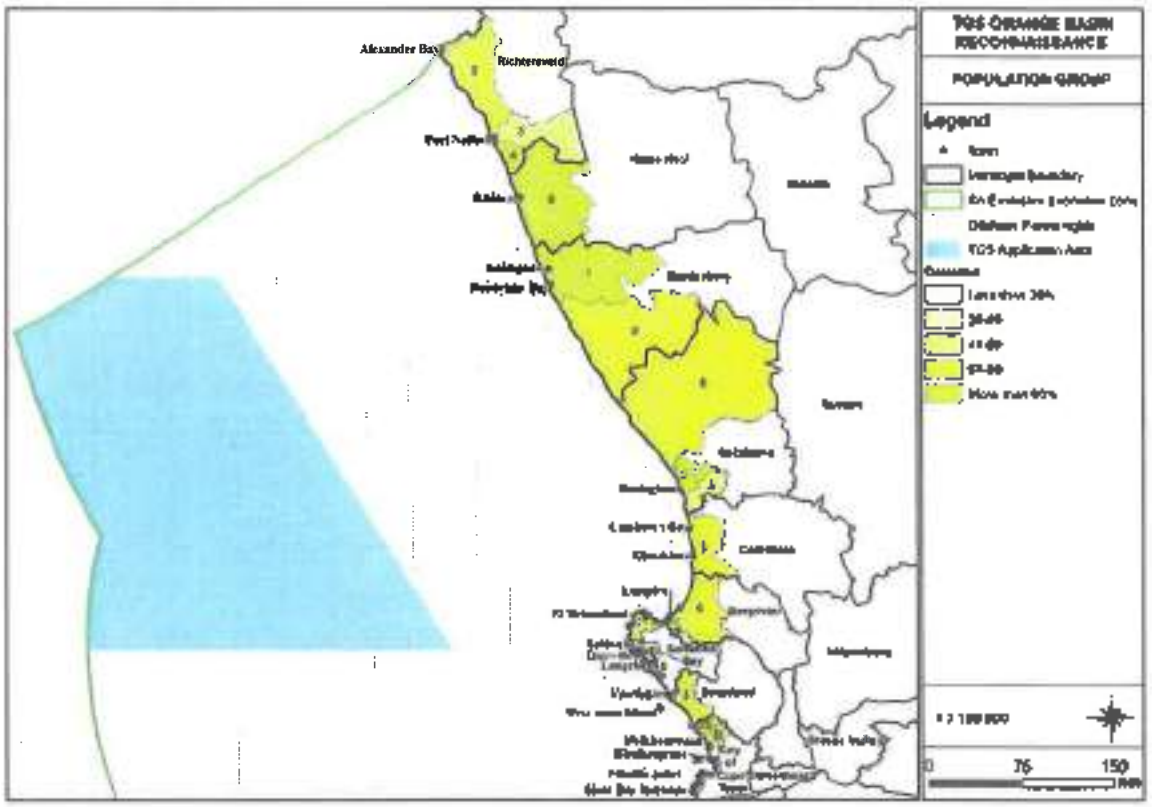

Figure 98: Classified as Coloured (shown in percentage, source: Census 2011)

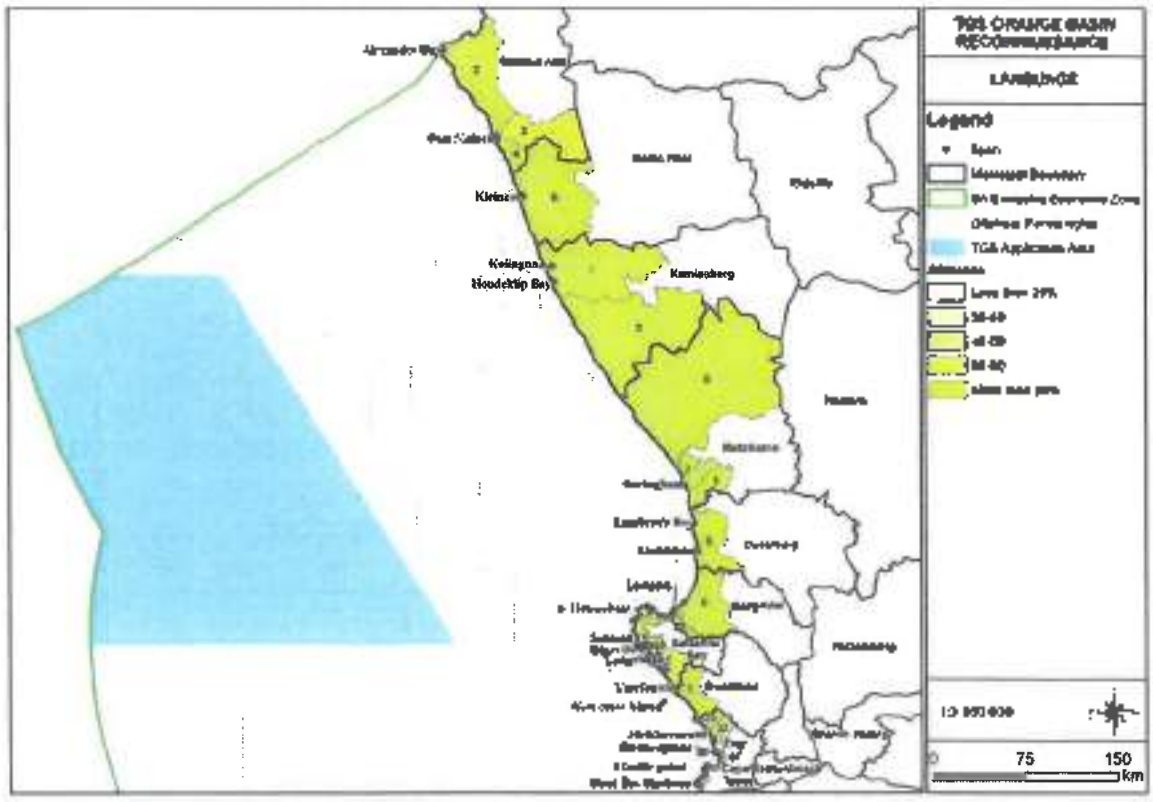

Figure 100: Home language Afrikaans (shown in percentage, source; Census 2011)

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8.7.1.3 EDUCATION

The highest proportion of people who did not complete high school is in the Saldanha Bay (73.59%) and the Swartland (72.83%) Local Municipalities while the Matzikama (32.7%) and Nama Khoi (37.37%) Local Municipalities have the lowest proportion of people that did not complete high school (Figure 101).

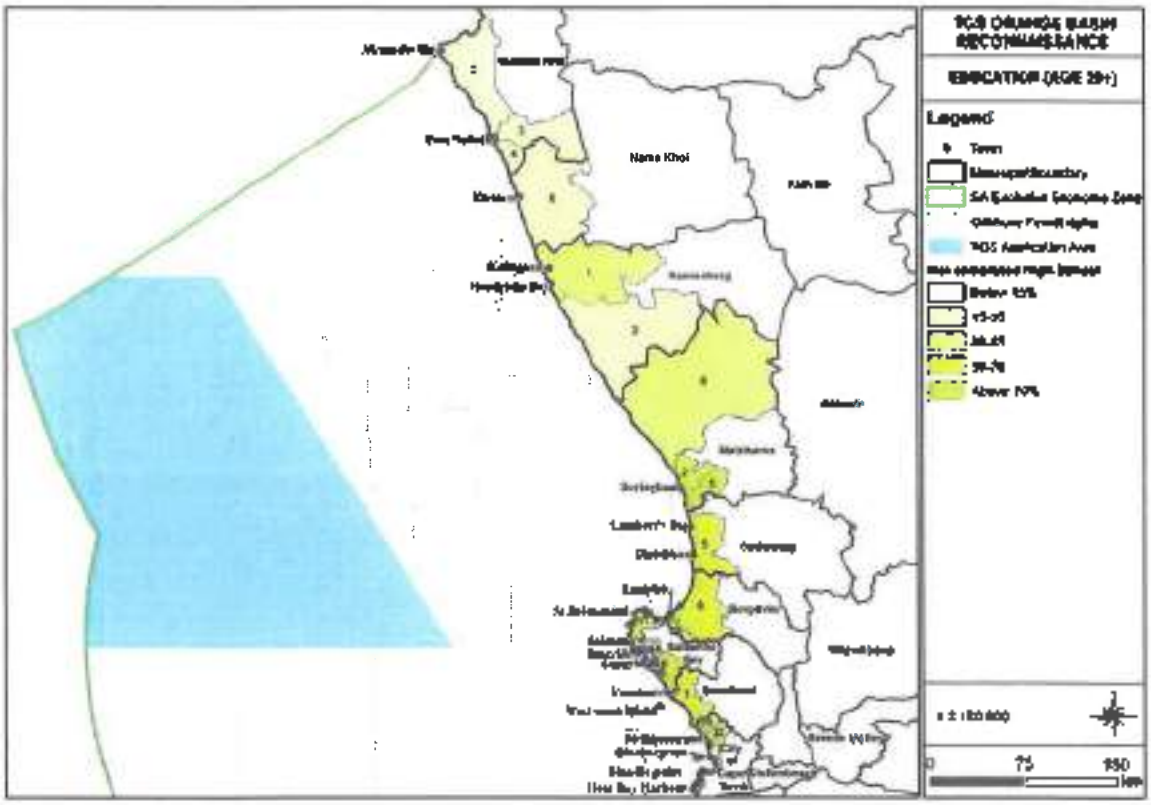


Figure 101: Proportion of people that did not complete secondary school (shown in percentage, source: Census 2011).

8.7.1.4 EMPLOYMENT

In 2011 the area with the highest proportion of unemployed people was Ward 1 in the Kamiesberg Local Municipality where Hondeklip Bay is located (Figure 102). The proportion of unemployed people include those actively seeking for work as well as discouraged work seekers. The majority of people who are working, is employed in the formal sector.

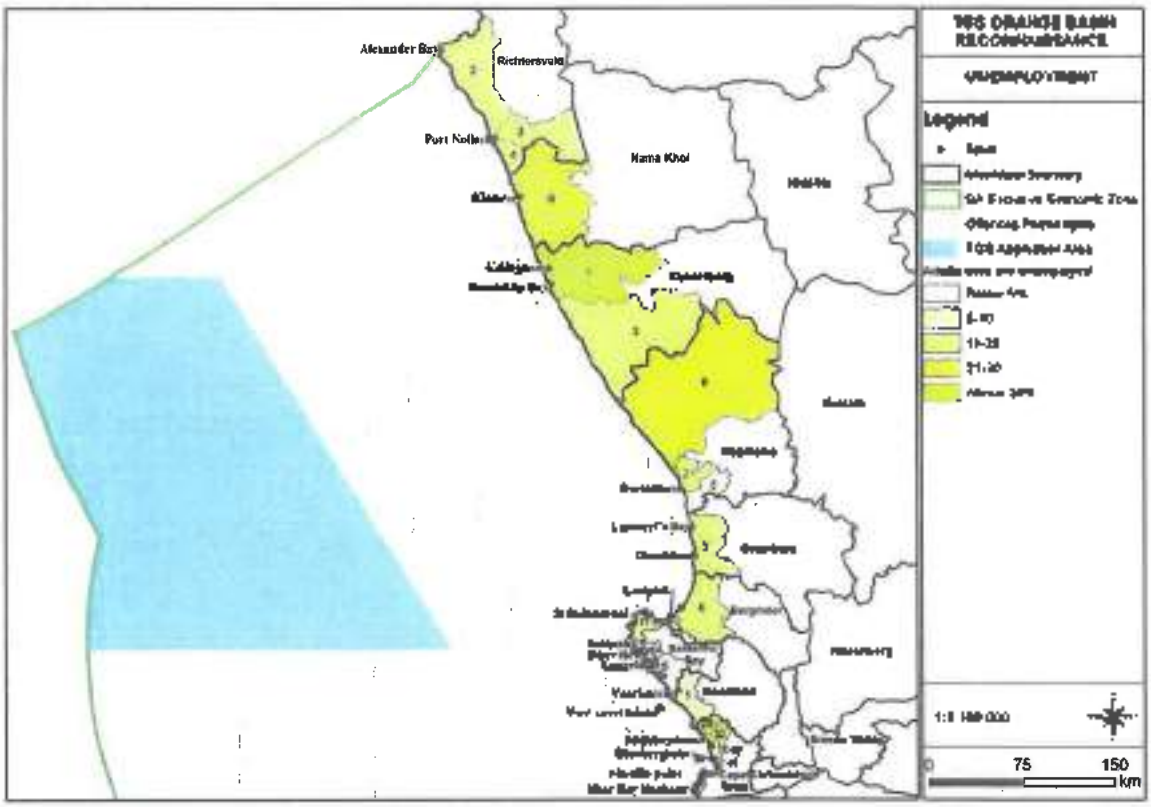


Figure 102: Proportion of adults that are unemployed (shown in percentage, source: Census 2011).

8.7.1.5 HOUSEHOLD INCOME

In 2011 almost a third of households on municipal level had an annual household income of R19 600 or less, with great variation between wards (Figure 103). Statistics South Africa (2015) has calculated the Food Poverty Line (FPL) for the Northern Cape Province as R310 per capita per month for 2011 where the FPL is the Rand value below which individuals are unable to purchase or consume enough food to supply them with the minimum per-capita-per-day energy requirement for good health. The FPL is one of three poverty lines, the others being the upper bound poverty line (UBPL) and the lower bound poverty line (LBPL). The LBPL and UBPL both include a non-food component. Individuals at the LBPL do not have enough resources to consumer or purchase both adequate food and non-food items and are forced to sacrifice food to obtain essential non-food items, while individuals at the UBPL can purchase both adequate food and non-food items. The LBPL for the Northern Cape Province was R457 per capita per month in 2011 and the UBPL R705 per capita per month respectively. The FPL for Western Cape was R352 per capita per month, the LBPL was R545 and the UPL was R804. Based on this, a household with four members needed an annual household income of approximately R17 000 in 2011 to be just above the FPL. When comparing this with the SAMPI data it seems as if there are more households below the poverty lines in the area than who are multi-dimensionally poor. This is due to the poverty lines using a financial measure and do not take into consideration payment in kind and livelihood strategies such as subsistence farming. If these were to be converted into a Rand value, the poverty line picture may have a closer resemblance to the SAMPI data.

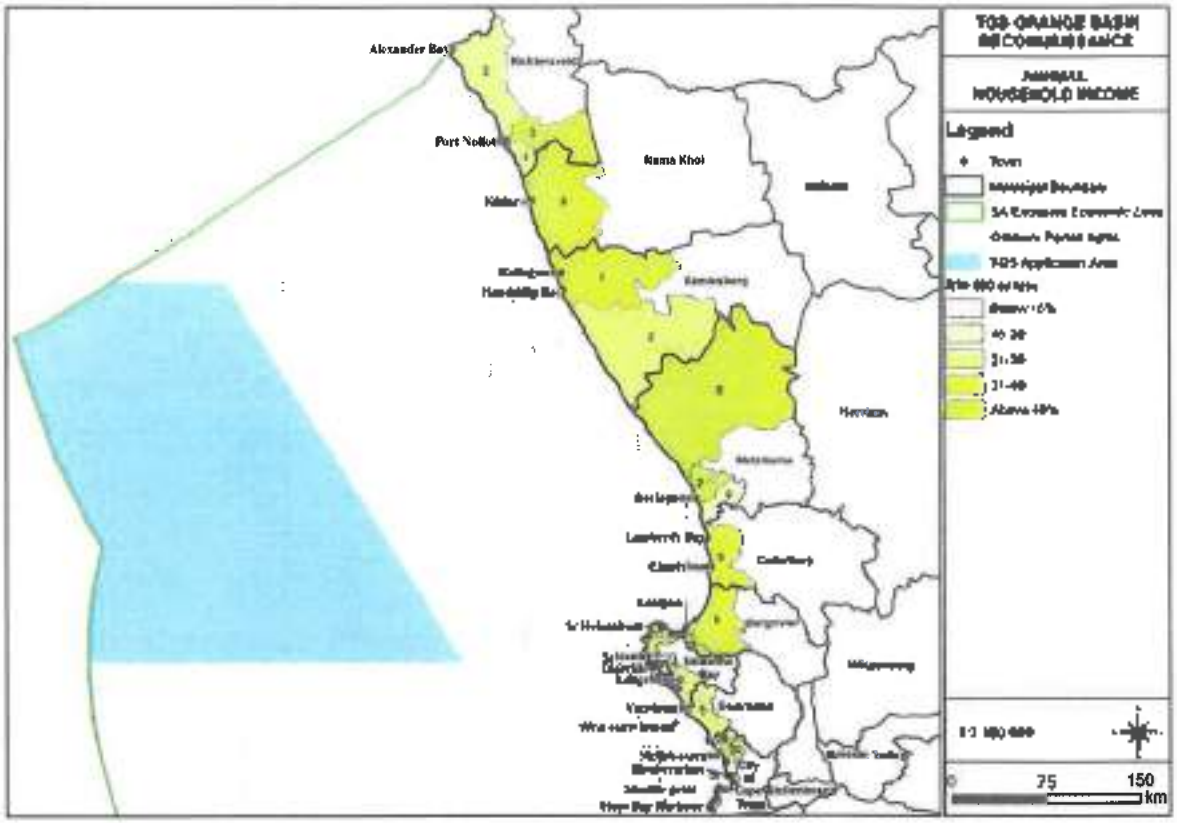


Figure 103: Proportion of households with an annual income of R19 600 or less in 2011 (shown in percentage, source: Census 2011).

8.7.1.6 HOUSING

The majority of households live in areas that are classified as urban, except in the Matzikama Local Municipality (Figure 104). The majority of people live in formal dwellings that that are houses or structures that are on a separate stand or yard. The incidence of informal dwellings is relatively low (Figure 105), except for Ward 1 of the Saldanha Bay Local Municipality where the majority of people live in informal dwellings. Wards 32 and 74 also have a relatively large proportion of households living in informal dwellings.

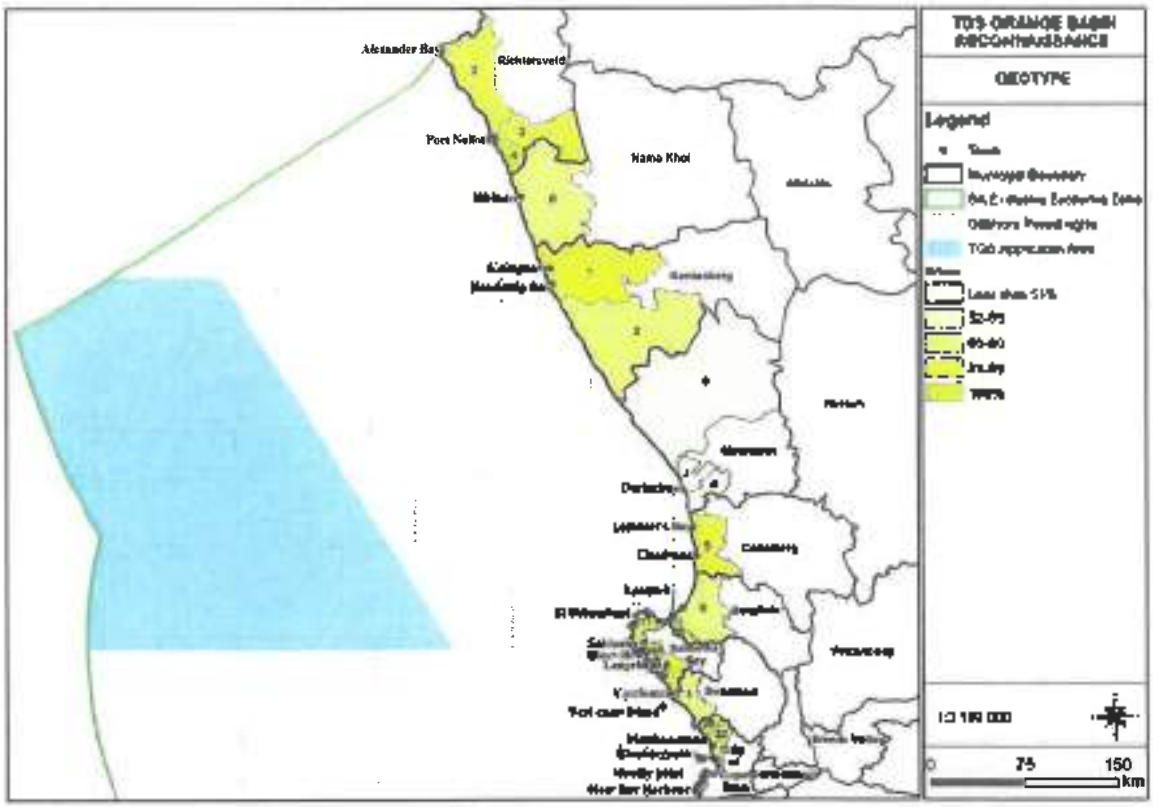


Figure 104: Proportion of households that live in urban areas (shown in percentage, source: Census 2011).

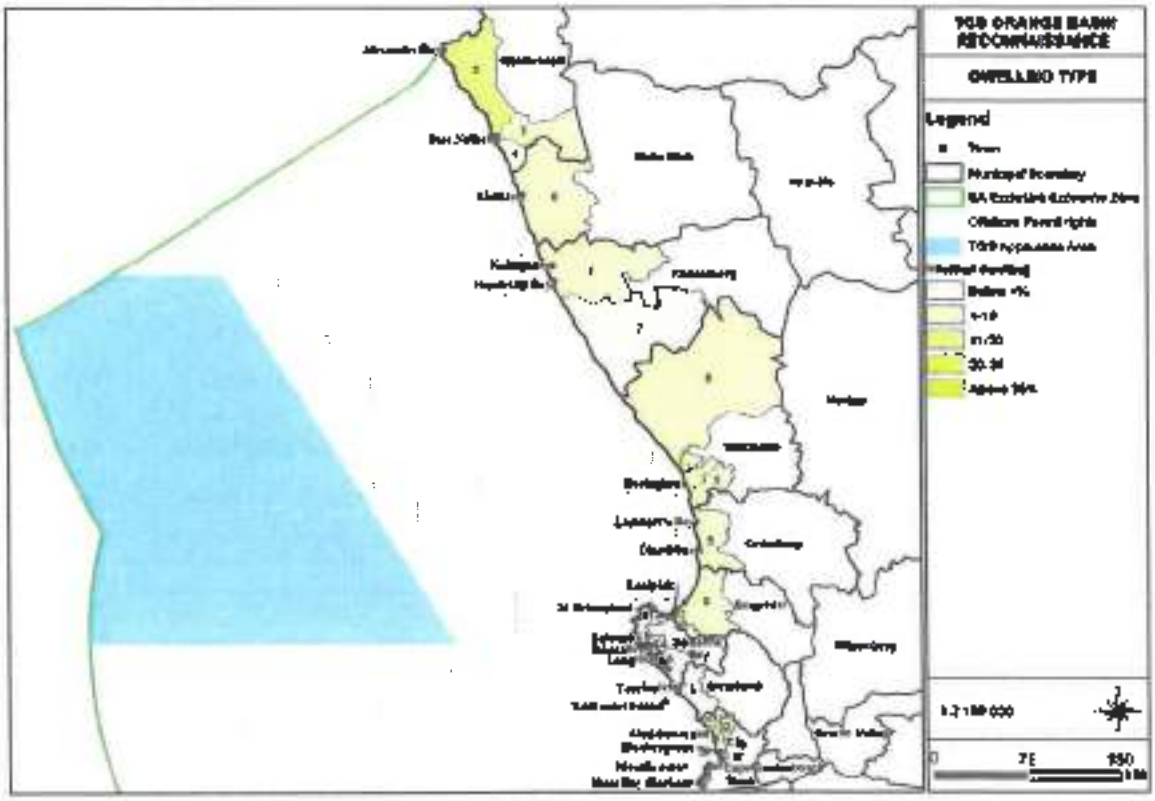


Figure 105: Proportion of households that live in informal dwellings (shown in percentage, source: Census 2011).

3.7.1.7 ACCESS TO WATER AND SANITATION

Access to piped water, electricity and sanitation relate to the domain of Living Environment Deprivation as identified by Noble *et al* (2006). Most households get their water from a regional or local water scheme, with the lowest incidence in Ward 1 of the Kamieskroon Local Municipality where Hondeklip Bay is located (Figure 106).

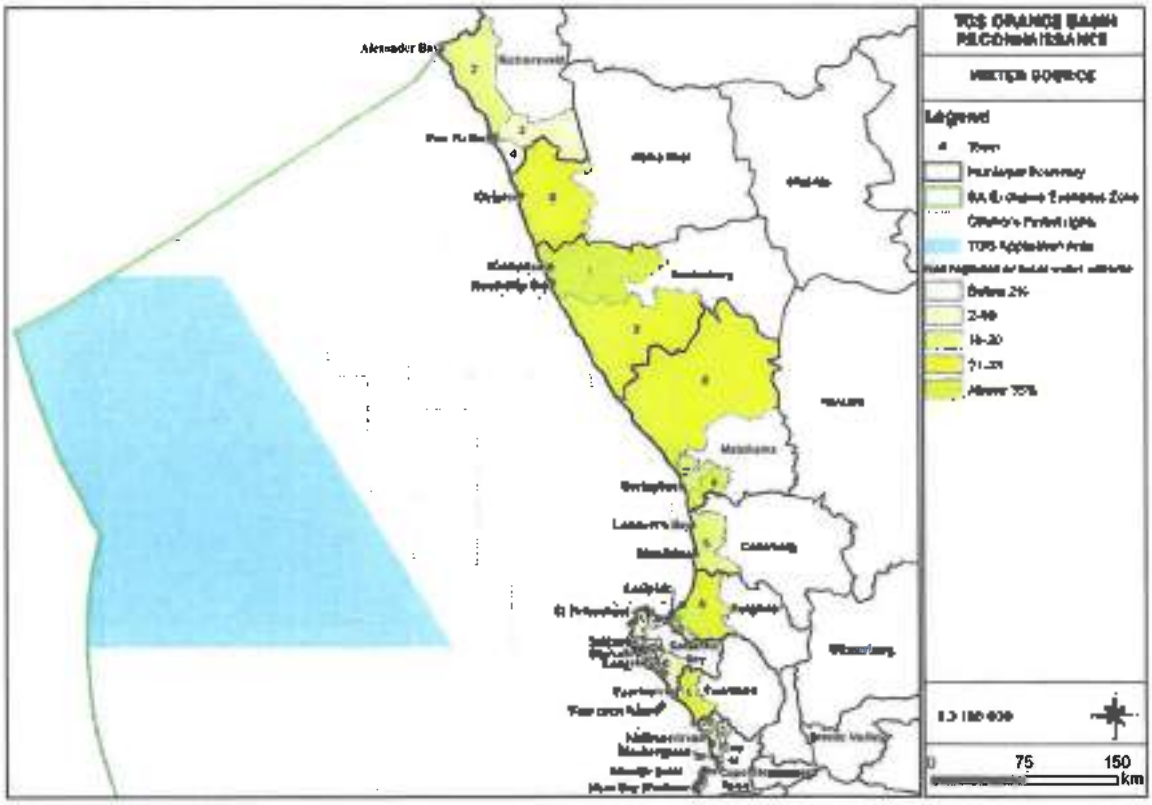


Figure 106: Proportion of households that does not get water from a regional or local water scheme (shown in percentage, source: Census 2011).

The incidence of access to piped water inside the dwelling varies and tend to be lower in the Northern Cape municipalities (Figure 107). Access to a flushing toilet is in general lower in the Northern Cape Municipalities (Figure 108).

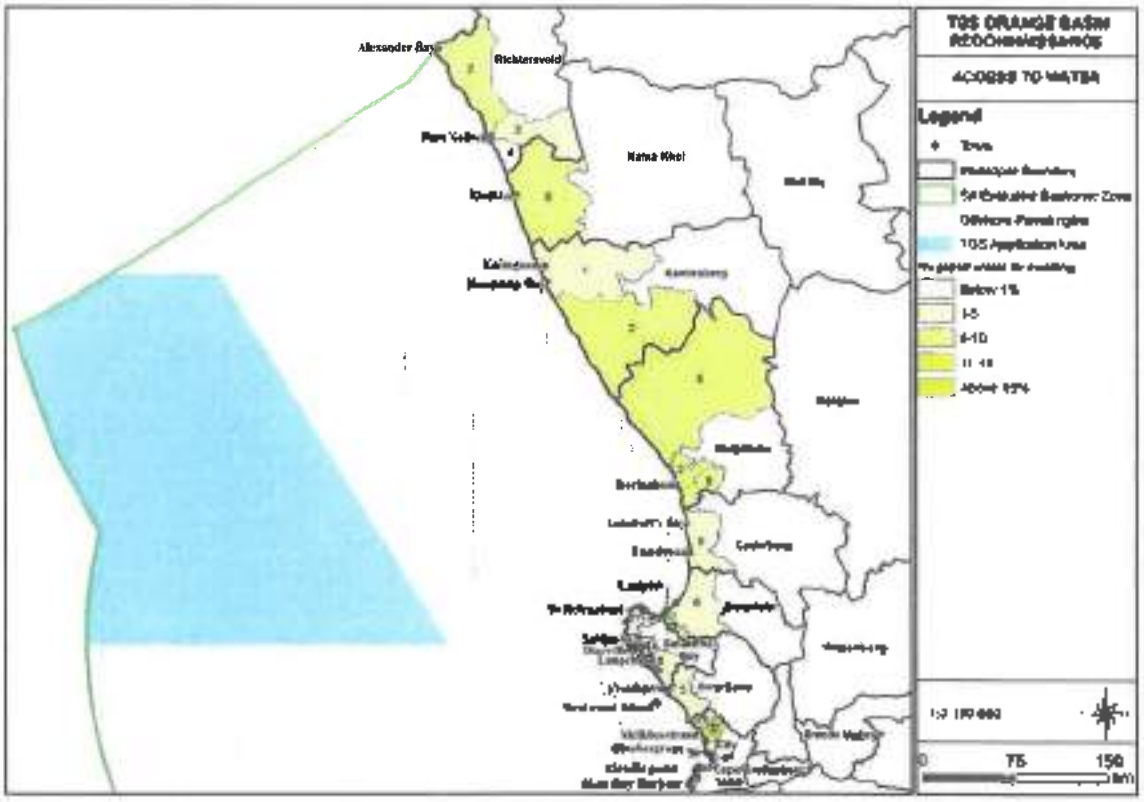


Figure 107: Proportion of households that does not have piped water in the dwelling (shown in percentage, source: Census 2011).

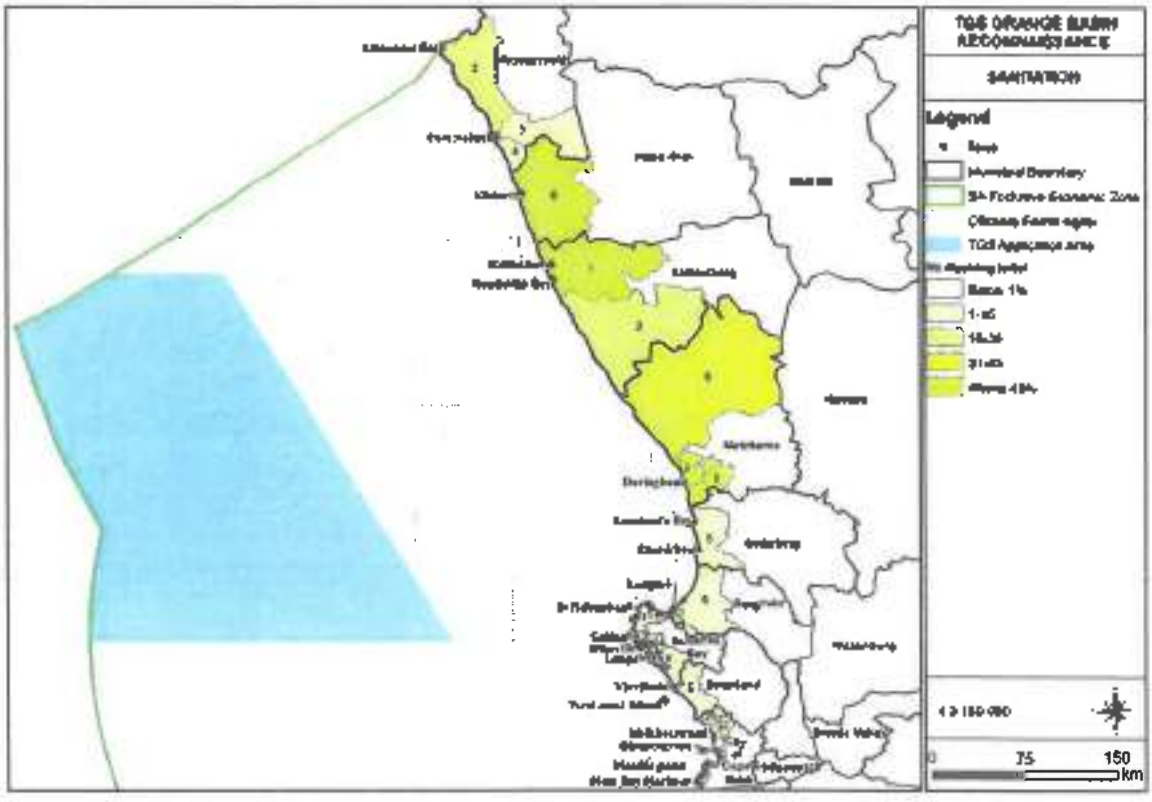


Figure 108: Proportion of households that does not have a flush toilet (shown in percentage, source: Census 2011).

8.7.1.8 ENERGY

Electricity is seen as the preferred lighting source (Noble et al, 2006) and the lack thereof should thus be considered a deprivation. Even though electricity as an energy source may be available, the choice of energy for cooking may be dependent on other factors such as cost. The majority of households have access to electricity for lighting purposes (Figure 109) but a lower proportion use electricity for heating (Figure 110) and cooking (Figure 111) purposes.

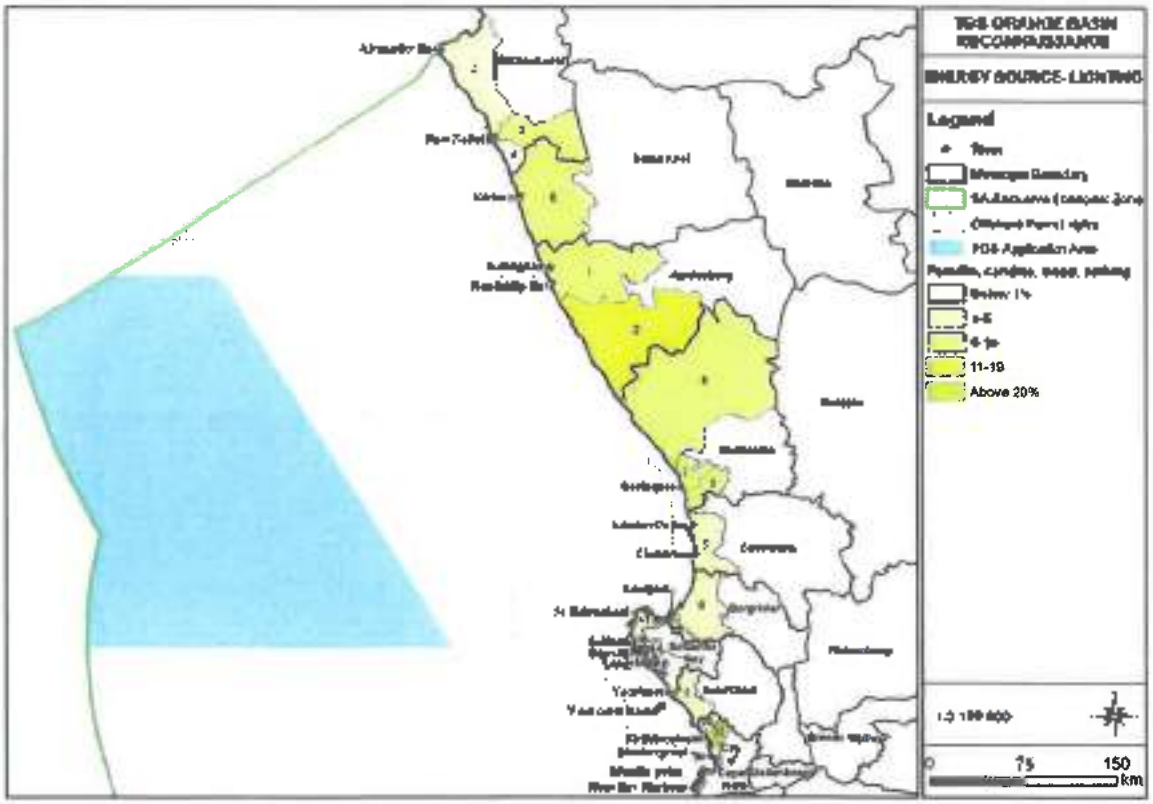


Figure 109: Proportion of households that use paraffin, candles, wood or nothing for lighting purposes (shown in percentage, source: Census 2011).

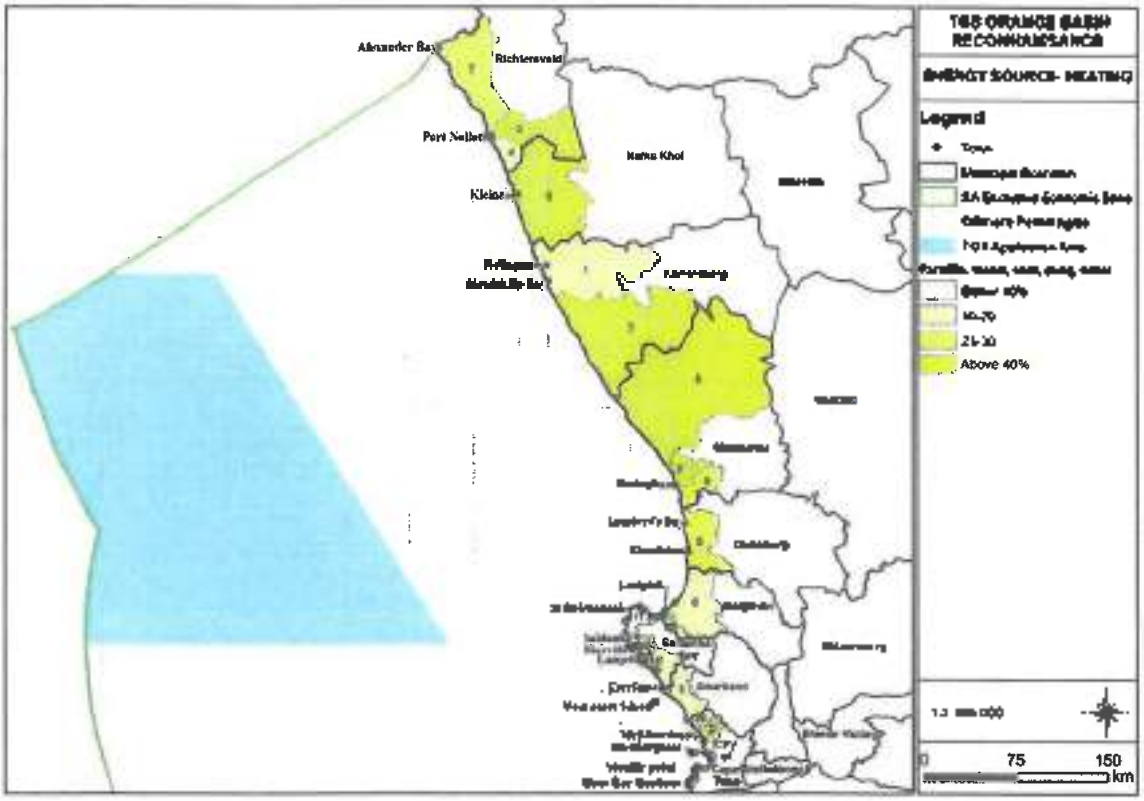


Figure 110: Proportion of households that use paraffin, wood, coal, dung or something else for heating purposes (shown in percentage, source: Census 2011).

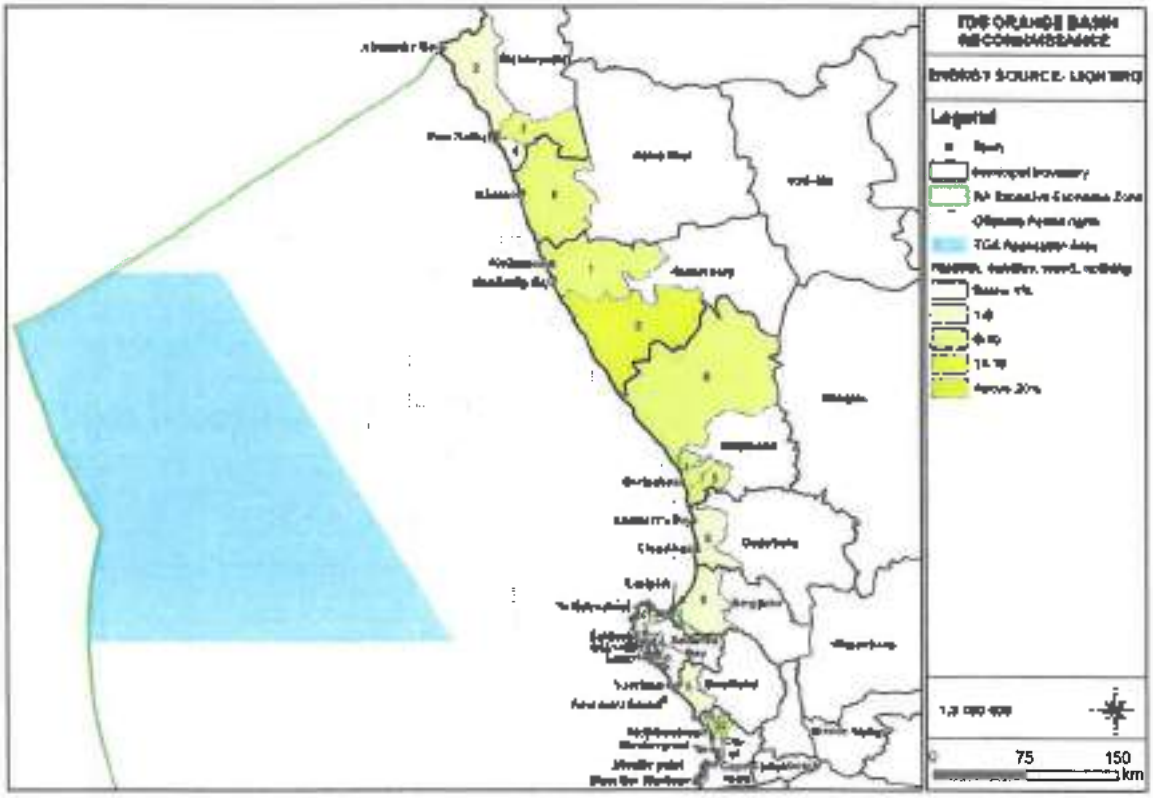


Figure 111: Proportion of households that use paraffin, wood, coal, dung or something else for cooking purposes (shown in percentage, source: Census 2011).

8.7.2 SHIPPING DENSITY

A large number of vessels navigate the major shipping lanes along the South African Coastline. Approximately 95% of the country's exports are conveyed by sea through eight commercial ports. These ports are the conduits for trade between South Africa and its southern African partners as well as hubs for traffic to and from Europe, Asia, the Americas and the east and west coasts of Africa. Figure 112 provides an indication of the shipping density along the South African Coast. It can be observed that the shipping density is generally medium – high over the majority of the Application Area.

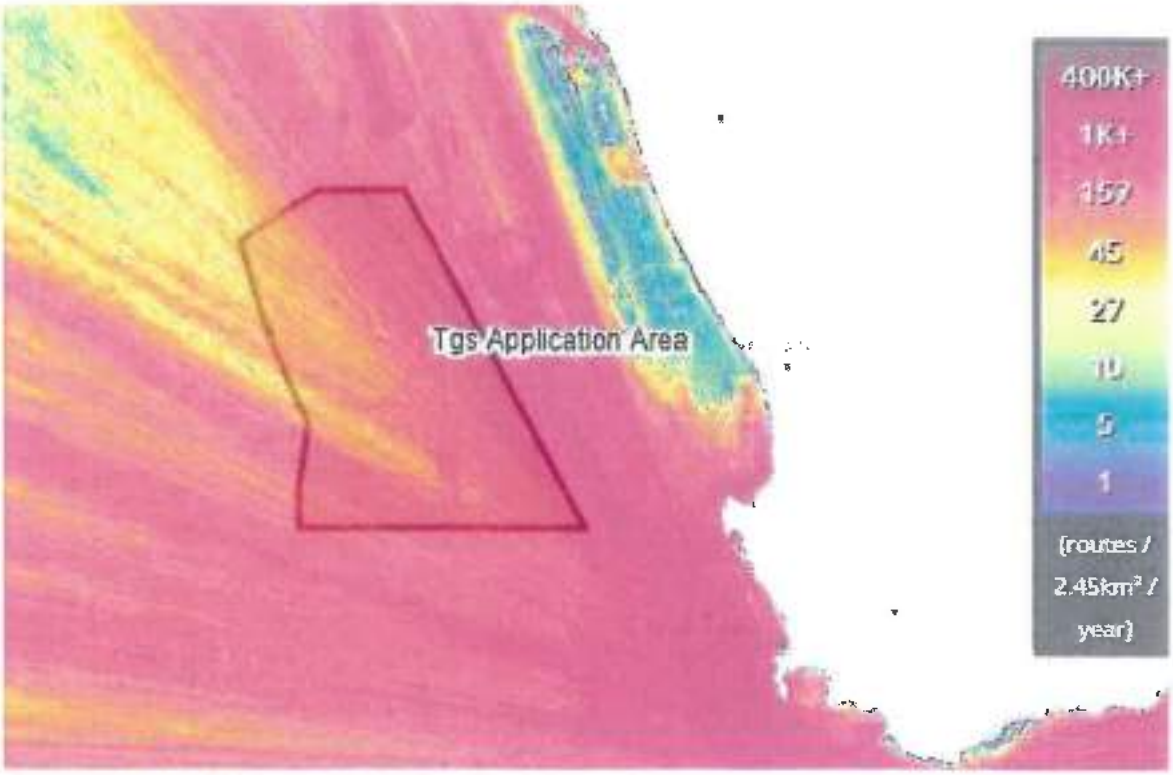


Figure 112: Shipping traffic density along the South African Coast.

8.8 CULTURAL AND HERITAGE RESOURCES

This section provides and overview of the cultural and heritage environment for the study area. The information has been sourced from the Heritage Impact Assessment undertaken by PGS Heritage (Pty) Ltd included in Appendix 5.

Marine resources have a long history of human exploitation. Evidence from archaeological sites suggest that the West Coast region was occupied from the Early Stone Age (ESA) through to the Middle Stone Age (MSA) and Later Stone Age (LSA), up until the arrival of early European settlers from the 16th century onwards. There are numerous sites (including shell middens, stratified cave deposits, rock art, stone tools, and fish traps) recorded along the coast that demonstrate that the rocky shorelines were attractive to hunter-gatherers through time. Much of what we know about settlement, subsistence strategies and diet along the coast is linked to these shorelines. Whilst gorges and stone sinkers are probably the best evidence for technical fishing equipment in the LSA, marine shell middens also demonstrate that the coastal zone was particularly favoured by LSA people (Deacon, 1995).

8.8.1 SHELL MIDDENS

Marine shell middens have been identified within 1 km of the coastline, near estuaries and in dune fields which lie adjacent to rock shores. While pre-historic people likely favoured the rocky shorelines for ease of access to marine resources, middens have also been found further inland, where people would have been able to exploit additional resources such as game life and fresh water.

In some instances, these shell middens are associated with domestic artefactual debris which suggests that they in fact represent occupation sites of long duration. Whilst the opposite can be said for midden sites that do not contain a formal stone artefact component, and instead may represent visits of short duration. These pre-historic people were the ancestors of the San and Khoikhoi. According to archaeologists, several shell middens in the Vredenburg Peninsula are associated with both San and Khoikhoi groups who were harvesting the shorelines and estuaries of the West Coast in a sustainable and patterned manner.

8.8.2 STONE FISH TRAPS

The remains of fish traps (visvywers; stone-walled tidal fish traps) have been recorded along the South African coastline from St Helena Bay to Mossel Bay. Along the south-western coastline, these traps, which use "the tidal range to allow fish to enter pre-built enclosures and be trapped at low tide", provide evidence of early fishing techniques. The preserved fish traps vary in shape, size, and spatial complexity. Identifying the architects of these traps is, however, a contentious issue.

Initially, researchers believed that the fish traps on the south coast were ancient maritime resource systems that originated among LSA people after 2000 years ago with the arrival of Khoikhoi herders. More recent research suggests that the development of fish traps along the southern and western coasts dates to the 19th century. Furthermore, these structures may have been introduced by European farmers as part of the farming-fishing system when intensive exploitation of inshore fish by local farmers occurred. In 1987, Graham Avery recorded a tidal fish trap in Mauritzbaai, south of Jacobsbaai. Hart and Halkett (1992) have also identified the remains of at least six traps in the intertidal zone at Wilde Varkens Valley, St Helena Bay.

8.8.3 INDIGENOUS PEOPLES

Before the colonial era, there were several diverse ancient tribes who traversed the valleys and plains of the present-day West Coast region of South Africa. The origins of the West Coast fishing communities can be traced back to the San and Khoikhoi peoples who lived within this region. Together, the Khoi and the San are the First Peoples of South Africa. In 1928, a German physical anthropologist Leonard Schultze, created the term 'Khoisan', to stress the similarities between the Khoikhoi and the San.

The settlers used the term 'Bushmen' when referring to the San, and many of whom the colonists' called 'Bushmen' were, in fact, Khoikhoi or former Hottentot. Today, this term is considered derogatory, and instead, scholars would rather refer to hunters and herders together as 'Khoisan'. It should be noted that although Khoi and San Peoples may share some experiences, culturally, they remain two distinct groups, and the general preference amongst both Khoi and San people is to be called by their clan names.

8.8.3.1 THE SAN

During almost the entire Holocene period, small groups of San hunter-gatherers were present in southern Africa. The San are the direct descendants of the first peoples of southern Africa. It should be noted that the term "San" is used to cover over a dozen distinct hunter-gatherer groups who speak distinctive "click" languages (incl. the Khwe, !Xun, Ju'hoansi, Naro, Inuu and other groups). These groups lived across Namibia, South Africa, Botswana, and Zimbabwe. The San were small groups of nomadic people who lived by the ethos of "all people are equal". They hunted and gathered resources and did not keep livestock.

It is generally agreed amongst academics that the San were the first inhabitants of the Cape region. During the latter part of the Holocene, there were hunter-gatherers living on the West Coast who made seasonal use of the coastal resources. Several archaeological sites, including Duyker Eiland, which is in Britannia Bay, confirmed the importance of shellfish, seals, marine birds, crayfish, and beached whales as a food source for the local inhabitants during this time.

8.8.3.1.1 THE INTRODUCTION OF THE KHOIKHOI

For thousands of years, the Khoikhoi people have occupied and moved around Southern Africa as nomadic herders. The Khoikhoi were large groups of nomadic herders who owned substantial herds (incl. cattle and sheep) and migrated for pasture, water, and food resources. It is understood that Khoikhoi peoples have a spiritual connection to land, where land is perceived as a gift from nature to be cared for.

Note that the Khoikhoi term is an umbrella term which refers to different tribes. The Khoikhoi people comprise four historical groupings: the Griqua, Nama, Koranna and Cape Khoi (incl. further subgroupings). Today, the Nama people are primarily located in the Northern Cape. The Griqua are in the Western Cape, Eastern Cape,

Kwazulu Natal and Gauteng, and various other parts of the country. The Korana people, live primarily in Kimberly and the Free State. The Cape Khoi are in the Western and Eastern Cape.

Evidence suggests that around 2000 years ago, the pastoralist Khoikhoi entered South Africa along the West Coast into the Cape region. They brought a new way of life, from its northern origins, to South Africa. The Khoikhoi introduced domesticated livestock and new material culture (incl. pottery) into the region. They relied more on sheep as a meat resource and hunted and gathered. Groups living close to the coast would also exploit shellfish, seals, and other marine resources. The St Helena Bay (Skipper Bay) region appears to have provided the Khoikhoi with invaluable resources, including whale meat obtained via 'cetacean traps.

One of the most important West Coast pastoralist sites, Kasteelberg, is an open-air archaeological site located 4 km from the coast. It provides evidence of occupation by herders between 1800 and 1600 years ago (Klein, 1986). The occupants of the site focused on harvesting seals and the presence of sheep bones also indicated that the inhabitants were most likely herding domestic stock.

It is thought that the indigenous people in the Cape populated a region from Northern Namibia to the Cape of Good Hope and from the Atlantic Ocean to the Fish River in the East. The area between Saldanha and Vredenburg was occupied by the CochoQua and the ChariGuriQua (GuriQua) group occupied the lower Berg River area which included St Helena Bay and regions around Piketberg. Some researchers choose to use the term Peninsular Khoikhoi" when referring to the Gorachoquas, Goringhaiquas and the Goringhaiconas ("strandlopers") and "Surrounding Khoikhoi" for the Cochoqua, Chainouqua and Hessequa.

In the pre-colonial era, the relations between the Khoikhoi and the San were relatively stable due to a mutual acknowledgement of territories. Although the San and Khoikhoi seemed to have co-existed for a period, it appears that, to some degree, the San groups were displaced. It's assumed that the Khoikhoi moved into areas that had previously been utilised by the San, thus forcing the San to move into more isolated coastal regions. The San's settlement and subsistence strategy changed from one based on the large-band occupation of open areas and the hunting of large game towards the more intensive utilisation of rock shelters, in small groups and a foraging-based economy. Unfortunately, indigenous groups who lived on the coast were the first people to be severely impacted by colonial oppression.

8.6.3.2 COLONIAL DISPOSSESSION

First contact between indigenous pastoralist groups and Europeans occurred during the 15th and 16th centuries when Portuguese mariners would sail down the coast. Before the Dutch East India Company's ('VOC') governance over the southernmost tip of Africa, European merchants and travellers en route to or from Asia would call in at the natural harbour of Saldanha Bay for refreshment. Encampments were also set up along the coast by survivors of shipwrecks, and in their journals, they would recall how they met and traded with indigenous groups. Written records reveal that in 1497, the GuriQua and the San (SonQua) witnessed the arrival and departure of Vasco da Gama in St Helena Bay. Although the Saldanha Bay harbour was more sheltered than Table Bay and allowed for the crews to trade livestock from the Khoikhoi in the area there was not enough fresh water available to allow for the establishment of large permanent settlements.

It was only in 1652 that the VOC decided to occupy the Cape and establish the first permanent European settlement in South Africa. The VOC established a station at Table Bay to supply Company fleets travelling between Europe and the Indies with refreshments (i.e., meat, wheat, vegetables, and freshwater) (Ward, 2009). When the Dutch colonists arrived, they encountered several Khoikhoi groups. The largest concentration of Khoikhoi lived in the lush pasture lands of the south-western Cape region.

Initially, the relationship between the Dutch and the Khoikhoi was one of cooperation, and the VOC established trading agreements with local chiefs to get regular supplies of fresh meat (Elphick, 1977). As the colony grew, the VOC decided to decrease their dependency on local trade with the Khoikhoi. Their alternative plan was to give land to free burghers to supply meat and grain to the Company.

Khoikhoi and San lives were impacted upon by both internal strife and direct conflict with the Europeans over the disregard of traditional customs, the privatisation of land, and exhausting indigenous resources (i.e., overfishing and farming). As the Dutch took over more of the Khoikhoi's grazing land for farms, much of the Khoikhoi and San peoples' traditional lands were dispossessed. In 1657, the Goringhaiqua tribe were ordered to move to the east of the Liesbeeck boundary and this 'eviction' event would be instrumental for the first war against colonial intrusion (Bredekamp and Newton-King, 1984). The First Khoikhoi-Dutch War lasted the whole of 1659.

According to Sleigh (1993: 148), "In 1672, two sons of the weakened Peninsular Khoisan chiefs signed a contract, which they probably did not fully understand, and sold huge tracts of land from Table Bay to Saldanha Bay in the North and to the Hottentots Hollands mountains in the East to the VOC for an incredible low price (which they did not even fully receive)".

After a few more instances of territories being ignored and further land appropriation, another war of resistance was initiated by the Cochoqua, and the Second Khoikhoi-Dutch War commenced (1673-1677). This led to more Khoikhoi groups being forced to relocate to areas further up the coast. According to writings of early settlers, it appears that some San groups, who pursued a hunting and foraging lifestyle, may have still resided in the mountainous regions of the Cape where they were less likely to clash with the Khoi or Dutch settlers. Regions that were less desirable for the colonists, such as Namaqualand, became places of refuge for the San and Khoikhoi who were able to continue many aspects of their traditional ways of life in this area for some time.

In 1713, the small-pox epidemic led to the death of many Khoikhoi people living in the south-western Cape. The surviving Khoisan became assimilated as domestic/farm workers due to the high demand for labour by the Dutch. In rural areas, the Khoisan were forced into what was referred to as semi-bonded labour. By the late 18th century, the Cape settler colony's territories incorporated the Berg (c. 1700), Olifants (1750), and Buffels (1798) rivers.

8.8.3.3 THE HISTORY OF FISHING ON THE WEST COAST

This section describes the history of fishing along the West Coast of South Africa.

8.8.3.3.1 17TH CENTURY

During the 17th century, the VOC established an outpost at St Helena Bay. From 1670, free burgers started to fish regularly in St Helena Bay. They introduced methods to the region that were not previously available to indigenous fisherman, such as metal hooks, boats, nets and bulk processing and storage.

8.8.3.3.2 18TH CENTURY

During the 18th century, the Cape settler's economy was primarily based on slave labour which was imported from Asia and East Africa. The agricultural sector which was maintained by free burghers (freed from Company service) was not stable and due to the trade of the Khoikhoi's livestock being intermittent, the settlers had to make alternative arrangements for food resources. This led to Robben Island being exploited for seals, penguins, and seabirds. Large rural landowners established private coastal fishing posts to supply marine resources to the Company; the local region; passing ships and for export. Soon, Dassen Island, Saldanha Bay and St Helena Bay developed as significant centres to supply the VOC with additional resources to sustain the growing number of people in the Cape colony, including the substantial number of slaves kept by the Company. According to Sleigh (1993), the slaves were given salted fish, seal meat, penguin, and bird eggs whilst the rest of the colony preferred to consume meat.

According to Marincowitz (1985: 40–46) "With exclusive land grants closing the north-western frontier, from the 1740s growing numbers of ex-slaves, dispossessed Khoekhoe, failed farmers, evicted tenants and bywoners (tenant farmers), new immigrants and fugitives from colonial and military justice moved onto the beaches of the west coast". Early fishing, sealing and whaling activities, by European and American whalers, around Saldanha Bay, especially near Marcus Island/Outer Bay and at Salamander Point, have been extensively documented in the archival/historical record. Although the inshore whale population declined after 1830, processing continued at Donkergat in Saldanha Bay.

8.8.3.3.3 19TH CENTURY

By the mid-19th century, scattered subsistence communities had emerged along the West Coast. Before the arrival of industrial fisheries, residents in St Helena Bay employed basic fishing technology (small-scale line fishing, beach seine nets and rowing boats) and fishing activities were informally organized by boat and net owners.

Malay slaves and other residents moved into the region to work as farm labourers. Over time, the unique fishing skills of enslaved Malay people intermingled with the fishing skills of the indigenous people. This led to the establishment of small fishing villages along the West Coast (incl. Saldanha, Langebaan and St Helena Bay).

After the emancipation of slaves, new laws were introduced to control both the freedom of movement and independent livelihoods of people who did not own land. This forced fishermen on the West Coast "to either

develop artisanal skills, become wage labourers or squat on coastal government land to eke out a living from small-scale production and seasonal work".

Using business capital in both the local and international markets, entrepreneurs were able to lease Crown land and establish coastal industries along the West Coast. By the 1890s, a Cape Town-based trading company, Stephan Brothers, was able to monopolise the West Coast trade. The company bought the main grain shipping points along the West Coast, including the southern shore of St Helena Bay, where they established Laaiplek (translated to 'loading place') at the mouth of the Berg River.

8.8.3.3.4 20th CENTURY

Although the local fishing industry on the West Coast employed a substantial number of locals at the start of the 20th century, the industry is associated with a history of hardship. The industry's collapse in the mid-20th century left numerous West Coast communities impoverished. Despite all the obstacles thrown at them, the West Coast fishing communities were resilient and continued their fishing tradition throughout the 20th century.

Historically, small-scale fishers have constantly had to compete against big scale fisheries. For example, Piketberg coastal fisheries used a method of fishing called beach seining to supply inland farmers with cheap ration fish. When there was a decline in snoek sources further south, Italian immigrant fishermen from Cape Town travelled up the West Coast on boats with set nets. Ultimately, their method of fishing impacted the supply of fish for the sedentary fishermen.

By 1900, the Stephan Brothers company were in control of nearly every suitable bay from Saldanha Bay to Lamberts Bay. They also owned numerous farms which were often acquired in exchange for debt. In 1909, the company negotiated an agreement with the State to establish an Exclusive Trek Seine Fishing Zone along the Malmesbury coast. This move meant that the company was able to dominate a new manufacturing industry which further exacerbated resource owners and local fishermen.

During World War One, there was a crayfish canning boom in the Cape. The sourcing of crayfish moved rapidly up the West Coast during this period. By the early 1920s, the overexploitation of crayfish resulted in an exhaustion of crayfish stocks and West Coast factories were forced to close. This meant that the small-scale seine fishermen, and fishermen who netted in the backwaters, were left even more vulnerable to the financial depression of the 1930s.

Then, in 1934, in an act of retaliation, "Saldanha Bay fishermen invaded the Piketberg area on motorboats carrying Italian lampara nets and, with the support of Government, wiped out the non-motorised Berg River inshore fisheries run by consortiums of farmers, fishery owners and canners". In 1951, increasing catches along the West Coast, meant that both skippers and fishermen yielded good financial returns. By 1955, South Africa had the largest fishing industry in the southern hemisphere.

With the Apartheid system arriving, the indigenous identity of the Khoisan was further disrupted through the Race Classification Act and the Populations Registration Act. The Khoisan were forcibly categorised as "Coloured". This label further dispossessed the people from their heritage. Under the Group Areas Act (1950) the towns of the West Coast were divided into segregated residential and business areas. The forced removals marked yet another era of forced removals from areas that indigenous people occupied. Despite the discrimination, the communities continued their tradition of fishing that had been passed on through the generations of fisher families.

8.8.3.3.5 MARITIME HERITAGE RESOURCES

The following section was developed by maritime archaeologist Vanessa Maitland.

The first recorded European voyages down the west coast of Africa were by the Portuguese. When the first Portuguese explorers travelled down the west African coast, they stuck close to the coastline, to map the land. However, occasionally they were swept towards the Americas, as is evident by the fate of the fleet of Pedro Alvares Cabral, in 1500. This was first Portuguese fleet which was to sail annually to the Indies. Twenty days after the fleet left Brazil, which they had "discovered", it was struck by storms and four ships, including the one under command of Bartolomeu Dias, foundered somewhere in the southern Atlantic. Different researchers put them anywhere between Tristan da Cunha and the Cape.

Bartolomeu Dias and his fleet passed the Orange River Mouth in 1487/1488 (Axelson, 1973). Thereafter, the rate of exploration and trade increased exponentially, as is evidenced by the increase in shipwrecks over the centuries. These early voyages were not well documented, and the archives often merely report that a fleet of

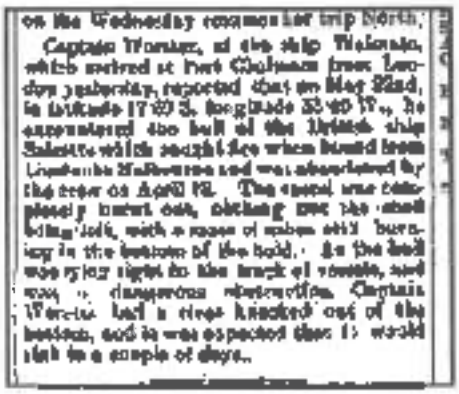
a certain number of vessels left and only a certain amount returned, with only vague references to their place and manner of loss. Therefore, there are many undocumented wrecks, along the coastline and even more offshore.

There is some anecdotal evidence that the Phoenicians circumnavigated Africa (Herodotus, 1954). If this is true, these ships had to stick right to the coastline and therefore are likely to be inshore. There's increasing evidence that the Chinese voyages of the 1400s explored parts, if not all, of the African coast (Paine, 2003). However, once again the archival evidence to date, and availability to Western researchers, limits this knowledge.

There are many ships that are only recorded as having disappeared between Europe and the Far East and Americas. As well as between local ports. The mechanics of sailing vessels and winds meant that for a ship to get from Europe to the Cape, they often sailed via South America. There are also numerous missing U-boats and other war vessels from WW1 and WW2 that may be found.

Thousands of ships have disappeared in the southern Atlantic Ocean, a portion of these can be seen in Figure 113. There are numerous historical reports of abandoned vessels being seen by other ships (Figure 114).

Figure 113 - A portion of the ships wrecked off South Africa and in the southern Atlantic.



on the Wednesday commenced trip North.

Captain Worster, of the ship Waimate, which arrived at Port Chalmers from London yesterday, reported that on May 22nd, in latitude 17° S., longitude 35° 40' W., he encountered the hull of the British ship Salsette which sailed for Wellington from Liverpool with coal for Melbourne and was abandoned by the crew on April 28. The vessel was completely burnt out, nothing but the shell being left, with a mass of ashes and burning in the bottom of the hold. As the hull was lying right in the track of vessels, and was a dangerous obstruction, Captain Worster had a rope knocked out of the bottom, and it was expected that it would sink in a couple of days.

Figure 114 - Report in The Auckland Star 26-07-1895, by the Waimate on the drifting hulk of the Salsette.

8.8.4 INTANGIBLE HERITAGE

Intangible heritage' (also referred to as 'Living Heritage') is a term which is used to describe "aesthetic, spiritual, symbolic or other social values people may associate with a site, as well as rituals, music, language, know-how, oral traditions and the cultural spaces in which these 'living heritage' traditions are played out." Through its efforts to safeguard intangible heritage UNESCO and its member states developed the Convention for the Safeguarding of the Intangible Cultural Heritage (ICHC). The following section is extracted from a UNESCO webpage that explains the importance of Intangible Heritage:

"While fragile, intangible cultural heritage is an important factor in maintaining cultural diversity in the face of growing globalization. An understanding of the intangible cultural heritage of different communities helps with intercultural dialogue and encourages mutual respect for other ways of life.

The importance of intangible cultural heritage is not the cultural manifestation itself but rather the wealth of knowledge and skills that is transmitted through it from one generation to the next. The social and economic value of this transmission of knowledge is relevant for minority groups and for mainstream social groups within a State, and is as important for developing States as for developed ones.

Intangible heritage is:

- Traditional, contemporary, and living at the same time: intangible cultural heritage does not only represent inherited traditions from the past but also contemporary rural and urban practices in which diverse cultural groups take part.
- Inclusive: we may share expressions of intangible cultural heritage that are similar to those practised by others. Whether they are from the neighbouring village, from a city on the opposite side of the world, or have been adapted by peoples who have migrated and settled in a different region, they all are intangible cultural heritage. They have been passed from one generation to another, have evolved in response to their environments and they contribute to giving us a sense of identity and continuity, providing a link from our past, through the present, and into our future. Intangible cultural heritage does not give rise to questions of whether or not certain practices are specific to a culture. It contributes to social cohesion, encouraging a sense of identity and responsibility which helps individuals to feel part of one or different communities and to feel part of society at large.
- Representative: intangible cultural heritage is not merely valued as a cultural good, on a comparative basis, for its exclusivity or its exceptional value. It thrives on its basis in communities and depends on those whose knowledge of traditions, skills and customs are passed on to the rest of the community, from generation to generation, or to other communities.
- Community-based: intangible cultural heritage can only be heritage when it is recognized as such by the communities, groups or individuals that create, maintain and transmit it – without their recognition, nobody else can decide for them that a given expression or practice is their heritage."

In this assessment, marine-related intangible cultural heritage and people's connection to the ocean is relevant. This type of heritage incorporates the unique ethos and identity of specific places linked with fishing villages; oral history; popular memory; cultural traditions; indigenous knowledge systems, rituals, beliefs, and practices (e.g., fishing techniques) associated with the ocean.

In some cultures, the ocean is regarded as a spiritual realm filled with healing powers and also a means to connect to one's ancestors. Gable (2014) explains how water is the Khoisan's "...'source of life, a sense of belonging and their permanence to nature'. Water is vital for various rituals and cleansing ceremonies. According to Boswell and Thornton (2021), the Khoisan "advocate for deep connections and complementarity between humans and nature, recognising the agency and 'direction' provided by nature to humanity".

Considering that the ICHC emphasises the declaration and listing of forms of Intangible Heritage, it can lead to a diminished recognition of intangible heritage not listed or formally recognised. The ICHC requires a State Party to develop an inventory of intangible heritage within their country or territory and then take measures to safeguarding with community participation. As Smith (2015) argues, the European Authorised Heritage Discourse within UNESCO emphasises the declaration and the importance of heritage and things as defined by experts or those entities and nation states promoting their discourse. The ICHC, however, did provide the opportunity for communities on a sub-national level to promote and give legitimacy to their intangible heritage. Unfortunately, the ICHC and its operational standards place the responsibility of assessment, nomination, and

listing on the State Parties. This leads to a gatekeeper process in which these Parties can decide and control what is listed and nominated through their national discourse to the detriment of the community or grouping. The Khoisan has historical experienced marginalisation and stigmatisation since the onset of colonialisation in Southern Africa.

Natural Justice (2016) submitted that strides were made in the recognition and legitimising of the Khoisan. However, entrenched continuing historic race classifications and the lack of leadership recognition through such issues as the dragging finalisation of the Traditional and Khoi-San Leadership Bill is robbing these communities of a voice and standing within the larger South African landscape. This speaks to the recognition of their culture that is inclusive of tangible and intangible heritage.

9 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 IMPACT ASSESSMENT METHODOLOGY

The impact significance rating methodology, as provided by EMS, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence / of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). The impact assessment will be applied to all identified alternatives. Where possible, mitigation measures will be recommended for impacts identified.

9.1.1 DETERMINATION OF ENVIRONMENTAL RISK

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence / of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E + D + M + R) * N}{4}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 35 below.

Table 35: Criteria for Determining Impact Consequence.

Aspect	Score	Definition
Nature	-1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary).
	3	Local (i.e. the area within 5 km of the site).
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years).
	4	Long term (the impact will cease after the operational life span of the project).
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).

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Aspect	Score	Definition
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected).
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected).
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way).
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per Table 36.

Table 36: Probability Scoring.

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \times P$$

Table 37: Determination of Environmental Risk.

Consequence						
	5	5	10	15	[illegible]	[illegible]
	4	4	8	12	16	[illegible]
	3	3	6	9	12	15
	2	2	4	6	8	10

	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 38.

Table 38: Significance Classes.

Risk Score	Description
< 10	Low (i.e. where this impact is unlikely to be a significant environmental risk).
≥ 10; < 20	Medium (i.e. where the impact could have a significant environmental risk).
≥ 20	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

9.1.2 IMPACT PRIORITISATION

Further to the assessment criteria presented in the section above, it is necessary to assess each potentially significant impact in terms of:

1. Cumulative impacts; and
2. The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 39: Criteria for Determining Prioritisation.

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.

	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 39. The impact priority is therefore determined as follows:

$$Priority = CI + LR$$

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from 1 to 1.5 (Refer to Table 40).

Table 40: Determination of Prioritisation Factor.

Priority	Ranking	Prioritisation Factor
2	Low	1
3	Medium	1.125
4	Medium	1.25
5	Medium	1.375
6	High	1.5

In order to determine the final impact significance, the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is an attempt to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table 41: Environmental Significance Rating

Value	Description
< -10	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ -10 < -20	Medium negative (i.e. where the impact could influence the decision to develop in the area).
≥ -20	High negative (i.e. where the impact would have an influence on the decision process to develop in the area).
0	No impact
< 10	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ 10 < 20	Medium positive (i.e. where the impact could influence the decision to develop in the area).

Value	Description
≥ 20	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

9.2 IMPACTS IDENTIFIED

This Section presents the impacts that have been assessed for the BA. Potential environmental impacts were identified by the EAP, the appointed specialists, as well as the preliminary input from the public. The impacts are included in Table 42 below. It should be noted that this report will be made available to I&AP's for review and comment and their comments and concerns will be addressed in the final BA Report submitted to the PASA/DMRE for adjudication.

The impacts were assessed in terms of nature, significance, consequence, extent, duration and probability in line with the methodology described in Section 9.1 above. The impact assessment matrix (including pre- and post-mitigation assessment) is included in Appendix 4. Without proper mitigation measures and continual environmental management, most of the identified impacts may potentially become cumulative, affecting areas outside of their originally identified zone of impact. The potential cumulative impacts have been identified, evaluated, and mitigation measures suggested and have been updated during the investigation.

When considering cumulative impacts, it is important to bear in mind the scale at which different impacts occur. There is potential for a cumulative effect at a broad scale, such as regional deterioration of air quality, as well as finer scale effects occurring in the area surrounding the activity. The main impacts which have a cumulative effect on a regional scale are related to the transportation vectors that they act upon. For example, air movement patterns result in localised air quality impacts having a cumulative effect on air quality in the region. Similarly, water acts as a vector for distribution of impacts such as contamination across a much wider area than the localised extent of the impacts source. At a finer scale, there are also impacts that have the potential to result in a cumulative effect, although due to the smaller scale at which these operate, the significance of the cumulative impact is lower in the broader context.

With reference to Table 29 in Section 8.5.4 above, it should be noted that there are only two fishing sectors that operate within the application area – i.e. the Large Pelagic Longline Sector and the Tuna Pole-Line Sector. As a result, it is anticipated that there will be no impacts on the remaining fisheries sectors described in Section 8.5 above and the impacts on these sectors have not been assessed further.

Table 42: Impacts Identified and Assessed during the BA

#	Impact	Phase
1	Impacts of seismic noise on mysticetes and odontocetes	Operation
2	Impacts of seismic noise on seals	Operation
3	Impacts of seismic noise on turtles	Operation
4	Impacts of seismic noise on diving seabirds	Operation
5	Impacts of seismic noise to pelagic fish	Operation
6	Impacts of seismic noise to marine invertebrates	Operation
7	Impacts of seismic noise to plankton and ichthyoplankton	Operation

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#	Impact	Phase
8	Disturbance and behavioural changes in seabirds, seals, turtles and cetaceans due to vessel noise	Operation
9	Disturbance and behavioural changes in seabirds, seals, turtles and cetaceans due to noise of support aircraft	Operation
10	Disturbance and behavioural changes in pelagic fauna due to vessel lighting	Operation
11	Impacts of marine biodiversity through the introduction of non-native species in ballast water and on ship hulls	Operation
12	Impacts of normal vessel discharges on marine fauna	Operation
13	Impacts on turtles and cetaceans due to ship strikes, collision and entanglement with towed equipment	Operation
14	Impacts on benthic and pelagic fauna due to accidental loss of equipment to the seabed or the water column	Operation
15	Impacts of an operational spill or collision on marine fauna	Operation
16	Impacts of exclusion from fishing ground on the large pelagic longline sector due to the safety zone around the survey vessel	Operation
17	Impact of Exclusion of the Tuna Pole-Line Sector from access to Fishing Ground	Operation
18	Impact of Underwater Sound on the Large Pelagic Longline Sector	Operation
19	Impact of Underwater Sound on the Tuna Pole-Line Sector	Operation
20	Impacts of an operational spill on the large pelagic longline sector	Operation
21	Impacts of the unplanned loss of equipment to sea from the survey vessel	Operation
22	Impacts on Cultural Heritage	Operation
23	Impacts of an operational spill or collision on marine fauna	Operation
24	Impacts on Cultural Heritage	Operation
25	Uncertainty	Planning
26	Concerns about cumulative impacts	Planning
27	Further marginalisation of vulnerable groups	Planning
28	Stakeholder fatigue and disillusionment	Planning
29	Perceived impact on livelihoods	Operation
30	Impacts on sense and spirit of place	Operation
31	Impacts on social licence to operate	Operation
32	Community expectations	Operation
33	Social unrest	Operation

9.3 DESCRIPTION AND ASSESSMENT OF IMPACTS

This section lists the potential impacts were identified during the BA based on the methodology described above. The impact assessment matrix is included in Appendix 9 and the below subsections describe each impact in more detail.

No separate noise impact assessment ratings are included in this report. The noise modelling results from the noise (acoustic) assessment are used entirely to inform the other specialist impacts, specifically the impacts on marine ecology and fisheries. Refer to Section 11.1.1.

9.3.1 IMPACTS ON MARINE ECOLOGY

This section provides a description of the Marine Ecological Impacts identified by in the Marine Ecological Study and Sound Transmission Loss Modelling Study. For a more detailed description of the impacts, please refer to the Marine Ecological Assessment and Acoustics Sound Transmission Loss Modelling Study undertaken by Pisces Environmental Services (Pty) Ltd included in Appendix 3.

9.3.1.1 ACOUSTIC IMPACTS OF SEISMIC SURVEYS ON MARINE FAUNA

The ocean is a naturally noisy place and marine animals are continually subjected to both physically produced sounds from sources such as wind, rainfall, breaking waves and natural seismic noise, or biologically produced sounds generated during reproductive displays, territorial defence, feeding, or in echolocation.

Acoustic cues are thought to be important to many marine animals in the perception of their environment as well as for navigation purposes, predator avoidance, and in mediating social and reproductive behaviour. Anthropogenic sound sources in the ocean can thus be expected to interfere directly or indirectly with such activities thereby affecting the physiology and behaviour of marine organisms. Of all human-generated sound sources, the most persistent in the ocean is the noise of shipping. Depending on size and speed, the sound levels radiating from vessels range from 160 to 220 dB re 1 µPa at 1 m. Especially at low frequencies between 5 to 100 Hz, vessel traffic is a major contributor to noise in the world's oceans, and under the right conditions, these sounds can propagate hundreds of kilometres thereby affecting very large geographic areas.

As the Application Area is located within the main offshore shipping routes that pass around southern Africa, the shipping noise component of the ambient noise environment is expected to be significant within and around the Application Area. For the duration of the survey an exclusion zone would be established around the survey vessel. Given the significant local shipping traffic and relatively strong metocean conditions specific to the area, ambient noise levels are expected to be 90–130 dB re 1 µPa for the frequency range 10 Hz – 10 kHz.

The seismic sources used in modern seismic surveys produce some of the most intense non-explosive sound sources used by humans in the marine environment. However, the transmission and attenuation of seismic sound is probably of equal or greater importance in the assessment of environmental impacts than the produced source levels themselves, as transmission losses and attenuation are very site specific, and are affected by propagation conditions, distance or range, water and receiver depth and bathymetrical aspect with respect to the source array. In water depths of 25 – 50 m seismic sources are often audible above ambient noise levels to ranges of 50 – 75 km, and with efficient propagation conditions such as experienced on the continental shelf or in deep oceanic water, detection ranges can exceed 100 km and 1,000 km, respectively. The signal character of seismic source pulses also change considerably with propagation effects. Reflective boundaries include the sea surface, the sea floor and boundaries between water masses of different temperatures or salinities, with each of these preferentially scattering or absorbing different frequencies of the source signal. This results in the received signal having a different spectral makeup from the initial source signal. In shallow water (<50 m) at ranges exceeding 4 km from the source, signals tend to increase in length from <30 milliseconds, with a frequency peak between 10-100 Hz and a short rise time, to a longer signal of 0.25-0.75 seconds, with a downward frequency sweep of between 200 – 500 Hz and a longer rise time.

In contrast, in deep water received levels vary widely with range and depth of the exposed animals, and exposure levels cannot be adequately estimated using simple geometric spreading laws. McCauley *et al* found that the received levels fell to a minimum between 5 – 9 km from the source and then started increasing again at ranges between 9 – 13 km, so that absolute received levels were as high at 12 km as they were at 2 km. With the complex sound reception fields arising from multi-path sound transmission.

Acoustic pressure variation is usually considered the major physical stimulus in animal hearing, but certain taxa are capable of detecting either or both the pressure and particle velocity components of a sound. An important component of hearing is the ability to detect sounds over and above the ambient background noise. Auditory masking of a sound occurs when its' received level is at a similar level to background noise within the same frequencies. The signal to noise ratio required to detect a pure tone signal in the presence of background noise is referred to as the critical ratio.

The auditory thresholds of many species are affected by the ratio of the sound stimulus duration to the total time (duty cycle) of impulsive sounds of <200 millisecond duration. The lower the duty cycle the higher the hearing threshold usually is. Although seismic sound impulses are extremely short and have a low duty cycle at the source, received levels may be longer due to the transmission and attenuation of the sound (as discussed above).

Below follows a brief review of the impacts of seismic surveys on marine faunal communities. This information is largely drawn from McCauley (1994), McCauley et al. (2000), the Generic EMPr for Oil and Gas Prospecting off the Coast of South Africa and the very comprehensive review by Cetus Projects (2007), supplemented by more recent peer-reviewed literature available on the WWW. While the discussion and assessments focus primarily on marine mammals, the effects on pelagic and benthic invertebrates, fish, turtles and seabirds are also covered briefly.

9.3.1.1.1 NOISE IMPACT ON WHALES AND DOLPHINS

The potential impact of seismic survey noise on whales and dolphins could include physiological injury to individuals, behavioural avoidance of individuals (and subsequent displacement from key habitat), masking of important environmental or biological sounds and indirect effects due to effects on predators or prey.

Physiological injury and mortality: The potential impact of seismic noise on physiological injury of mysticetes and odontocetes, considering their high sensitivity, the high probability of the impact occurring and the medium consequence, is deemed to be of MEDIUM significance pre-mitigation.

Behavioural avoidance: The potential impact of seismic noise on behavioural changes in mysticetes and odontocetes, considering their high sensitivity, the high probability of the impact occurring and the medium consequence, is deemed to be of MEDIUM significance pre-mitigation.

Masking of Sounds and Communication: The potential impact of seismic noise on the masking of environmental sounds and communications in mysticetes and odontocetes, considering their high sensitivity, the high probability of the impact occurring and the medium consequence, is deemed to be of MEDIUM significance pre-mitigation.

Indirect impacts due to effects on predators or prey: The potential indirect impact of seismic noise on food sources of mysticetes and odontocetes, considering their high sensitivity, the low likelihood of the impact occurring and the very low consequence, is thus deemed to be of VERY LOW significance pre-mitigation.

The potential impacts cannot be eliminated due to the nature of the seismic sound source required during surveying. The proposed mitigation measures, which are essentially designed to keep animals out of the immediate area of impact and thereby reduce the risk of deliberate injury to marine mammals would reduce the intensity of most impacts to medium, and the residual impacts will reduce to low consequence and LOW significance, except for the effects on prey which remains of VERY LOW significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impacts of seismic noise on mysticetes and odontocetes	Operation	Medium	Low	Low
Mitigation Measures				

• Please refer to Section 11.4.1 below for detailed mitigation measures for cetaceans. Key mitigation measures include:
  • Application of the mitigation hierarchy;
  • Pre-survey planning;
  • Passive acoustic monitoring and MMOs;				

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Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
• Seismic source testing and pre-start protocols; and • Vessel and aircraft operations to avoid sensitive areas.				

9.3.1.1.2 NOISE IMPACT ON SEALS

The potential impact of seismic survey noise on seals could include physiological injury to individuals, behavioural avoidance of individuals (and subsequent displacement from key habitat), masking of important environmental or biological sounds and indirect effects due to effects on predators or prey. The Cape fur seal that occurs off the West Coast forages over the continental shelf to depths of over 200 m and is thus unlikely to be encountered in the Reconnaissance Permit Area (see Figure 46).

Physiological injury and mortality: The potential impact of seismic noise on physiological injury or mortality of seals, considering their low sensitivity, the very low likelihood of the impact occurring and the medium consequence, is deemed to be of LOW significance pre-mitigation.

Behavioural avoidance: The potential impact of seismic noise on behavioural changes in seals, considering their low sensitivity, the very low likelihood of the impact occurring and the very low consequence, is deemed to be of VERY LOW significance pre-mitigation.

Masking of Sounds and Communication: The potential impact of seismic noise on the masking of environmental sounds and communications in seals, considering their low sensitivity, the very low likelihood of the impact occurring and the very low consequence, is deemed to be of VERY LOW significance pre-mitigation.

Indirect impacts due to effects on predators or prey: The potential indirect impact of seismic noise on food sources of seals, considering their low sensitivity, the very low likelihood of the impact occurring and the very low consequence, is thus deemed to be of VERY LOW significance pre-mitigation.

With the implementation of the typical 'soft-start' procedures, the residual impacts of physiological injury and mortality reduce to VERY) LOW significance. All other impacts on seals would all remain NEGLIGIBLE.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impacts of seismic noise on seals	Operation	Low	Low	Low
Mitigation Measures				
• Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source during all hours it is confirmed visually by the MMO during the pre-acquisition watch (60 minutes) that there are no seals within 500 m of the seismic source. • In the case of fur seals being observed within the mitigation zone, which may occur commonly around the vessel, delay "soft-starts" for at least 10 minutes until it has been confirmed that the mitigation zone is clear of all seal activity. However, if after a period of 10 minutes seals are still observed within 500 m of the seismic sources, the normal "soft-start" procedure should be allowed to commence for at least a 20-minute duration. Seal activity should be carefully monitored during "soft-starts" to determine if they display any obvious negative responses to the seismic source and gear or if there are any signs of injury or mortality as a direct result of the seismic activities. • Terminate seismic source on observation of any obvious mortality or injuries to seals when estimated by the MMO to be as a direct result of the survey.				

9.3.1.1.3 NOISE IMPACTS ON TURTLES

The potential effects of seismic surveys on turtles include:

- Physiological injury (including disorientation) or mortality from seismic noise;
- Behavioural avoidance of seismic survey areas;
- Masking of environmental sounds and communication; and
- Indirect impacts due to effects on predators or prey.

Physiological injury and mortality: The potential impact of seismic noise on physiological injury or mortality of turtles, considering their high sensitivity and medium consequence, is deemed to be of MEDIUM significance. In the case of hatchlings and juveniles, the impact can be considered of MEDIUM significance due to their high sensitivity and the potentially high intensity of the impact pre-mitigation.

Behavioural avoidance: The potential impact of seismic noise on behavioural changes in turtles, considering their medium sensitivity, the medium probability of the impact occurring and the very low consequence, is deemed to be of VERY LOW significance pre-mitigation.

Masking of Sounds and Communication: The potential impact of seismic noise on the masking of environmental sounds and communications in turtles, considering their medium sensitivity, the medium probability of the impact occurring and the very low consequence, is deemed to be of VERY LOW significance pre-mitigation.

Indirect impacts due to effects on predators or prey: The potential indirect impact of seismic noise on food sources of turtles, considering their medium sensitivity, the very low likelihood of the impact occurring and the very low consequence, is thus deemed to be of VERY LOW significance pre-mitigation.

With the implementation of the mitigation measures above, the residual impact on potential physiological injury would reduce to LOW. The other impacts would remain of VERY LOW significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impacts of seismic noise on turtles	Operation	Medium	Low	Low
Mitigation Measures				
• Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source during all hours it is confirmed visually by the MMO during the pre- acquisition watch (60 minutes) that there are no turtles within 500 m of the seismic source. • In the case of turtles being observed within the mitigation zone, delay the "soft-start' until animals are outside the 500 m mitigation zone. • Terminate seismic source on: o Observation of turtles within the 500 m mitigation zone. o Observation of any obvious mortality or injuries to turtles when estimated by the MMO to be as a direct result of the survey. o For turtles, terminate source until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required). • Avoid surveying within 100 m of critical foraging habitats (e.g. seamounts or convergence zones).				

9.3.1.1.4 NOISE IMPACTS ON SEABIRDS

Potential impacts of seismic pulses to diving birds could include physiological injury, behavioural avoidance of seismic survey areas and indirect impacts due to effects on prey. The seabird species are all highly mobile and would be expected to flee from approaching seismic noise sources at distances well beyond those that could cause physiological injury, but initiation of a sound source at full power in the immediate vicinity of diving seabirds could result in injury or mortality where feeding behaviour override a flight response to seismic survey

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sounds. The potential for physiological injury or behavioural avoidance in non-diving seabird species, being above the water and thus not coming in direct contact with the seismic pulses, is considered NEGLIGIBLE and will not be discussed further here.

Physiological injury and mortality: The potential impact of seismic noise on physiological injury or mortality of pelagic seabirds, considering their medium sensitivity, the medium likelihood of the impact occurring and low consequence, is deemed to be of LOW significance pre-mitigation.

Behavioural avoidance: The potential impact of seismic noise on behavioural changes in pelagic seabirds, considering their medium sensitivity the medium likelihood of the impact occurring and very low to low consequence, is deemed to be of VERY LOW to LOW significance pre-mitigation.

Indirect impacts due to effects on predators or prey: The potential indirect impact of seismic noise on food sources for pelagic seabirds, considering their medium sensitivity, the very low likelihood of the impact occurring and the very low consequence, is thus deemed to be of VERY LOW significance pre-mitigation.

With the implementation of the mitigation measures above, the residual impact on potential physiological injury or behavioural avoidance by seabirds, masking of sounds and indirect impacts on food sources would remain VERY LOW.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impacts of seismic noise on diving seabirds	Operation	Low	Low	Low
Mitigation Measures				
• Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source during all hours it is confirmed visually by the MMO during the pre-shoot watch (60 minutes) that there are no penguins or feeding aggregations of diving seabirds within 500 m of the seismic source. • In the case of penguins or feeding aggregations of diving seabirds being observed within the mitigation zone, delay the 'soft-start' until animals are outside the 500 m mitigation zone. • Terminate seismic source on observation of penguins and feeding aggregations of diving seabirds within the 500 m mitigation zone. • For penguins and feeding aggregations of diving seabirds, terminate source until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required).				

9.3.1.1.5 NOISE IMPACTS ON FISH

Fish hearing has been reviewed by numerous authors including Popper and Fay (1973), Hawkins (1973), Ateme *et al.* (1988), Hawkins & Popper (2018) and Slabbekoorn *et al.* (2019) (amongst others). Fish have two different systems to detect sounds namely 1) the ear (and the otolith organ of their inner ear) that is sensitive to sound pressure and 2) the lateral line organ that is sensitive to particle motion. Certain species utilise separate inner ear and lateral line mechanisms for detecting sound; each system having its own hearing threshold (Tavolga & Wodinsky 1963), and it has been suggested that fish can shift from particle velocity sensitivity to pressure sensitivity as frequency increases (Cahn *et al.* 1970, in Turl 1993). More recently, Popper & Hawkins (2018) determined that most fish (and all elasmobranchs) primarily detect particle motion.

In fish, the proximity of the swim-bladder to the inner ear is an important component in the hearing as it acts as the pressure receiver and vibrates in phase with the sound wave. Vibrations of the otoliths, however, result from both the particle velocity component of the sound as well as stimulus from the swim-bladder. The resonant frequency of the swim-bladder is important in the assessment of impacts of sounds as species with swim-bladders of a resonant frequency similar to the sound frequency would be expected to be most susceptible to injury. Although the higher frequency energy of received seismic impulses needs to be taken into consideration,

the low frequency sounds of seismic surveys would be most damaging to swim-bladders of larger fish. The lateral line is sensitive to low frequency (between 20 and 500 Hz) stimuli through the particle velocity component of sound and would thus be sensitive to the low frequencies of airguns, which most energy at 20-150 Hz.

The sound waves produced during seismic surveys are low frequency, with most energy at 20-150 Hz (although significant contributions may extend up to 500 Hz) (Hirst & Rodhouse 2000), and overlap with the range at which fish hear well (Dalen & Knutsen 2008). A review of the available literature suggests that potential impacts of seismic pulses to fish (including sharks) species could include physiological injury and mortality, behavioural avoidance of seismic survey areas, reduced reproductive success and spawning, masking of environmental sounds and communication, and indirect impacts due to effects on predators or prey (Popper & Hawkins 2018).

Physiological injury and mortality: The potential impact of seismic noise on physiological injury or mortality of fish, considering their high sensitivity and medium consequence, is thus deemed to be of MEDIUM significance pre-mitigation.

Behavioural avoidance: The potential impact of seismic noise on behavioural changes in large migratory pelagic fish, considering the high sensitivity, the low to medium likelihood of the impact occurring and medium consequence, is deemed to be of MEDIUM significance pre-mitigation.

Reproductive success / spawning: The potential impact of seismic noise on the reproductive success and spawning of nearshore commercial fish species, considering their high sensitivity, the low to medium likelihood of the impact occurring and the very low consequence, is deemed to be of LOW significance pre-mitigation.

Masking of environmental sounds and communication: The potential impact of seismic noise on the masking of sounds of fish, considering the high sensitivity, the low likelihood of the impact occurring and the very low consequence is thus deemed to be of LOW significance pre-mitigation.

Indirect impacts due to effects on predators or prey: The potential indirect impact of seismic noise on food sources for fish, considering their high sensitivity, the low likelihood of the impact occurring and the very low consequence, is thus deemed to be of LOW significance pre-mitigation.

The potential impacts cannot be eliminated due to the nature of the seismic sound source required during surveying. The location of the Application Area well to the west of the 'ring-fenced' area and proposed mitigation measures, which are essentially designed to keep animals out of the immediate area of impact and thereby reduce the risk of deliberate injury to fish, reduces the intensity of the impacts relating to physiological injury / mortality to medium, the residual impact will reduce to low consequence and be of LOW significance. All other impacts on fish remain of LOW significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impacts of seismic noise to pelagic fish	Operation	Medium	Low	Low
Mitigation Measures				
• Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source during hours it is confirmed visually by the MMO during the pre-shoot watch (60 minutes) that there are no shoaling large pelagic fish within 500 m of the seismic source. • Terminate seismic source on o Observation of slow swimming large pelagic fish (including whale sharks, basking sharks, manta rays) within the 500 m mitigation zone. o Observation of any obvious mass mortalities of fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO to be as a direct result of the survey.				

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
• For slow swimming large pelagic fish, terminate source until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required).				

9.3.1.1.6 NOISE IMPACTS ON MARINE INVERTEBRATES

Many marine invertebrates have tactile organs or hairs (termed mechanoreceptors), which are sensitive to hydro-acoustic near-field disturbances, and some have highly sophisticated statocysts, which have some resemblance to the ears of fishes (Offutt 1970; Hawkins & Myrberg 1983; Budelmann 1988, 1992; Packard *et al.* 1990; Popper *et al.* 2001) and are thought to be sensitive to the particle acceleration component of a sound wave in the far-field. Potential impacts of seismic pulses on invertebrates would include physiological injury or mortality in the immediate vicinity of the airgun sound source, and behavioural avoidance. Masking of environmental sounds and indirect impacts due to effects on predators or prey have not been documented and are highly unlikely and are thus not discussed further here.

The potential impact of 3D seismic noise on benthic, and neritic and pelagic invertebrates, considering the low sensitivity, the low likelihood of the impact occurring is thus deemed to be of NEGLIGIBLE significance pre-mitigation.

With the implementation of the typical 'soft-starts', the residual impact on potential behavioural avoidance by cephalopods would remain of NEGLIGIBLE significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impacts of seismic noise to marine invertebrates	Operation	Low	Low	Low
Mitigation Measures				
• Terminate seismic source on observation of any obvious mass mortalities of squid when estimated by the MMO to be as a direct result of the survey.				

9.3.1.1.7 NOISE IMPACT ON PLANKTON

As the movement of phytoplankton, zooplankton and ichthyoplankton is largely limited by currents, they are not able to actively avoid the seismic vessel and thus are likely to come into close contact with the sound sources, potentially experiencing multiple exposures during acquisition of adjacent lines. Potential impacts of seismic pulses on plankton would include physiological injury or mortality in the immediate vicinity of the airgun sound source.

The potential impact of seismic noise on phytoplankton and zooplankton, considering the medium sensitivity and very low consequence, is thus deemed to be of VERY LOW significance both with and without mitigation. Due to the medium consequence and medium sensitivity of ichthyoplankton, but the low likelihood of the impact occurring in offshore waters, the impacts are deemed to be of MEDIUM significance pre-mitigation.

This potential impact cannot be eliminated due to the nature of the seismic sound source required during surveying. With the implementation of the below mitigation measure, the residual impact would reduce to VERY LOW significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Noise impact on Plankton	Operation	Medium	Low	Low

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Mitigation Measures				
• As the Application Area is located far offshore, it is not deemed necessary to implement mitigation measures to avoid the key spring spawning periods thereby mitigating potential impacts on plankton to some degree. In addition, TGS has agreed to avoid the key "ring fenced" fishing and spawning areas in the south-east of the reconnaissance permit area identified during previous consultation with the commercial fishing sector. No other direct mitigation measures for potential impacts on plankton and fish egg and larval stages are feasible or deemed necessary.				

9.3.1.2 OTHER IMPACTS OF SEISMIC SURVEYS ON MARINE FAUNA

9.3.1.2.1 IMPACTS OF NON-SEISMIC NOISE (VESSEL AND HELICOPTER NOISE)

Elevated underwater and aerial noise can affect marine fauna, including cetaceans, by:

- causing direct physical injury to hearing;
- masking or interfering with other biologically important sounds (e.g. communication, echolocation, signals and sounds produced by predators or prey);
- causing disturbance to the receptor resulting in behavioural changes or displacement from important feeding or breeding areas.

Vessel Noise: The potential impact of vessel noise causing physiological injury to, or behavioural avoidance by, pelagic and coastal sensitive species, is deemed to be of VERY LOW significance pre-mitigation.

Aircraft Noise: The potential impact of aircraft noise causing physiological injury to, or behavioural avoidance by, pelagic and coastal sensitive species, is deemed to be of LOW significance pre-mitigation.

The generation of noise from helicopters cannot be eliminated if helicopters are required for crew changes. Similarly, the generation of vessel noise cannot be eliminated. The proposed mitigation, specifically maintaining the regulated altitude over the coastal zone and MPAs and flying perpendicular to the coast would reduce the intensity of the impact to very low, but the residual impact will remain of very low consequence and of LOW significance. Without mitigation measures for vessel noise, the residual impact of vessel noise would remain VERY LOW.

Aircraft and vessel noise would, however, likely contribute to the growing suite of cumulative acoustic impacts to marine fauna in the area, but assessing the population level consequences of multiple smaller and more localised stressors (see for example Booth *et al.* 2020; Derous *et al.* 2020) is difficult.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impacts of vessel noise on marine fauna	Operation	Low	Low	Low
Impacts of support aircraft noise on marine fauna	Operation	Low	Low	Low
Mitigation Measures				
• Pre-plan flight paths to ensure that no flying occurs over coastal seal colonies and seabird nesting areas. • Avoid extensive low-altitude coastal flights by ensuring that the flight path is perpendicular to the coast, as far as possible.				

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
• Brief all pilots on the ecological risks associated with flying at a low level along the coast or above marine mammals.				

9.3.1.2.2 IMPACT OF VESSEL LIGHTING ON PELAGIC FAUNA

The survey activities would be undertaken in the offshore marine environment, more than 100 km offshore, far removed from any sensitive coastal receptors (e.g. bird or seal colonies), but could still directly affect migratory pelagic species (pelagic seabirds, turtles, marine mammals and fish) transiting through the Reconnaissance Permit Area. The strong operational lighting used to illuminate the survey vessel at night may disturb and disorientate pelagic seabirds feeding in the area. Operational lights may also result in physiological and behavioural effects of fish and cephalopods as these may be drawn to the lights at night where they may be more easily preyed upon by other fish and seabirds.

The potential for collision of birds with the survey vessel due to lighting or behavioural disturbance by vessel lighting is deemed to be of VERY LOW significance pre-mitigation, due to the medium sensitivity of the receptors, the low likelihood of the impact occurring and the very low consequence.

With the implementation of the mitigation measures above, the residual impact would remain VERY LOW.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impact of vessel lighting	Operation	Low	Low	Low
Mitigation Measures				
• The lighting on the survey and support vessels should be reduced to a minimum compatible with safe operations whenever and wherever possible. Light sources should, if possible and consistent with safe working practices, be positioned in places where emissions to the surrounding environment can be minimised. • Keep disorientated, but otherwise unharmed, seabirds in dark containers for subsequent release during daylight hours. Ringed/banded birds should be reported to the appropriate ringing/banding scheme (details are provided on the ring).				

9.3.1.2.3 BALLAST WATER DISCHARGES AND HULL FOULING

Artificial structures deployed at sea serve as a substrate for a wide variety of larvae, cysts, eggs and adult marine organisms. The transportation of equipment from one part of the ocean to another would therefore also facilitate the transfer of the associated marine organisms. Survey vessels, seismic equipment and support vessels are used and relocated all around the world. Similarly, the ballasting and de-ballasting of these vessels may lead to the introduction of exotic species and harmful aquatic pathogens to the marine ecosystems (Bax *et al.* 2003).

The marine invertebrates that colonize the surface of vessels can easily be introduced to a new region, where they may become invasive by outcompeting and displacing native species. Marine invasive species are considered primary drivers of ecological change in that they create and modify habitat, consume and outcompete native fauna, act as disease agents or vectors, and threaten biodiversity. Once established, an invasive species is likely to remain in perpetuity (Bax *et al.* 2003).

The potential for introductions of non-native marine species through hull fouling or ballast water discharge is deemed to be VERY LOW pre-mitigation, due to the very low sensitivity of the offshore receptors, the low likelihood of the impact occurring and the low consequence.

With the implementation of the mitigation measures above, the residual impact would reduce to NEGLIGIBLE.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Ballast water discharges	Operation	Low	Low	Low
Mitigation Measures				
• Avoid the unnecessary discharge of ballast water. • Use filtration procedures during loading in order to avoid the uptake of potentially harmful aquatic organisms, pathogens and sediment that may contain such organisms. • Ensure that routine cleaning of ballast tanks to remove sediments is carried out, where practicable, in mid-ocean or under controlled arrangements in port or dry dock, in accordance with the provisions of the ship's Ballast Water Management Plan. • Ensure all infrastructure (e.g. arrays, streamers, tail buoys etc) that has been used in other regions is thoroughly cleaned prior to deployment.				

9.3.1.2.4 ROUTINE VESSEL DISCHARGES

The discharge of wastes to sea could create local reductions in water quality, both during transit to and within the Application Area. Deck and machinery space drainage may result in small volumes of oils, detergents, lubricants and grease, the toxicity of which varies depending on their composition, being introduced into the marine environment. Sewage and galley waste will place a small organic and bacterial loading on the marine environment, resulting in an increased biological oxygen demand.

These discharges will result in a local reduction in water quality, which could impact marine fauna in a number of different ways:

- Physiological effects: Ingestion of hydrocarbons, detergents and other waste could have adverse effects on marine fauna, which could ultimately result in mortality.
- Increased food source: The discharge of galley waste and sewage will result in an additional food source for opportunistic feeders, speciality pelagic fish species.
- Increased predator - prey interactions: Predatory species, such as sharks and pelagic seabirds, may be attracted to the aggregation of pelagic fish attracted by the increased food source.

The impacts associated with normal waste discharges from the survey vessel is deemed to be of VERY LOW significance pre-mitigation, due to the medium sensitivity of the offshore receptors, the medium probability of the impact occurring and the very low consequence.

This potential impact cannot be eliminated because the seismic / support vessels are needed to undertake the survey and will generate routine discharges during operations. With the implementation of the project controls and mitigation measures, the residual impact will remain of VERY LOW significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Routine vessel discharges	Operation	Low	Low	Low
Mitigation Measures				
• Implement leak detection and repair programmes for valves, flanges, fittings, seals, etc. • Use a low-toxicity biodegradable detergent for the cleaning of all deck spillages.				

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9.3.1.3 UNPLANNED EVENTS

9.3.1.3.1 VESSEL STRIKES AND ENTANGLEMENT

The potential affects of vessel presence and towed equipment on turtles and cetaceans include physiological injury or mortality.

The potential for collision with or entanglement by turtles and cetaceans during the seismic survey or the transit of the vessel to or from the Application Area is deemed to be of LOW significance pre-mitigation, due to the high sensitivity of the receptors, but very low likelihood of the impact occurring and the low consequence.

With the implementation of the mitigation measures above, the residual impact would remain LOW.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Vessel strikes and entanglement	Operation	Low	Low	Low
Mitigation Measures				
• The vessel operators should keep a constant watch for marine mammals and turtles in the path of the vessel. • Keep watch for marine mammals behind the vessel when tension is lost on the towed equipment and either retrieve or regain tension on towed gear as rapidly as possible. • Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'. • Ensure vessel transit speed between the Application Area and port is a maximum of 12 knots (22 km/hr), except in MPAs where it is reduced further to 10 knots (18 km/hr) as well as when they are present in the vicinity.				

9.3.1.3.2 LOSS OF EQUIPMENT

The potential impacts associated with lost equipment include:

- Potential disturbance and damage to seabed habitats and crushing of epifauna and infauna within the equipment footprint; and
- Potential physiological injury or mortality to pelagic and neritic marine fauna due to entanglement in streamers, arrays and tail buoys drifting on the surface or in the water column.

The impacts associated with the accidental loss of equipment are deemed to be of VERY LOW significance pre-mitigation, due to the medium sensitivity of the offshore receptors, the very low likelihood of the impact occurring and the very low consequence.

With the implementation of the project controls and mitigation measures, the residual impact will remain of VERY LOW significance

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Release of diesel	Operation	Low	Low	Low
Mitigation Measures				
• Ensuring that loads are lifted using the correct lifting procedure and within the maximum lifting capacity of crane system. • Minimise the lifting path between vessels.				

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
• Undertake frequent checks to ensure items and equipment are stored and secured safely on board each vessel. • In the event that equipment is lost during the operational stage, assess safety and metocean conditions before performing any retrieval operations. Establishing a hazards database listing the type of gear left on the seabed and/or in the Reconnaissance Permit area with the dates of abandonment/loss and locations, and where applicable, the dates of retrieval				

9.3.1.3.3 RELEASE OF DIESEL

Marine diesel spilled in the marine environment would have an immediate detrimental effect on water quality, with the toxic effects potentially resulting in mortality (e.g. suffocation and poisoning) of marine fauna or affecting faunal health (e.g. respiratory damage). If the spill reaches the coast, it can result in the smothering of sensitive coastal habitats.

The impact methodology used to assess the impact significance calculates an overall LOW pre-mitigation significance. However, considering the high sensitivity of receptors and the very low (offshore) and medium consequence (nearshore), the potential impact on the marine fauna is in reality considered to range from LOW significance (offshore) to MEDIUM significance (nearshore) without mitigation. The likelihood of the impact occurring is, however, low.

With the implementation of the project controls and mitigation measures, the residual impact will reduce to LOW significance for nearshore spills, and remain LOW for offshore spills.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Release of diesel	Operation	Medium	Low	Low
Mitigation Measures				
• Use low toxicity dispersants cautiously and only with the permission of DFFE. • As far as possible, and whenever the sea state permits, attempt to control and contain the spill at sea with suitable recovery techniques to reduce the spatial and temporal impact of the spill • Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station. • Ensure offshore bunkering is not undertaken in the following circumstances: o Wind force and sea state conditions of ≥6 on the Beaufort Wind Scale; o During any workboat or mobilisation boat operations; o During helicopter operations; o During the transfer of in-sea equipment; and o At night or times of low visibility.				

9.3.1.4 CONFOUNDING EFFECTS AND CUMULATIVE IMPACTS

The assessments of impacts of seismic sounds provided in the scientific literature usually consider short-term responses at the level of individual animals only, as our understanding of how such short-term effects relate to adverse residual effects at the population level are limited. Data on behavioural reactions to seismic noise acquired over the short-term could, however, easily be misinterpreted as being less significant than the cumulative effects over the long-term, i.e. what is initially interpreted as an impact not having a detrimental effect and thus being of low significance, may turn out to result in a long-term decline in the population.

particularly when combined with other stressors (e.g. temperature, competition for food, shipping noise). Confounding effects are, however, difficult to separate from those due to seismic surveys.

Similarly, potential cumulative impacts on individuals and populations as a result of other seismic surveys undertaken either previously, concurrently or subsequently are difficult to assess. A significant adverse residual environmental effect is considered one that affects marine biota by causing a decline in abundance or change in distribution of a population(s) over more than one generation within an area. Natural recruitment may not re-establish the population(s) to its original level within several generations or avoidance of the area becomes permanent. Historic survey data for the West Coast is illustrated in Figure 115, which shows the 2D survey lines acquired between 2001 and 2018 and indicates 3D survey areas on the West Coast. Despite the density of seismic survey coverage over the past 17 years, the southern right whale population is reported to be increasing by 6.5% per year, and the humpback whale by at least 5% per annum over a time when seismic surveying frequency has increased, suggesting that, for these populations at least, there is no evidence of long-term negative change to population size as a direct result of seismic survey activities.

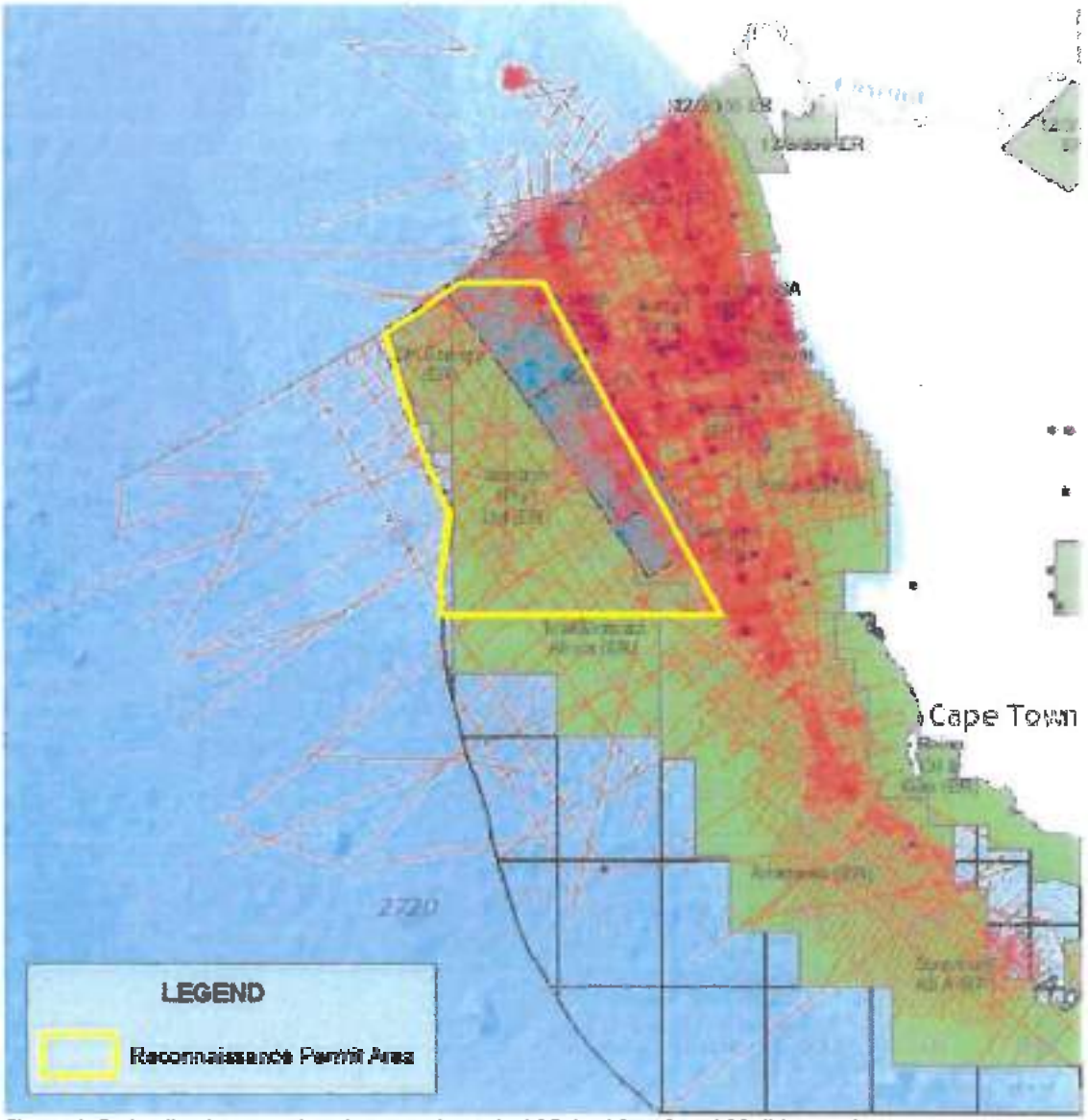

Figure 115: Application Area in relation to historical 2D (red lines) and 3D (blue and purple polygons) surveys conducted on the West Coast between 2001 and 2018 (Source: PASA).

Reactions to sound by marine fauna depend on a multitude of factors including species, state of maturity, experience, current activity, reproductive state, time of day. If a marine animal does react briefly to an

underwater sound by changing its behaviour or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the population as a whole. However, if a sound source displaces a species from an important feeding or breeding area for a prolonged period, impacts at the population level could be significant. The increasing numbers of southern right and humpback whales around the Southern African coast, and their lingering on West Coast feeding grounds long into the summer, suggest that those surveys conducted over the past 17 years have not negatively influenced the distribution patterns of these two migratory species at least. Information on the population trends of resident species of baleen and toothed whales is unfortunately lacking, and the potential effects of seismic surveys on such populations remains unknown

Consequently, suitable mitigation measures must be implemented during seismic data acquisition to ensure the least possible disturbance of marine fauna in an environment where the cumulative impact of increased background anthropogenic noise levels has been recognised as an ongoing and widespread issue of concern. Should other concurrent seismic survey activities be undertaken in the Orange Basin, cumulative impacts can be expected.

Despite the difficulty in undertaking a reliable assessment of the potential cumulative environmental impacts of future seismic acquisition in the Deep Water Orange Basin due to likely variation in the scope, extent and duration of proposed surveys, the cumulative impacts of three potential surveys occurring concurrently needs to be considered.

The cumulative assessment table below assumes the worst case scenario of three surveys (Searcher, TGS and GX Technologies) occurring simultaneously during the summer survey window in 2022/23. In the unlikely event that multiple surveys would be undertaken concurrently within the Deep Water Orange Basin Area, associated impacts to marine fauna would be of high intensity and extend regionally, over the short-term (assuming they take place over the same summer survey window). The impact consequence for cumulative surveys is therefore considered medium.

The impacts to marine fauna associated with concurrent surveys are deemed to be of MEDIUM significance, due to the high sensitivity of the offshore receptors, the very high likelihood of cumulative effects of acoustic impacts on marine fauna.

With the implementation of the above-mentioned controls and mitigation measures, the intensity of the impact would reduce to MEDIUM and the probability of the impact would reduce to UNLIKELY, but the overall significance would remain MEDIUM.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impacts to marine fauna of concurrent seismic acquisition by multiple operators	Operation	Medium	Medium	Medium
Mitigation Measures				
• Should surveys be run simultaneously, ensure that a distance of at least 40 km is maintained between survey vessels[23] until sufficient objective evidence is obtained that a reduced buffer distance is acceptable.				

[23] This 40 km buffer maintained by any other survey vessels aligns to advice by the US Department of Interior (2014) and is considered sufficient on the basis that it provides a corridor between vessels where seismic source noise approaches ambient levels such that animals may pass between, and/or the potential cumulative effect beyond this distance is considered to be negligible.

9.3.2 IMPACTS ON FISHERIES

This section provides a description of the Fisheries impacts identified by in the Fisheries Study and Sound Transmission Loss Modelling Study. For a more detailed description of the impacts, please refer to the Fisheries Study and Sound Transmission Loss Modelling Study included in Appendix 3.

9.3.2.1 EXCLUSION FROM FISHING GROUND DUE TO TEMPORARY SAFETY ZONE AROUND SURVEY VESSEL

A purpose-built seismic vessel would be contracted to conduct the 3D seismic survey. The acoustic source would consist of up to 20 active airguns with an overall operating pressure of 2 000 pound-force per square inch (psi). The acoustic source would be situated approximately 50 m behind the seismic vessel at 7 m to 8 m below the water surface. The receiver array for the 3D survey would consist of up to 10 streamer cables, 8 km in length, towed in parallel with a separation of 150 m. The streamer cables would be towed at a depth of between 6 m and 10 m and would therefore not be visible to other vessels. A tailbuoy would mark the far end of each of the streamer cables and would be marked by AIS.

Figure 126: Schematic diagram showing side-view of the airgun array and hydrophone cable ("streamer") towed in a 2D seismic survey.

The acquisition of high quality seismic data requires that the position of the survey vessel and the array be accurately known. Seismic surveys consequently require accurate navigation of the sound source over pre-determined survey transects. This, and the fact that the airgun array and the hydrophone streamer need to be towed in a set configuration behind the tow-ship, means that the survey operation has little manoeuvrability whilst operating. For this reason, the vessel is considered as a fixed marine feature that is to be avoided by other vessels.

The safety zones aim to ensure the safety of navigation, avoiding or reducing the probability of damage to the towed streamer cables. The temporary exclusion of vessels from entering the safety zone around a seismic survey vessel poses a direct impact to fishing operations in the form of loss of exclusion from fishing grounds.

Based on the location of the Reconnaissance Permit application area, there is no impact of exclusion from fishing grounds expected on the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, linefish, west coast rock lobster or small-scale fisheries. There is a high probability that the large pelagic longline sector (targeting tuna, swordfish and shark) will experience loss of access to fishing ground over the duration of the proposed 70 day survey. Although the Reconnaissance Permit area is situated offshore of the continental shelf break, this being an area of peak fishing activity, there is a high probability that vessels and drifting lines could be expected within the Reconnaissance Permit area. The extent of the impact is considered to be regional due to the large area (57 400 km²) within which the survey could take place[24]. The impact of exclusion is assessed to be of high magnitude[25]. Based on the combination of extent, duration and magnitude of the impact, and considering the high probability that the impact would occur, the overall significance of the impact is considered to be MEDIUM NEGATIVE. Due to the low probability of the operations of the tuna pole-line sector within the Reconnaissance Permit area, the overall significance of the impact on the sector is considered to be LOW NEGATIVE.

This potential impact cannot be eliminated because the seismic vessels are needed to undertake the survey and a safety zone will be enforced around the vessel during routine operations. Timing the survey to avoid taking

[24] Also noting that during a 3D seismic survey the vessel would acquire the data progressively across the designated area i.e. the area of exclusion area is localised at any one point in time. However, the impact rating has been assessed based on the cumulative impact of exclusion across the full extent of the Reconnaissance Permit area.

[25] Where fishing operations in the affected area could temporarily cease

place during the months of June and July (periods of seasonally high fishing effort) could lead to a residual impact of LOW NEGATIVE significance on the large pelagic longline sector.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Fisheries Exclusion: Large Pelagic Longline	Operation	**Medium**	Low	Low
Fisheries Exclusion: Tuna Pole-line	Operation	Low	Low	Low

Mitigation Measures

- Timing of the seismic survey to avoid periods of peak fishing activity during June and July is recommended in order to reduce the probability of disruption to the large pelagic longline fishing sector.
- At least three weeks prior to the commencement of seismic survey activities the following key stakeholders should be consulted and informed of the proposed seismic survey programme (including navigational co-ordinates of location, timing and duration of proposed activities) and the likely implications thereof (specifically the exclusion and safety zone around the seismic vessel):
    - Fishing industry associations: SA Tuna Association; SA Tuna Longline Association, Fresh Tuna Exporters Association, South African Deepsea Trawling Industry Association (SADSTIA), South African Hake Longline Association (SAHLLA).
    - Other key stakeholders: South African Navy Hydrographic Office (SANHO), South African Maritime Safety Association, Ports Authority and the DFFE Vessel Monitoring, Control and Surveillance Unit in Cape Town.
    - These stakeholders should again be notified at the completion of the project when the survey and support vessels are off location.
- Request, in writing, the SANHO to broadcast a navigational warning via Navigational Telex (Navtex) and Cape Town radio for the duration of the seismic survey activity.
- Distribute a Notice to Mariners prior to the commencement of the seismic survey operations. The Notice to Mariners should give notice of (1) the co-ordinates of the survey area, (2) an indication of the proposed survey timeframes, (3) the dimensions of the towed gear array and dimensions of the safety zone around the seismic vessel, and (4) provide details on the movements of support vessels servicing the project. This Notice to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.
- An experienced Fisheries Liaison Officer (FLO) should be placed on board the seismic or escort vessel to facilitate communications with fishing vessels in the vicinity of the seismic survey area.
- The lighting on the seismic and support vessels should be managed to ensure that they are sufficiently illuminated to be visible to fishing vessels, as well as ensure that it is reduced to a minimum compatible with safe operations.
- Ensure project vessels fly standard flags and lights to indicate that they are engaged in towing surveys and are restricted in manoeuvrability.
- Notify any fishing vessels at a radar range of 12 nm from the seismic vessel via radio regarding the safety requirements around the seismic vessel.
- Implement a grievance mechanism in case of disruption to fishing or navigation.

9.3.2.2 IMPACT OF SOUND ON CATCH RATES

In addition to the potential impacts of exclusion to fishing areas, international research has shown that the noise energy generated during seismic surveys may cause mortality, physiological damage, masking effects and/or behavioural responses in fish and invertebrates (Caroll *et al* 2017). As such, the possible effects of seismic sound on species relevant South African fisheries are considered. Differences in morphology and behaviour between species means that species vary in their vulnerability to seismic noise, and generalisations across groups are not easily made. The potential impact of elevated underwater sound on fish can be grouped into four types of effects:

- **Mortality or lethal effects:** life-threatening physical injuries, including death and severe physical injury. Fish mortality is associated with very high source noise levels and fish in close proximity to the noise source (for example, underwater explosions). Susceptibility to mortality at a particular sound level can vary between fish species, for example shellfish and fish without swim bladders can typically survive higher noise levels.
- **Physical (or physiological) effects:** non-life-threatening physical injuries, such as temporary or permanent auditory damage. The type and severity of physiological effects at different noise levels can differ between species. Some fish detect and respond to sound predominantly by detecting particle motion in the surrounding fluid while others are capable of detecting sound pressure via the gas bladder.
- **Masking effects:** the reduction in the detectability of a sound as a result of the simultaneous occurrence of another noise. Masking noise interferes with the ability of the animal to detect and respond to biologically important sounds.
- **Behavioural effects:** include perceptual, stress and indirect effects, of which the most common are startle responses or avoidance of an area. Behavioural responses can vary between species and sometimes extend over large distances, until the noise decreases below the background sound level.

Summarised below are some of the main findings relevant to the assessment of effects on fisheries:

- Generally, fish species with specialisations for sound pressure detection (e.g. swim bladder) have lower sound pressure thresholds and respond at higher frequencies than fishes lacking these morphological adaptations.
- Evidence suggests that pelagic species have more sensitive hearing (thresholds at lower frequencies) than demersal species.
- Cartilaginous fishes (e.g. sharks) have the highest sensitivity to low frequency sound (~20 Hz to ~1500 Hz) (Myrberg, 2001). Since this group lacks a swim bladder, their detection capabilities are restricted to the particle motion component of sound (Myrberg, 2001; Casper *et al*., 2012).
- A range of damaging physical effects due to airgun noise have been described for fish, including swim-bladder damage, transient stunning, short-term stress responses, temporary hearing loss, haemorrhaging, eye damage and blindness. However, studies have shown that physical damage to fish caused from seismic sources occurs only in the immediate vicinity of the airguns, in distances of less than a few meters (Gausland 2003).
- Adult and juvenile fish have been shown to display several behavioural responses to seismic sound. These include leaving the area of the sound source by swimming away and changing depth distribution, changing schooling behaviour and startle responses to short range start up. Behavioural responses to seismic sound could lead to decreased catch rates if fish move out of important fishing grounds (Hirst and Rodhouse 2000).
- Studies indicate that offshore seismic survey activity had no effect on catch rates of crustaceans in the surrounding area (Andriguetto-Filho *et al*. 2005; Parry & Gason 2006), and little effect on reef invertebrates (crustaceans, echinoderms and molluscs) exposed to commercial seismic airgun noise (Wardle *et al*. 2001).

57.28

- The abundance and spatial distribution of fish and invertebrate larvae and eggs is highly variable and dependent on factors such as fecundity, seasonality in production, tolerances to temperature, length of time spent in the water column, hydrodynamic processes and natural mortality. Due to their importance in commercial fisheries, numerous studies have been undertaken experimentally exposing the eggs and larvae of various species to airgun sources (reviewed in McCauley, 1994). Physiological effects on eggs and larvae of a seismic array have been demonstrated to a distance of 5 m from the acoustic source (Kostyuchenko 1971). When compared with total population sizes and natural daily mortality rates, the impact of seismic sound sources on fish eggs and larvae could be considered insignificant (McCauley, 1994; Dalen and Naested 2006). The wash from ships propellers and bow waves can be expected to have a similar, if not greater, volumetric effect on plankton than the sounds generated by airgun arrays.
- For squid and other cephalopods a 2 - 5 km zone of acoustic influence is assumed around the acoustic source point.

The zones of impact on fish of impulsive signal emissions from the array source are presented in Table 43. The results relate only to physiological effects on fish. The zones of potential injuries were predicted to be within 160 m from the 3D array for fish species with a swim bladder and 80 m for fish species without a swim bladder. The zone of potential impact was predicted to be within 160 m for fish eggs and larvae.

Based on the noise exposure criteria provided by Popper *et al.* (2014) for fish that use a swim bladder for hearing, relatively high behavioural risks are expected at near to intermediate distances (tens to hundreds of meters) from the source location. Relatively moderate behavioural risks are expected for at far field distances (thousands of meters) from the source location.

The cumulative sound fields based on one assumed 24-hour survey operation were modelled and the zones of cumulative impact (i.e. the maximum horizontal perpendicular distances from assessed survey lines to cumulative impact threshold levels) are presented in Table 44. The zones of potential mortal injuries for fish species with and without a swim bladder, and for fish eggs and larvae are predicted to be within 60 m from the survey lines. For recoverable injury, the zones of impact are predicted to be within 20 m from the survey lines for fish without a swim bladder, and within 200 m for fish with a swim bladder. The zones of TTS effect for fish species with and without swim bladders are predicted to be within 3.5 km from the survey lines for the 3D survey 24-hour operation scenarios considered.

Existing experimental data regarding recoverable injury for fish eggs and larvae is sparse and no guideline recommendations have been provided. However, based on a subjective approach, noise impacts for fish eggs and larvae are expected to be moderate at the near field (i.e. in the distance of tens of meters) from the source location, low at intermediate (i.e. in the distance of hundreds of meters) and far field (i.e. in the distance of thousands of meters) from the source location.

Table 43: Zones of immediate impact from single pulses (2D / 3D seismic airgun arrays) for mortality and recoverable injury for fish, fish eggs and fish larvae (SLR, 2022).

Type of animal	Zones of impact – maximum horizontal distances from source to impact threshold levels			
	Mortality and potential mortal injury		Recovery injury	
	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m
Fish: no swim bladder (particle motion detection)	>213	70 / 80	>213	70 / 80
Fish: swim bladder is not involved in hearing (particle motion detection)	>207	140 / 160	>207	140 / 160

Type of animal	Zones of impact – maximum horizontal distances from source to impact threshold levels			
	Mortality and potential mortal injury		Recovery injury	
	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m
Fish: swim bladder involved in hearing (primarily pressure detection)	>207	140 / 160	>207	140 / 160
Fish eggs and fish larvae	>207	140 / 160	-	-

Table 44: Zones of cumulative impact from multiple pulses (2D / 3D seismic airgun arrays) for mortality and recoverable injury for fish, fish eggs and fish larvae (SLR, 2022).

Type of animal	Zones of impact – maximum horizontal/perpendicular distances from assessed survey lines to cumulative impact threshold levels (2D / 3D)					
	Mortality and potential mortal injury		Recoverable injury		TTS	
	Criteria - SEL_{24h} dB re 1 µPa²·s	Maximum threshold distance, m	Criteria - SEL_{24h} dB re 1 µPa²·s	Maximum threshold distance, m	Criteria - SEL_{24h} dB re 1 µPa²·s	Maximum threshold distance, m
Fish: no swim bladder (particle motion detection)	219	< 10	216	15 / 20	186	~2 000 / 3 500
Fish: swim bladder is not involved in hearing (particle motion detection)	210	20 / 30	203	80 / 200	186	2 000 / 3 500
Fish: swim bladder involved in hearing (primarily pressure detection)	207	40 / 60	203	80 / 200	186	2 000 / 3 500
Fish eggs and fish larvae	210	20 / 50	-	-	-	-

Pulfrich (2022) concluded that the impact of the acoustic source on fish eggs and larvae accounts for an insignificant amount of mortality compared to the natural mortality rate per day for most fish species at that life stage. The Reconnaissance Permit area does not coincide with spawning areas of key commercial fish species.

The overall effects on the fishing industry of physiological injury to fish as a result of the proposed surveys is considered to be of overall LOW NEGATIVE significance (with mitigation) on the large pelagic longline sector, the only sector that operates within the Reconnaissance Permit application area.

The zones of impact of pulsed sounds on behavioural responses of fish were not modelled in the STLM because of the variability in published findings on the topic. However, if a precautionary approach is adopted, a sound range of 161 to 166 dB re 1 µPa RMS may be used as an indicator of the sound pressure level at which behavioural modifications of fish start to take place. The STLM results predict a RMS SPL of 162 dB re 1µPa at a horizontal distance of 4 km from the airgun array (SLR 2021). For the purposes of this assessment, we have assumed that the catch rates to a distance of 4 km from the Reconnaissance Permit area could be affected.

Based on the location of the Reconnaissance Permit area, the noise generated during the survey would be expected to the large pelagic longline and tuna pole-line sectors. Because the sector operates across the extent of the Reconnaissance Permit area, the affected area is considered to be of regional extent. Behavioural effects are generally immediate, with duration of the effect being less than or equal to the duration of exposure.

The noise generated during the survey would be expected to attenuate to below threshold levels for behavioural disturbance before reaching the fishing grounds of all other sectors viz. demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, traditional linefish, west coast rock lobster, small-scale fisheries and net fisheries. The Reconnaissance Permit area does not overlap with spawning areas of key commercial species (and the timing of the proposed survey is not expected to coincide with peak spawning periods).

Noise would be expected to attenuate to below threshold levels for behavioural disturbance before reaching inshore recruitment and/or nursery areas. Due to the location of the Reconnaissance Permit area in the deepwater environment, sound generated during the survey is not expected to influence the spawning behaviour or migration route of snoek (a species of key importance to the linefish and small-scale fisheries sectors). The Reconnaissance Permit area is situated well offshore of the shelf break which is where snoek are known to spawn during winter-spring.

The impact of sound on the large pelagic longline sector is assessed to be of overall MEDIUM NEGATIVE significance before mitigation, whereas the impact on the tuna pole-line sector is assessed to be of overall LOW NEGATIVE significance. Due to the distance of the Reconnaissance Permit area from fishing grounds, the sound is likely to attenuate to below threshold levels for behavioural disturbance of all other fisheries sectors viz. the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, traditional linefish, west coast rock lobster, small-scale fisheries and netfish sectors. There is no impact expected on these sectors.

With the implementation of recommended mitigation measures, the residual impact of sound generated during the proposed survey is assessed to be of LOW NEGATIVE overall significance to the large pelagic longline and tuna pole-line sectors. There is no impact expected on the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, traditional linefish, west coast rock lobster, small-scale and netfish sectors.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impact of Seismic Source Sound on Fishing Operations: Large Pelagic Longline Sector	Operation	Medium	Low	Low
Impact of Seismic Source Sound on Fishing Operations: Tuna Pole-line Sector	Operation	Low	Low	Low
Mitigation Measures				
• The seismic survey should avoid taking place during periods of peak fishing activity (June and July) in order to reduce the probability of disruption to the large pelagic longline fishing sector. • At least three weeks prior to the commencement of seismic survey activities the following key stakeholders should be consulted and informed of the proposed seismic survey programme (including navigational co-ordinates of location, timing and duration of proposed activities) and the likely implications thereof (specifically the exclusion and safety zone around the seismic vessel): o Fishing industry associations: SA Tuna Association; SA Tuna Longline Association and Fresh Tuna Exporters Association. o Other key stakeholders: SANHO, SAMSA, National Ports Authority and the DFFE Vessel Monitoring, Control and Surveillance Unit in Cape Town.				

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Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance

- These stakeholders should again be notified at the completion of the project when the survey and support vessels are off location.

- Request, in writing, the broadcast by SANHO of a navigational warning via Navigational Telex (Navtext) and Cape Town radio for the duration of the seismic survey activity.
- Distribute a Notice to Mariners prior to the commencement of the seismic survey operations. The Notice to Mariners should give notice of (1) the co-ordinates of the survey area, (2) an indication of the proposed survey timeframes, (3) the dimensions of the towed gear array and dimensions of the safety zone around the seismic vessel, and (4) provide details on the movements of support vessels servicing the project. This Notice to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.
- An experienced FLO should be placed on board the seismic or escort vessel to facilitate communications with fishing vessels in the vicinity of the seismic survey areas.
- Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source during all hours it is confirmed visually by the MMO during the pre-acquisition watch (60 minutes) that there are no shoaling large pelagic fish within 500 m of the seismic source.
- In the case of shoaling large pelagic fish being observed within the mitigation zone, delay the "soft-start" until animals are outside the 500 m mitigation zone.
- Terminate seismic source on
  - Observation of slow swimming large pelagic fish (including whale sharks, basking sharks, and manta rays) within the 500 m mitigation zone.
  - Observation of any obvious mass mortalities of fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO to be as a direct result of the survey.
  - For slow swimming large pelagic fish, terminate source until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required).
- For the duration of the survey, circulate a daily survey schedule (look-ahead), via email, to key fishing associations.
- Establish a functional grievance mechanism that allows stakeholders to register specific grievances related to operations, by ensuring they are informed about the process and that resources are mobilized to manage the resolution of all grievances, in accordance with the Grievance Management procedure.

9.3.2.3 UNPLANNED EVENTS

9.3.2.3.1 ACCIDENTAL RELEASE OF OIL AT SEA

Oil spilled in the marine environment would have an immediate detrimental effect on water quality, with toxic effects potentially resulting in mortality (e.g. suffocation and poisoning) or sub-lethal (e.g. respiratory damage) effects on marine fauna. An oil spill can also result in several indirect impacts on fishing. These include:

- Exclusion of fisheries from polluted areas and displacement of targeted species from normal feeding / fishing areas, both of which could potentially result in a loss of catch and / or increased fishing effort;
- Mortality of animals (including eggs and larvae) leading to reduced recruitment and loss of stock (e.g. mariculture); and
- Gear damage due to oil contamination.

Oil contamination could potentially have the greatest impact on commercial fisheries for rock lobster and sessile filter feeders (e.g. mussels) and grazers (e.g. abalone). Mortality is expected to be high on filter feeders and, to

a lesser extent, grazers. These species have low mobility and no means to escape contamination and ultimately mortality. Thus, mariculture facilities could be impacted if a spill extended into these areas. For a large oil spill, fishing / mariculture activities and revenues could be affected over a wide area until such time as the oil has either been dispersed or broken down naturally.

The Reconnaissance Permit area coincides with fishing grounds used by the large pelagic longline sector only. Thus, any spill within the Reconnaissance Permit application area, could impact this sector. The dominant wind and current direction will ensure that any spill in the Application Area is dispersed in a north-westerly direction away from the more actively fished areas inshore of the Reconnaissance Permit application area. An offshore spill is likely to disperse rapidly (days). Without the implementation of mitigation measures, the potential impact on the offshore fishing sectors is considered to be of local extent for small instantaneous spills, of regional for larger volumes spills and of moderate magnitude in the short-term. The potential impact on commercial fishing operations is assessed to be of LOW NEGATIVE significance due to the improbable likelihood of such an event occurring.

In the case of a spill en route to the survey area (i.e. during a vessel accident), the spill may reach the coastline. Nearshore fishing (linefish and small-scale fisheries) and mariculture operations (abalone and mussel) would be at risk of the effects of an oil spill (refer to the marine fauna assessment report (Pulfrich, 2022)). The greatest risk of contamination is on sessile filter feeding (e.g. mussels and oysters) and grazing species (e.g. abalone) via physical clogging and or direct absorption of the contaminant, leading to mortality.

With the implementation of the above-mentioned intrinsic mitigation measures, the residual impact would be of LOW NEGATIVE significance for offshore or for nearshore spills.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impact of Accidental Release of Oil at Sea on Fisheries Sectors (Offshore)	Operation	Low	Low	Low
Impact of Accidental Release of Oil at Sea on Fisheries Sectors (Nearshore)	Operation	Low	Low	Low
Mitigation Measures				
• Ensure personnel are adequately trained in both accident prevention and immediate response, and resources are available on each vessel. • Use low toxicity dispersants. • Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station. • Ensure offshore bunkering is not undertake in the following circumstances: o Wind force and sea state conditions of ≥6 on the Beaufort Wind Scale; o During any workboat or mobilisation boat operations; o During helicopter operations; o During the transfer of in-sea equipment; and o At night or times of low visibility. • Ensure that solid streamers rather than fluid-filled streamers are used. Alternatively, low toxicity fluid-fill streamers could be used.				

9.3.2.3.2 LOSS OF EQUIPMENT AT SEA

These activities (or event) are described further below:

- Irretrievable loss of equipment to the seabed during seismic acquisition; and
- Accidental loss of paravanes, streamers, arrays, and tail buoys during seismic acquisition.

During seismic acquisition, the survey vessel tows a substantial amount of equipment; the deflectors or paravanes, which keep the streamers equally spread are towed by heavy-duty rope, and the streamers themselves are towed by lead-in cables. Each streamer is fitted with a dilt float at the head of the streamer, numerous streamer mounts (birds and fins) to control streamer depth and lateral positioning, and a tail buoy to mark the end of the streamer. Streamers are neutrally buoyant at the required depth, but have buoyancy bags embedded within them that inflate at depth. If streamers are accidentally lost, they would float in the water column for some time before sinking. Dilt floats and tail buoys would ultimately be dragged down under the weight of the streamer. Airguns are suspended under floats by a network of ropes, cables, and chains, with each float configuration towed by an umbilical. Should both the float and umbilical fail, the airguns would sink to the seabed.

The potential impacts (direct) associated with lost equipment include:

- Potential snagging of demersal gear with regards to equipment that sinks to the seabed; and
- Potential entanglement hazards with regards to lost streamers, arrays and tail buoys drifting on the surface or in the water column.

The accidental loss of equipment onto the seafloor would provide a localised area of hard substrate in an area of otherwise unconsolidated sediments. The Reconnaissance Permit area does not coincide with fishing grounds of any demersal fishing sectors thus snagging of demersal gear is considered to be unlikely.

The loss of streamers and floats could result in entanglement hazards in the water column before the streamers sink under their own weight. In the unlikely event of streamer loss, associated impact could be highly localised and limited to the site (although would potentially float around regionally) over the short-term. The impact magnitude for equipment lost to the water column is, therefore, considered to be low and of LOW NEGATIVE significance to the large pelagic longline fishery.

The implementation of the mitigation measures will reduce the impact; however, the residual impact will remain of low magnitude and of LOW NEGATIVE significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impact on Fisheries Sectors of Loss of Equipment at Sea.	**Operation**	**Low**	**Low**	**Low**
Mitigation Measures				
• Ensuring that loads are lifted using the correct lifting procedure and within the maximum lifting capacity of the crane system. • Minimise the lifting path between vessels. • Undertake frequent checks to ensure items and equipment are stored and secured safely on board each vessel. • Retrieval of lost objects / equipment, where practicable, after assessing the safety and metocean conditions. Establish a hazards database listing the type of gear left on the seabed and / or in the survey area with the dates of abandonment / loss and locations and, where applicable, the dates of retrieval.				

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
• Notify SAN#O of any hazards left on the seabed or floating in the water column; and request that they send out a Notice to Mariners with this information. • Ensure at a minimum, one FLO person should be present on board the seismic or escort vessel to facilitate communication with the fishing vessels that are in the area.				

9.3.2.4 CUMULATIVE IMPACTS

The impacts on each of the above fishing sectors could be increased due to the combination of impacts from other projects that may take place during the same period. Cumulative impacts include past, present and future planned activities which result in change that is larger than the sum of all the impacts. Cumulative effects can occur when impacts are 1. additive (incremental); 2. interactive; 3. sequential or 4. synergistic and would include anthropogenic impacts (including fishing and hydrocarbon industries) as well as non-anthropogenic effects such as environmental variability and climate change[26].

In the Benguela region, it has been suggested that the seasonal movement of Longfin Tuna northwards from the west coast of South Africa into southern Namibia may be disrupted by the noise associated with an increasing number of seismic surveys. While the potential exists to disrupt the movement of Longfin Tuna in the Benguela, this disruption, if it occurs, would be localised spatially and temporarily and would be compounded by environmental variability. In Australia, no direct cause and effect in changes in movement or availability of Bluefin Tuna could be attributed to seismic surveys (Evans et al., 2018), with observed changes being attributed to inter-annual variability. Due to the dearth of information on the impacts of seismic noise on truly pelagic species links between changes in migration patterns and subsequent catches thus remains speculative. In addition to the above, the following should also be considered to take account of catch variability and stock declines, which can be attributed to the following (Shomura et al 1995, Kuo-Wie Lan et al 2011, Lehodey et al 2006 and Punt et al 1996):

- Increasing fishing effort exacerbated by improved fish finding technology (vessel monitoring systems, use of sonar, sea surface temperature spatial mapping using satellite technology);
- Environmental variability such as cold and warm water events e.g. Benguela El Niño events have been shown to result in a change in the vertical distribution of tuna stocks within the water column, resulting in reduced catch rates;
- Migration and feeding patterns that change abundance levels annually and are linked to the environment; and
- Inconsistent or irregular catch reporting.

This said, there is the possible chance of an increase in disturbance and disruption to fisheries active in the area and pressure on local services and facilities should additional exploration and mining activities commence (by other applicants or existing exploration right holders) in a relatively short period. There are a number of reconnaissance permit application and EIA / Basic assessments being undertaken for proposed seismic surveys off the West Coast, although it is unlikely that all these will be undertaken as they are targeting similar areas in the Deep Water Orange Basin.

Concurrent activities such as other planned speculative or proprietary seismic surveys in the southern Benguela region could add to the cumulative impact on fisheries. Although it is unlikely that concurrent seismic surveys would be undertaken in the same area during the same survey window, the current report includes an assessment of the cumulative impact on fisheries during simultaneous operations of three regional seismic surveys off the west coast. Simultaneous survey operations would result in an increase in the extent and

[26] Refer to Augustyn et al. (2018) for a synopsis of climate change impacts on South African fisheries.

magnitude of the impact on the large pelagic longline sector. The impact duration would remain unchanged[27]. Three seismic surveys of regional extent, undertaken simultaneously, could be expected to result in an impact of MEDIUM NEGATIVE significance on the large pelagic longline sector and of LOW NEGATIVE significance on the tuna pole-line sector, both with and without the application of mitigation measures. Once completed there is not expected to be any residual impact.

9.3.3 IMPACTS ON HERITAGE

This section provides a description of the Heritage impacts identified by in the HIA. For a more detailed description of the impacts, please refer to the HIA undertaken by PGS Heritage (Pty) Ltd included in Appendix 3.

9.3.3.1 IMPACTS ON CULTURAL HERITAGE

It must be noted that a large section of the affected communities not only view themselves as small-scale fishers but also as indigenous people and, as such, are intrinsically linked to the ocean and the land they have lived on for centuries. The resurgence movement through which Khoi and San descendants are reclaiming their identity has in recent decades afforded these communities the ability to re-establish their cultural roots and grounding in an ancient landscape. This sentiment is echoed in the founding affidavit submitted (5 Feb 2022) during the appeal submitted to the first Searcher application by CJ Adams. It notes that the ocean is not only important for fishing but also has spiritual meaning and is a place of healing and holds healing powers for the indigenous communities. It further expanded that the ocean and its resources play an important part in their community's history and heritage.

Community identity and culture are thus strongly linked to the ocean and what it can provide, physically and spiritually. Communities have coexisted with the ocean for generations. This existence has created a culture and heritage that defines their way of living, community, and kinship unique to the West Coast of South Africa. Cook (2001) describes this as maritimity, a process whereby the sum of cultural adaptations made by coastal populations becomes imbued with meaning and culture. This is evident in community structures, cultural events, and seasonal activities. Their culture and heritage historically had a physical manifestation in village layouts, boat building and the unique west coast architectural vernacular. This vernacular was appropriated by the rich to develop quasi-cultural village expressions in the modern expansions of West Coast towns such as Paternoster.

This uptake of the cultural heritage manifestations or elements of the indigenous communities by the public at large, provides a manner of legitimacy to their culture that is deeply entwined with the ocean and coastal landscape. It, unfortunately, does not translate into economic providence and brings no relief to their plight as subsistence communities. The changes in the fishing economies around the South African coast in the past four decades have resulted in a loss in income and livelihoods. It has inevitably impacted their community structures and activities which are a large part of their cultural heritage.

The public meetings and focused discussions with interlocutors have shown that these communities and groupings are struggling economically due to decades of turmoil in the fishing industry. An industry plagued by the closing of fish processing plants, fishing licence and quota issues, and diminishing catches due to environmental and industrial impacts, to name a few. This economic downturn led to social issues within the communities. Foremost are poverty, loss of social fabric, substance abuse, teenage pregnancies, and violence. In all the interviews, the above issues were raised as central to their social existence and community experience.

Considering the Article 8(j) and 10 Convention on Biological Diversity (29 December 1993), of which South Africa has been a signatory since 1995, the need to "...respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices" must be considered within the

[27] Seismic surveys are undertaken within a window period of December to May as specified by DMRE as part of the EMP conditions to mitigate the impacts on sensitive migration periods for cetaceans.

available South African legislation. As such, the NHRA (section 3) (2)) considers heritage resources that are part of the national estate to include:

- Places to which oral traditions are attached or which are associated with living heritage;
- Or as per subsection 3, has cultural significance or other special values because of –
  - its importance in the community or pattern of South Africa's history;
  - its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
  - its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
  - its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
  - its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
  - its importance in demonstrating a high degree of creative or technical achievement at a particular period;
  - its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons; and
  - its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.

Culture is more than just the tangible but is also shared beliefs, values, language, traditions, functionality, meaning and community connections. Considering the various values and heritage significance as listed in section 3(3) of the NHRA, the cultural and living heritage associated with the communities and indigenous people along the southwestern and west coast of South Africa holds heritage significance. It is part of the national estate and holds importance as a way of life for small-scale fishers and Khoisan descendants alike. The physical and spiritual interaction with the ocean and the shorelines through millennia resulted in a maritimity that developed into the cultural fabric as they experience it today.

The significance of such intangible and living cultural heritage features can potentially have a combined heritage grading of Grade II or even Grade I through further research. However, grading inevitably implies the investigation into and consideration of a Provincial or Heritage declaration of significance for a largely intangible cultural heritage. This is problematic as the NHRA provides for the proclamation/declaration of place, objects, or structures as Provincial or National Heritage Sites and only refers to intangible/living heritage relating to such place, objects, or structures.

The cultural heritage and living heritage related to the communities linked to fisheries and ocean subsistence and further identifying as indigenous communities can potentially be impacted by the proposed project. This impact is indirect and is in the community perceived to be primarily linked to their economic existence as a result in the loss of fishing yield. Investigation and discussion have shown that the historic economic decline of fisheries has resulted in the loss of social cohesion, activities, and traditions.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impact on Cultural Heritage	**Operation**	**Medium**	**Low**	**Low**
Mitigation Measures				
• Implement recommended mitigation measures as listed in the other specialist reports for the project.				

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
• Re-assess post-project the potential effects on the identified communities and their intangible cultural heritage. This will require consideration of the socio-economic baseline developed during this environmental impact process against quantified economic damage and losses and human development impacts in a follow-up socio-economic assessment. It will enable the heritage specialist to evaluate the link between the socio-economic changes induced by the proposed project as it relates to changes in the intangible cultural heritage practices of the communities. Based on the outcomes, provide resources and support for communities to develop and undertake safeguarding measures or plans to enhance the mitigation capacity of their intangible cultural heritage by fostering dialogue, mutual understanding and reconciliation between and within communities. It is anticipated that this can be achieved through the implementation of the mitigation measures in the Social Impact Assessment. • 3D seismic surveys have the potential to locate wrecks on the surface, and sometimes below sediments on the ocean floor. Any shipwrecks or pieces thereof noted during the survey must be shared with the SAHRA MAIOH Unit for inclusion into the national database. These could then be identified and be incorporated into the EMPr.				

9.3.3.2 CUMULATIVE HERITAGE IMPACTS

The heritage specialist is aware of at least one other current application and the potential of another application soon occurring in the Orange Basin. Communities have expressed a definite concern about the multiple applications occurring in their fishing waters and the potential long-term effect of these surveys resulting in Oil and Gas companies starting applications for production rights based on the findings of these reconnaissance surveys. It is foreseeable that continued seismic surveys could add to the overall load of impacts on fish population that indirectly could impact community livelihoods and thus their way of living and cultural heritage. At this stage, cumulative impacts are purely speculative. Still, the potential for the future increase in cumulative impacts due to current and future seismic surveys and the potential for future Oil and Gas production cannot be excluded but is not quantifiable at this stage for cultural heritage.

9.3.4 SOCIAL IMPACTS

This section provides a description of the Social Impacts identified by in the Social Impact Assessment (SIA). For a more detailed description of the impacts, please refer to the SIA undertaken by Equispectives Research & Consulting Services included in Appendix 3.

Social impacts are the result of social change, and to fully understand the potential impacts it is important to know the impact pathways. A social change process is a discreet, observable and describable process that changes the characteristics of a society, taking place regardless of the societal content (that is, independent of specific groups, religions etc.). Social change processes can be measured objectively. The way in which social change processes are perceived, given meaning or valued, depend on the social context in which various societal groups act. Some groups in society are able to adapt quickly and exploit the opportunities of a new situation. Others (e.g. vulnerable groups) are less able to adapt and will bear most of the negative consequences of change. These social change processes may, in certain circumstances and depending on the context, lead to the experience of social impacts. Social impacts are therefore completely context dependent.

9.3.4.1 UNCERTAINTY

The fishing communities are uncertain about the impact that the seismic survey will have on their livelihoods. They feel that there is not enough information available to them to determine whether the surveys will have an impact on their activities. In the past year a number of companies approached them to participate in EIA processes about seismic surveys. They want to have some definitive answers about the potential impacts from specialists. They would like to engage with them for more than two hours to make sure that they understand exactly what the project entails and what the potential impacts are. Only then will they be able to make informed decisions. The fishing communities have made a living from the sea for hundreds of years and they have learned

how to read the ocean and the weather to know where and when fish are moving. They are concerned that the surveys could disrupt the behaviour of snoek (that is endemic to the area and a major source of income) and other fish that they rely on. They have noticed changes in the patterns of the fish they catch due to industrial activities in the past. Some examples are the potato factory in Lambert's Bay that discharges warm water in the sea and the cofferdams constructed by the diamond mines. After a previous seismic survey at the Wild Coast, people observed dead Black Steenbras that were reported to have protruding nostrils. Furthermore, they also noticed changes in the patterns of the fish that they ascribed to climate change. For the fishing communities, the sea is an integral part of their identity, and they possess local knowledge that are not yet written up in scientific reports.

The marine fauna and fisheries reports indicate that low to negligible impacts on marine life and that all the impacts are reversible. However, the communities are not convinced. According to them, the fish can either go deeper in the sea to get away of the source of noise, which would be a tragedy for them, or they can go closer to the shore, which would be beneficial for them. They feel that no-one can predict with certainty how the fish would respond to the noise, just that they would try to move away from the source.

The impact of seismic surveys on the catchability of marine fish remains a contentious issue for communities, with some claims that seismic surveys may negatively affect catch rates. However, little empirical evidence exists to quantify the impact or identify the mechanisms of such impact. The communities feel that there is simply not sufficient data available to negate or substantiate these claims and much more research on the topic is needed, especially from a local perspective. The consensus seems to be that there is a great knowledge gap in this regard. Community members feel that companies doing seismic surveys or those who have an interest in the data obtained through seismic surveys can make a great contribution to scientific knowledge of this field by funding independent research on the topic in South African waters.

People's livelihoods are already impacted by external factors such as fishing quotas, climate change, commercial over-fishing, mining in the sea and the recent Covid pandemic. They fear that the seismic surveys will contribute to an already dire situation and be a tipping point that will render them helpless and without their last source of income. They see seismic surveys as a gateway to oil and gas exploration and are concerned about the potential impacts that the results of the seismic surveys can unlock. There is a high level of uncertainty about the future of the ocean, which causes great concern and distress amongst the fishing communities, especially because the uncertainty is related to their livelihoods, and they are already struggling to make ends meet. Uncertainty also takes its toll on people psychologically and may result in mental health issues for some people in the long run.

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
Uncertainty	Operation	High	Medium	Medium
Mitigation Measures				
• TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism. • TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. TGS will further contact relevant scientific research institutions to offer the potential of collaborating in independent on-water research during the survey. • Consult with communities on potential ways in which to make a positive contribution to the communities.				

9.3.4.2 **FURTHER MARGINALISATION OF VULNERABLE GROUPS**

In South Africa, claims for and access to natural resources are deeply embedded in people's histories, identities, and livelihood experiences. As in the case of land, access to and rights over fisheries resources is a highly contested issue where individuals and communities have equated such rights with human rights (Williams,2021).

Globally, fishing activities for many communities sees strong cultural and traditional links spanning many generations, and its value is seen beyond the means of earning a living (i.e. economic values). Whilst fishing takes place at sea, other activities related to fishing such as boat and net maintenance, the selling and trading of fish, etc. take place on land. Men and women are involved in fishing and indigenous knowledge and skills such as gutting and cleaning fish, reading the sea, and finding fish are transferred from generation to generation. The activities associated with fishing create a particular identity or characterise an area as a result of these activities (Williams,2021). Fishing is part of the cultural identity of the people living in fishing villages on the West Coast.

Many of the people on the West Coast belong to the Nama, Khoi or San people. Most of the Khoi people were traditionally cattle or sheep herders, while the San people were traditionally hunters and gatherers (www.san.org). They were the first inhabitants of southern Africa and one of the earliest distinct groups of homo sapiens. They have endured centuries of gradual dispossession at the hands of waves of new settlers, including the Bantu, whose descendants make up most of the black population of South Africa (https://foreignpolicy.com/2018/10/19/south-africas-first-nations-have-been-forgotten-apartheid-khoisan-indigenous-rights-land-reform/). The process of land distribution instituted by the Government since 1994 has largely excluded the Khoi and the San people, as the government has not acknowledged them as the country's first peoples and their land was mostly taken before the apartheid era. There is a growing movement of indigenous activists that believe it is time to rightfully claim their traditional land.

One of the Khoi and San's biggest challenges is the racial classification system used in South Africa. They are being classified as 'Coloured' - a label that was used during Apartheid for citizens that did not fit the binary race model and included mixed-race children and Afrikaans-speaking non-whites. This categorisation condemned much of the Khoi and San's history to oblivion and facilitated the appropriation of their land. It excluded them from land restitution as it was conceived to be a benefit to black South Africans, and they were not considered to be black. As such the Khoi and San are considered to be very vulnerable and marginalised groups. Being marginalised means that they may easily be overlooked by corporate groups or businesses unfamiliar with the local history. Their needs, their views and even themselves as a stakeholder group can easily be omitted – both intentionally and unintentionally. In a previous application for a seismic survey by another company in the area the Khoi and San felt that they were not consulted with. Therefore, they are sceptic about the intentions of any company doing seismic surveying. They felt that they were discriminated against by not being consulted during that previous application, deepening their status as marginalised groups, and causing distraught to them as groups. Many of the fishers are of Khoi and San descendance, and they feel that they simply cannot win in any situation – whether it is fishing rights, land rights or culture identity.

With increasing interest in the West Coast area by seismic surveyors, which is viewed as the precursor for oil and gas companies to start developing the area, these communities risk increased marginalisation and an increase in vulnerability with every application where their voices are not being heard. They feel that currently they need to fight to make their voices heard. They have been using legal avenues, as they feel that just speaking up is not effective and has failed to give them the desired outcomes. Communities feel that their cultural heritage is threatened.

The San has published the San Code of Research Ethics that provides a guideline for researchers and companies that want to work in their sphere of influence on how to conduct themselves and how to interact with the San. From their perspective, an EIA application is also viewed as a form of research. This guideline can be applied to the Khoi and other people in the fishing communities as well. The San Code of Research Ethics is based on:

- Respect for individuals, community and culture;
- Honesty;
- Justice and fairness;

- Care; and
- Process (following San research protocol).

The San Code of Research Ethics states that lack of care can be demonstrated by talking down to communities, confusing them with complicated scientific language, or treating communities as ignorant. It further states that a lack of care is also represented by failing to ensure that something is left behind that improves the lives of the San.

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
Further marginalization	Operation	[illegible]	Medium	Medium
Mitigation Measures				
• TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism. • TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. TGS will further contact relevant scientific research institutions to offer the potential of collaborating in independent on-water research during the survey. • Consult with communities on potential ways in which to make a positive contribution to the communities. • A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with adjusting the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective. • TGS should initiate discussions in their industry. The seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.				

9.3.4.3 CONCERNS ABOUT CUMULATIVE IMPACTS

A great source of concern for the fishing communities is the effect of cumulative impacts on their livelihoods and sense and spirit of place. There are a number of applications in process as well as approved applications relating to seismic surveys, mining, and oil and gas exploration in the West Coast area. There are also existing mining activities, significant shipping traffic and commercial fishing taking place in the ocean. The concern is that at some stage a tipping point will be reach where the marine life no longer recovers from the activities in the ocean or take a long time to recover to the extent that it would no longer be viable to make a living from the sea in those areas. In Norway small-scale fishing successfully co-exists with oil extraction in the ocean, but for the small-scale fishers on the West Coast, it remains uncertain to what extent it will be the case for them as well. Although cumulative impacts are assessed as part of the EIA process, there are limitations associated with budgets, timeframes, and access to resources. The competent authorities have a legal and moral duty to consider the cumulative impacts of the activities taking place and are planned to take place on the livelihoods and heritage of the vulnerable communities in the area from a strategic perspective. There must be a balance between the contribution these activities can make to South Africa's economy and sustaining the livelihoods of

the vulnerable communities on the West Coast. The communities are clear that they do not necessarily want to stop development, they want to make sure that their livelihoods and heritage are protected, and that the rights of future generations will not be compromised. Once these have been affected negatively, it may not be possible to easily undo the damage.

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
Cumulative social impact concerns	Operation	[illegible]	Medium	Medium
Mitigation Measures				
• TGS should approach the authorities and enter into conversation regarding a strategic impact assessment for the area that should be contributed to by all the production/ exploration companies involved.				

9.3.4.4 PERCEIVED IMPACT ON LIVELIHOODS

A livelihood refers to the way of life of a person or household and how they make a living, in particular, how they secure the basic necessities of life, e.g., their food, water, shelter and clothing, and live in the community (Vanclay et al., 2015). The coastal communities in the area of interest are mostly fishing communities that make their livelihoods from the sea and have been doing so for generations. They rely on the ocean for food and economic security, as well as their identity and heritage. They know how to make a living from the sea. If it is no longer possible for them to make a living from the sea, or if their ability to make a living from the sea is reduced it will result in a great increase in poverty in the area as there are very limited alternative options for them to make a livelihood. Their skill sets are strongly linked to the sea and cannot be transferred to other economic activities without skills development, training activities and the economic diversification of the area. Men and women rely on the sea for their livelihoods, and it is closely linked to the culture and identity of the people. This makes these communities extremely vulnerable. Furthermore, an increase in poverty in the area will place an additional burden on tax payers.

The small-scale fishers can travel approximately 15 nautical miles offshore with their boats. Some of them have indicated that they already sometimes need to go further to be able to catch enough fish, which is not only more expensive for them in terms of the diesel required for their boats, but it is also more dangerous. In the mining areas around Port Nolloth they are struggling to get access to the sea and the areas where they are allowed to fish are getting smaller.

Livelihoods are already compromised due to the fishing quota system, over-fishing, lack of employment opportunities, pollution, effects of climate change and the recent Covid 19 pandemic. However, with reference to the assessment of the impacts on the catch rates from the fisheries assessment undertaken by CapMarine (2022), the impact on livelihoods is not because of the actual impact on catch rates, but because of the perceived impact of the oil/gas industry on fishing industry.

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
Perceived impact on livelihoods	Operation	Medium	Medium	Medium
Mitigation Measures				
• TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism.				

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
• TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. TGS will further contact relevant scientific research institutions to offer the potential of collaborating in independent on-water research during the survey. • Consult with communities on potential ways in which to make a positive contribution to the communities. • A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with adjusting the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective. • TGS should initiate discussions in their industry. The seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.				

9.3.4.5 IMPACTS ON SENSE AND SPIRIT OF PLACE

Sense of place refers to an individual's personal relationship with his/her local environment, both social and natural, which the individual experiences in his/her everyday daily life (Vanclay *et al*, 2015). It is highly personal, and once it is affected, it cannot be restored. It is also difficult to quantify. The environmental philosopher Glenn Albrecht noted a consistent theme of distress caused by coal mining in Australia by the assault on the people's sense of identity, place, belonging, control, and good health. He identified a melancholia from the loss of solace and comfort connected with their home which he termed 'solastalgia' – a form of homesickness that one gets when one is still at 'home' associated with the major project impacts they experienced (Albrecht *et al*, 2007). Social impacts can therefore range from significant health impacts to the loss of a cherished landscape and associated loss of a sense of place.

Spirit of place refers to the unique, distinctive, and cherished aspects of a place. Whereas 'sense of place' is the personal feelings an individual has about a place, spirit of place refers the inherent characteristics of the place (Vanclay *et al*, 2015). In this case the spirit of place includes the ocean and the properties assigned to it.

Many things can impact on a person's perception of sense of place. For the fishing communities the ocean is an integral part of their being, therefore anything that is perceived to potentially harm the ocean would also cause harm to them. The ocean provides them with food and thus keeping them from starvation. For many the sea is a sacred place. Its water has healing powers that take care of the sick. Many loved ones have given their lives to the ocean while they were out trying to make a living, and their remains have never been found. The sea kept their bones, making the ocean the graveyard where their loved one's rest. For some people the thought of disturbance in the sea causes great distress. The heritage aspects relating to this are discussed in the heritage impact assessment report. Although this cultural and spiritual connection with the sea might be difficult to understand for outsiders, it must be respected as a cultural right.

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
Impact on sense of spirit and place	Operation	Medium	Medium	Medium

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
Mitigation Measures				
• TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism. • Consult with communities on potential ways in which to make a positive contribution to the communities.				

9.3.4.6 **IMPACTS ON THE SOCIAL LICENCE TO OPERATE**

Social licence to operate (SLO) is a popular expression to imply that the acceptance of the community is also necessary for a project to be successful. It appears as if TGS does not currently have social licence to operate in the fishing communities. Based on the events surrounding previous applications and recent reports about seismic surveys in the media, the communities expressed that they do not trust TGS or any other company conducting seismic surveys. Applications for seismic surveys and community opposition to these surveys have been widely reported and debated in the media during the last year (Compare News 24, 13 Jan 2022; Mail and Guardian, 20 Jan 2022; Eye Witness News, 1 September 2022 amongst others). Numerous NGOs specialising in social and environmental justice have aligned with communities and assist them with opposing seismic surveys. Some community members think that seismic surveys are opening the door for oil and gas exploration, which is a great concern for them, mostly due to the anticipated impacts on their livelihoods.

Given that there are a number of applications for seismic surveys in the Orange Basin, and that each application is subjected to a Basic Assessment process, communities are confused and reaching saturation regarding consultation. From their perspective, with each new application, it is a new face standing in front of them, from a new company, but "basically everyone wants the same thing". Communities do not distinguish between different seismic survey companies. They feel as if their questions are not answered, and concerns are not addressed – each consulting firm just repeat the same technical information about what a seismic survey entails to them. Although this is not TGS's fault and they are following a prescribed legal process, it impacts on their social licence to operate and on the seismic survey industry as a whole.

The term "social fabric" embraces numerous complex and interrelated phenomena, including demographic and economic factors, behavioural issues (e.g. investment choices, political dynamics), social institutions (e.g. families), social organisations (e.g. municipalities and churches), and social networks, or relationships amongst people. The social fabric is underpinned by people's beliefs and sentiments, including a sense of belonging and identification with a particular social unit (Atkinson et al, 2017).

The social fabric in the communities have been damaged through previous negative experiences with businesses in the area. A number of factories in the greater area have closed or moved away and in the process of doing so created great hardship for the communities remaining behind. Very little severance was paid, and this aggravated the communities. Mines closed without proper rehabilitation plans. In some places, access to the areas where they earn their livelihoods are becoming increasingly restricted, especially through the activities of mining companies. This has reached a point where the communities have realised that they need to fight for the protection of their livelihoods as historically companies have in most cases not treated them fairly or with respect. It is unlikely that any company that would like to undertake an activity in the ocean will be given social licence to operate by the community. The community have been traumatised by historical events and behaviour of companies too many times. On the other hand, there are members in the community that welcome any new development and feel that living from the sea has its limitations and would soon be impossible. The dynamics between the different groups in the community, caused by the myriad of seismic survey applications, has already done significant harm to the social fabric of the fishing communities. People with individual agendas cause conflict in the community, and given the vulnerability of the community, the dire socio-economic conditions and

high levels of poverty, illiteracy and unemployment, community members are susceptible to these forms of manipulation.

Another aspect that affects TGS's current social license to operate negatively, is that previous applicants such as Searcher and Shell failed to conduct sufficient meaningful consultation with the small-scale fishers in the past. The MPRDA Regulations as amended in 2020 define meaningful consultation as: consulting in good faith, in a way that gives the landowner, lawful occupier and/or interested and affected persons all the relevant information, and reasonable time and opportunity to make an informed decision regarding the impact of the proposed activities.

The communities feel disrespected and marginalised by the processes followed up to date by previous applicants in the area. Engaging with the communities in a meaningful way, following the appropriate structures and protocols, will go a long way in improving TGS's social license to operate. It does not guarantee that the communities will accept TGS or any other company wanting to conduct seismic surveys. It must be kept in mind that improving social license to operate takes time and effort.

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
Impacts on the social license to operate	Operation	High	Medium	Medium
Mitigation Measures				
• TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism. • Consult with communities on potential ways in which to make a positive contribution to the communities. • A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with adjusting the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective. • TGS should initiate discussions in their industry. The seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.				

9.3.4.7 **STAKEHOLDER FATIGUE AND DISILLUSIONMENT**

Signs of stakeholder fatigue are visible in the communities. Stakeholder fatigue may occur where many stakeholder initiatives have taken place in the past, especially in circumstances where they did not lead to tangible outcomes for stakeholders. There are a number of applications for seismic surveying, exploration and mining in the area that the stakeholders were invited to. The most obvious way to deal with this would be to avoid working with communities, suffering from stakeholder fatigue (Durham *et al*, 2014), but this is not always possible and infringes on their rights. The EIA process requires public participation and information sharing. The volume of consultation and information shared are confusing to the communities. Stakeholders start to feel overloaded, which negatively affects their willingness to participate and lessens the quality of their input. Over time only those who are deeply interested, that are strongly supportive of or strongly opposing may still participate. This can hinder potential projects, and can particularly occur when the stakeholders consulted are

not actively involved in decision-making. To be effective and to reduce stakeholder fatigue, engagements need to be targeted, with clear aims and results. Stakeholders need to be clear on what the goal or end benefits to themselves would be for participating. It must be kept in mind that the more stakeholders contribute their time and knowledge, the more they will expect in return from the project, so one always need to ensure that the relationship remains balanced.

Related to stakeholder fatigue is stakeholder disillusionment, which can occur during a project or can be a legacy of past involvement in stakeholder participation. Disenchantment can result from failure to manage credibility, relevance and legitimacy, particularly when communication is poor or expectations are not met. Stakeholders can feel let down from previous involvement and disenchantment can also result from failure to keep promises. A number of stakeholders have already indicated that they feel their voices don't matter and participating in all the processes are not making a difference.

Credibility, relevance, and legitimacy can be enhanced when (www.IZinsights.org):

- Other invited stakeholders are considered to be appropriate;
- Stakeholders with opposing views who are included are generally respected;
- There are clear objectives;
- The processes used are transparent and seen to be appropriate;
- There is continuity in the participation, allowing relationships to be maintained, trust to be developed, and stakeholder knowledge and skills to be built on;
- Attention is paid to appropriate timing of participation processes;
- Results are delivered in a timely manner;
- The participation and communication processes are effective and ongoing throughout the application process;
- Participation is adapted to changing circumstances;
- Understandable language is used;
- The process for participation for all stakeholders is clearly stated and appropriate;
- Stakeholders feel that their interests have been understood and taken into account;
- The multiple stakeholders involved are seen to be a balanced group; and
- Use unbiased facilitators where possible.

TGS can only influence what happens in their own application. By attending to issues discussed and keeping promises made to stakeholders, they give their own application process the best possible chance and make it more likely that stakeholders will participate in the future.

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
Impacts on the social license to operate	Operation	Medium	Low	Medium
Mitigation Measures				
• TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism.				

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
• Consult with communities on potential ways in which to make a positive contribution to the communities. • A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with adjusting the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective.				

9.3.4.8 COMMUNITY EXPECTATIONS

Not everyone in the fishing communities is opposed to the project or to oil and gas exploration. Their perceptions are that the ability to make a living from the sea is already declining. It is a hard live and they want a better life for their children. There are very limited alternative opportunities for making a livelihood and very limited job opportunities. They will support industrial development in the area if it brings opportunities for their children for employment and skills development. They want to know that they will benefit from the process that will be set in motion by the seismic surveys. They know they will not be direct beneficiaries from the extraction of oil and gas, but that they will be the ones that pay the price. Their expectations are that the oil and gas companies will invest in these communities and assist them with creating alternative livelihoods and obtaining the necessary skills and experience in that regard. Although TGS will be doing a survey to gather data that will be utilised by oil and gas companies, and TGS's activities will be of a temporary nature, with little benefit to the locals, the communities do not distinguish between data collection and exploration or extraction. For them these companies are one and the same, and they have similar expectations of TGS.

The proposed project collects data that would be of great value for the companies interested in extracting oil and gas in the area in future. Should this happen, it would have a positive impact on the economy of South Africa, seen together with the Government's plans for the development of a new industrial port at Boegoebaai. In a country with very high unemployment levels and suffering from a recession and an energy crisis, this is seen as a positive future development by many role players. As such, the communities feel that the government supports the application, and that community consultation is simply a matter of ticking the boxes. The question of who pays the price and who gets the benefit is relevant in this context. The price that the fishing communities will pay eventually, will be high as it may have an extremely negative impact on their livelihoods with little or no benefit to them, unless measures are put in place to protect their livelihoods. It must be considered that community livelihoods are broader than just catch rates and fishing, but includes the capabilities, assets (including both material and social resources) and activities required for a means of living.

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
Community Expectations	Operation	**Medium**	**Medium**	**Medium**
Mitigation Measures				
• TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism. • Consult with communities on potential ways in which to make a positive contribution to the communities. • TGS should investigate opportunities for the employment of people from local communities and skills development.				

9.3.4.9 SOCIAL UNREST

Generally, social unrest occurs when a group gathers publicly to express dissatisfaction or anger centred around a common cause and is usually accompanied by a demand for societal change. Poor socio-economic conditions caused by unemployment rates, corruption, inflation, and bad governance can contribute to social unrest. South Africa has a history of using protests to air grievances. Social unrest is often triggered by an event or action that provokes strong feelings amongst community members.

Some of the communities are adamant that they would not allow gas or oil extraction in the area, and that includes collecting the required data from the ocean. There have already been court cases in this regard, and there are also court cases that are ongoing. Some community members have threatened with violence against surveying vessels. Others have threatened that they will take action to fight seismic surveys, in any way that they seem appropriate. This is a very emotional issue for many people and that could erupt into social unrest. Related to this is potential for conflict between community members who support the project and those that are against the project.

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
Social Unrest	Operation	Medium	Low	Medium
Mitigation Measures				
• TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism. • Consult with communities on potential ways in which to make a positive contribution to the communities. • A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with adjusting the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective. • TGS should initiate discussions in their industry. The seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.				

9.3.5 CUMULATIVE NOISE IMPACTS ASSOCIATED WITH MULTIPLE SURVEYS

Should other seismic survey campaigns be undertaken concurrently with TGS's proposed survey programme (although highly unlikely to be undertaken in the same area during the same survey window due to impacts on operation and data acquisition), cumulative impacts may be likely and there would need for alignment in planning of such concurrent operations in order to reduce cumulative impacts to an acceptable significance in terms of concurrent noise impacts. Current pending applications at PASA include the Searcher Geodata seismic survey application (PASA ref 12/1/043), as well as the GX Technology Corporation[28] survey application (ref 12/1/042), which both overlap the area proposed for the TGS 3D survey (Figure 117). It is understood that there

28 It is understood that ION GXT has been declared bankrupt and have ceased operations - as such, the ION GXT Reconnaissance Permit is considered to be defunct.

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is potentially another application that would overlap the same area, but for which a Reconnaissance Application has not been submitted.

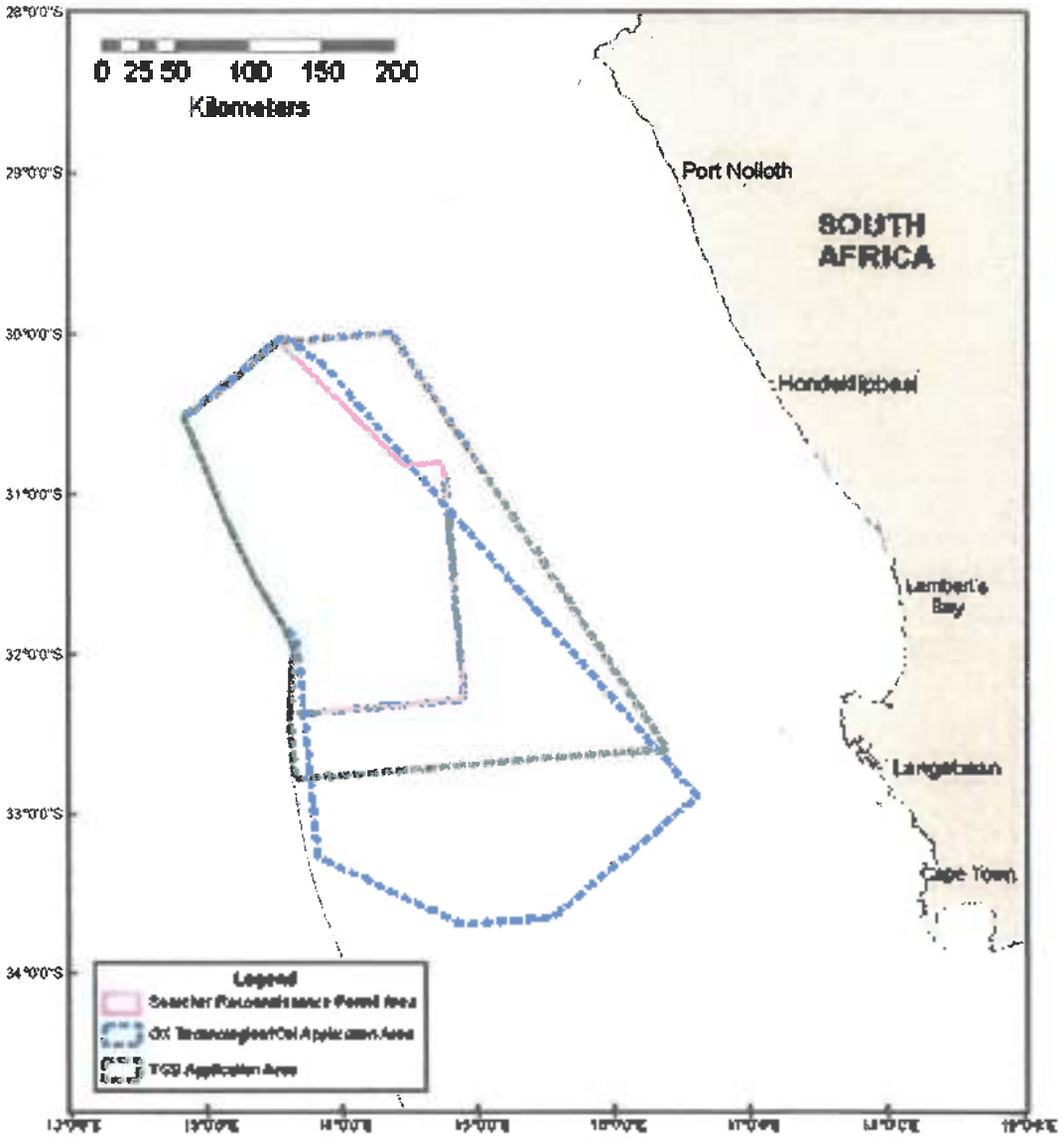

Figure 117: Application Areas for cumulative assessment in the unlikely event of multiple simultaneous surveys.

Despite the difficulty in undertaking a reliable assessment of the potential cumulative environmental impacts of future seismic acquisition in the Deep Water Orange Basin due to likely variation in the scope, extent and duration of proposed surveys, the cumulative impacts of three potential surveys occurring concurrently needs to be considered. The cumulative assessment assumes the worst-case scenario of three surveys (Searcher, TGS and GX Technologies) occurring simultaneously during the summer survey window in 2022/23.

In the unlikely event that multiple surveys would be undertaken concurrently within the Deep Water Orange Basin Area, associated impacts to marine fauna would be of high intensity and extend regionally, over the short-term (assuming they take place over the same summer survey window). The impact consequence for cumulative surveys is therefore considered medium.

Concurrent activities such as other planned speculative or proprietary seismic surveys in the southern Benguela region could add to the cumulative impact on fisheries. Simultaneous survey operations would result in an increase in the extent and magnitude of the impact on the large pelagic longline sector. The impact duration would remain unchanged. Three seismic surveys of regional extent, undertaken simultaneously, could be

expected to result in an impact of medium negative significance on the large pelagic longline sector, both with and without the application of mitigation measures. Once completed there is not expected to be any residual impact.

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
Cumulative impacts on marine fauna and fisheries	Operation	Medium	Low	Low
Mitigation Measures				
In the unlikely event that multiple surveys would take place at the same time within the same survey area, the risk of cumulative noise impact must be considered and is suggested to be managed as follows: • Should surveys be run simultaneously, ensure that a distance of at least 40 km is maintained between survey vessels until sufficient objective evidence is obtained that a reduced buffer distance is acceptable. • Each of the additional activities to those described in the technical noise report would be modelled or otherwise considered in terms of the cumulative noise level and with reference to the criteria described in the report. This modelling is only considered required in the case where a 40 km buffer distance between active survey ships cannot be maintained. • Should surveys run simultaneously, it would be required to amend the EMPr, which would be subject to further assessment and consultation.				

9.3.6 NO-GO ALTERNATIVE

The no go alternative would imply that no survey activities are undertaken and, as such, the negative impacts as stated above, would not materialise. However, conversely, this will negate the potential positive impacts associated with the proposed survey activities, including:

- The opportunity to identify potential oil and gas resources within the Application Area including potential future contribution to the economy of South Africa;
- The opportunity to conduct independent research on how fish species on the West Coast such as snoek respond to seismic surveying; and
- Provision of job or training opportunities (very limited during the survey phase).

Since there are no mitigation measures, the impact significance will be low pre- and post-mitigation and final significance will be the same.

Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Significance
No-Go Alternative	Operation	Low	Low	Low
Mitigation Measures				
• N/A				

10 CLOSURE AND REHABILITATION

It is anticipated that the activities will have a limited impact on the receiving environment. The impacts will be limited to the planning and operational phases and it is not anticipated that there will be any need for closure or rehabilitation once the 3D surveys have been concluded. As such, closure of the project will be limited to the conclusion of the physical 3D surveys to be undertaken in the target area. This will mainly relate to:

- Waste generation and disposal; and
- Water contamination and pollution.

Residual impacts post completion of the seismic activities are limited (if any) and therefore there will be no requirements for closure, decommissioning and rehabilitation actions. The overall closure objective will be to ensure that the post closure environment aligns with the pre-development. Therefore, no financial provisions apply to this application. A Rehabilitation, Decommissioning and Closure Plan is included as Appendix 6.

11 CONCLUSIONS AND RECOMMENDATIONS

The BA process identified potential issues and impacts associated with the proposed project. The BA addresses those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with applicable phases of the project and recommends appropriate mitigation measures for potentially significant environmental impacts. The BA report provides sufficient information regarding the potential impacts and the acceptability of these impacts in order for the Competent Authority to make an informed decision regarding the proposed project. The release of a draft BA Report provides stakeholders with an opportunity to verify that the issues they have raised through the process had been captured and adequately considered.

The BA report aims to achieve the following:

- Provide an overall description of the social and biophysical environments affected by the proposed project.
- Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed project.
- Identify and recommend appropriate mitigation measures for potentially significant environmental impacts; and
- Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

11.1 CONCLUSIONS FROM SPECIALIST STUDIES

The conclusions and recommendations of this BA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive, and every effort has been made to include representatives of all stakeholders in the study area. The main conclusions from each of the specialist studies are presented below.

11.1.1 NOISE / ACOUSTICS

The zones of potential injuries for fish species with a swim bladder, turtles and fish eggs and fish larvae are predicted to be within 180 m from the array source. However, fish species without swim bladders have higher injury impact thresholds, and therefore have smaller zones of potential injuries within 90 m from the airgun array source.

The zones of potential mortal injuries for fish species with a swim bladder, fish eggs, and fish larvae are predicted to be within 30 m from the adjacent survey lines for all the 24-hour survey operation scenarios considered. For recoverable injury, the zones of impact are predicted to be within 80 m from the adjacent survey lines for fish with a swim bladder for all the operation scenarios considered. Fish without swim bladder are not expected to suffer or any potential injury. The zones of TTS effect for fish species with and without swim bladders are predicted to be within 2.9 km from the adjacent survey lines for the relevant 24-hour survey operation scenarios considered. Existing experimental data regarding recoverable injury and TTS impacts for fish eggs and larvae is sparse and no guideline recommendations have been provided. However, based on a subjective approach, noise impacts are expected to be moderate for fish eggs and larvae. Impact is expected to be low for all of them at intermediate and far field from the source location.

Three (3) long range modelling source locations are proposed for the 3D seismic survey. The modelling is representative of the noise propagation within the proposed 3D seismic area. Source location L1 is adjacent to the marine sensitive area. L2 represents the average depth of the south survey area and L3 is located towards the deeper water environment of the survey area. As can be seen from the horizontal and vertical contour figures, the received noise levels at far-field locations vary at different angles and distances from the source locations. This directivity of received levels is due to a combination of the directivity of the source array, and propagation effects caused by bathymetry and sound speed profile variations.

In general, the bathymetry profiles with significant upslope section across the continental slope region have the sound propagations experiencing significant attenuation due to the strong interaction between the sound signal and the seabed. The bathymetry profiles with downslope section have much less sound attenuation. These effects are evident in all locations for propagation paths towards shoreline directions.

For all source locations and except for downslope sections, the seabed depth variations are not significant along the propagation paths within the deep-water region. Therefore, the directivity of received noise is dominated by the directionality of the source array.

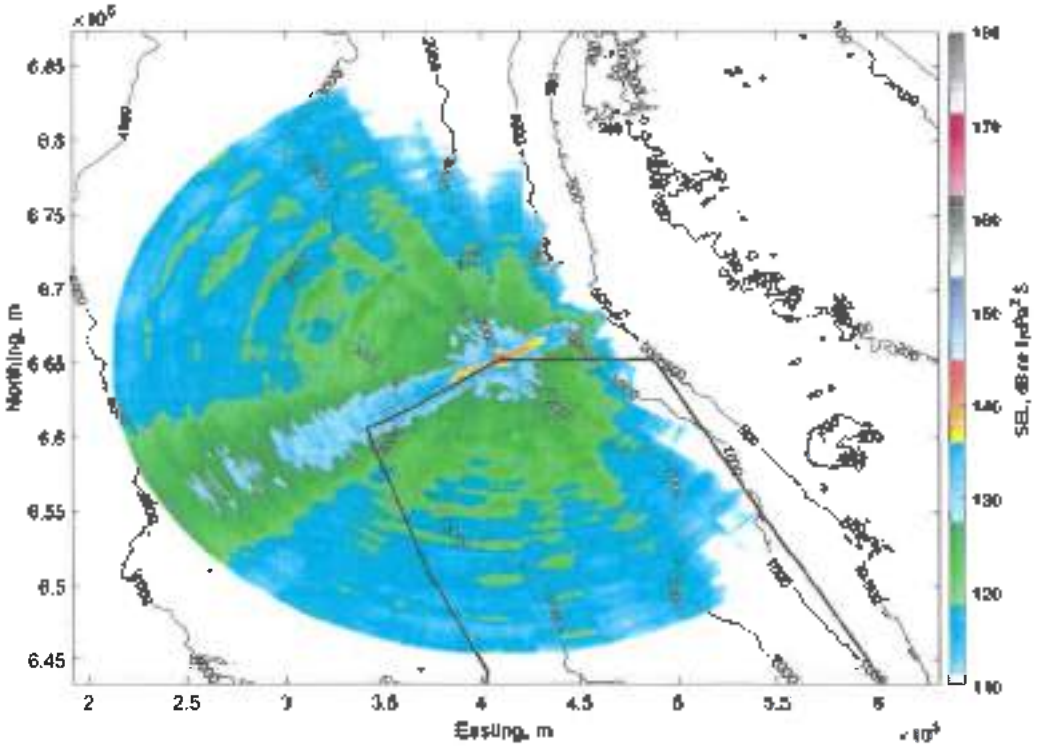

Figure 118: Modelled horizontal contour image of the predicted maximum SEL (unweighted and maximum level across water column) contours for source location L1 to a maximum range of 200 km, overlayed with bathymetry contour lines. Coordinates in WGS 84/UTM Zone 33S.

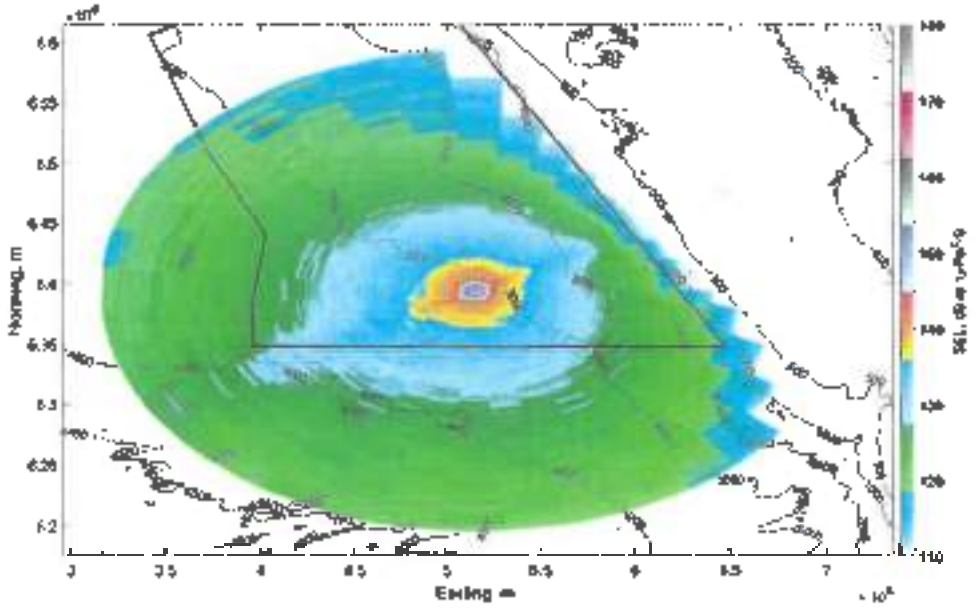

Figure 119: Modelled horizontal contour image of the predicted maximum SEL (unweighted and maximum level across water column) contours for source location L2 to a maximum range of 200 km, overlayed with bathymetry contour lines. Coordinates in WGS 84/UTM Zone 33S.

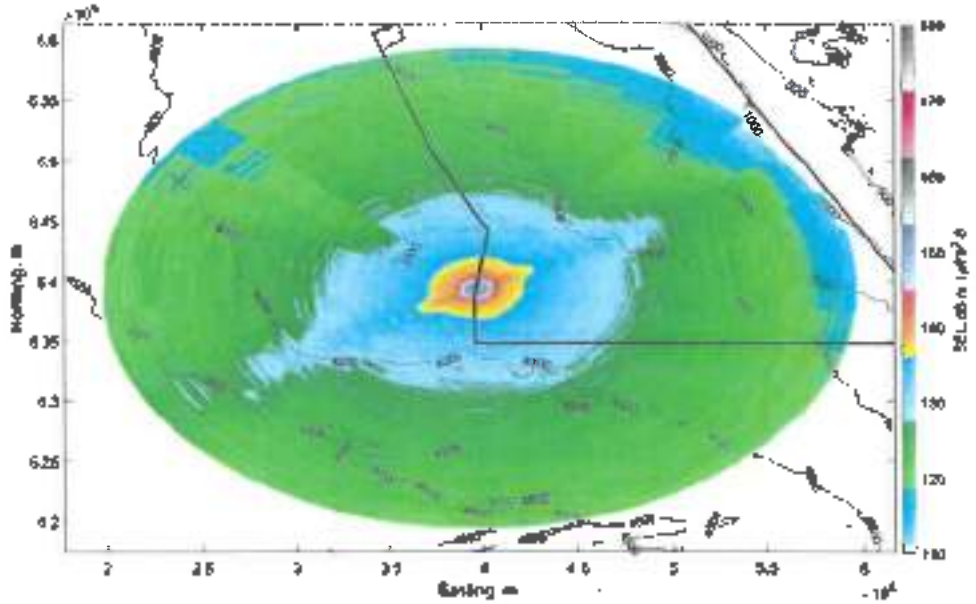

Figure 120: Modelled horizontal contour image of the predicted maximum SEL (unweighted and maximum level across water column) contours for source location L3 to a maximum range of 200 km, overlayed with bathymetry contour lines. Coordinates in WGS 84/UTM Zone 33S.

In terms of the impact from immediate exposure to individual airgun array pulses, the maximum zones of PTS effect for sea turtles are predicted to be within 19 m from the source location. On the other hand, the maximum zones of TTS effect for sea turtles are predicted to be within 24 m of the source array. The behavioural disturbance for sea turtles caused by the immediate exposure to individual pulses are predicted to be within 1.3 km of the source array.

In terms of the impact from cumulative exposure to multiple airgun array pulses, the noise impacts related to recoverable injury and TTS on sea turtles are expected to be high at the near field from the source location. The

maximum zones of PTS impact are predicted to range within 10 m of the source array. The maximum zones of TTS effect for sea turtles are predicted to be within 500 m of the source array. Further work will include the recommendation of underwater noise mitigation measures from seismic survey activities related to zones of impact and implementation of soft-starts if required.

Relevant mitigation measures are recommended to minimise the seismic impact on assessed marine fauna species:

- Recommended safety zones are based on the maximum threshold distances modelled for PTS (marine mammals and sea turtles) and potential mortal injury (fish) due to immediate exposure from single pulses and cumulative exposure from multiple pulses.
- Implement a soft-start procedure if testing multiple seismic sources. Delay soft-starts if shoaling large pelagic fish, turtles, seals, or cetaceans are observed within the zone of impact.
- Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented that would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior to the commencement of the survey and then operational levels of noise during the survey.

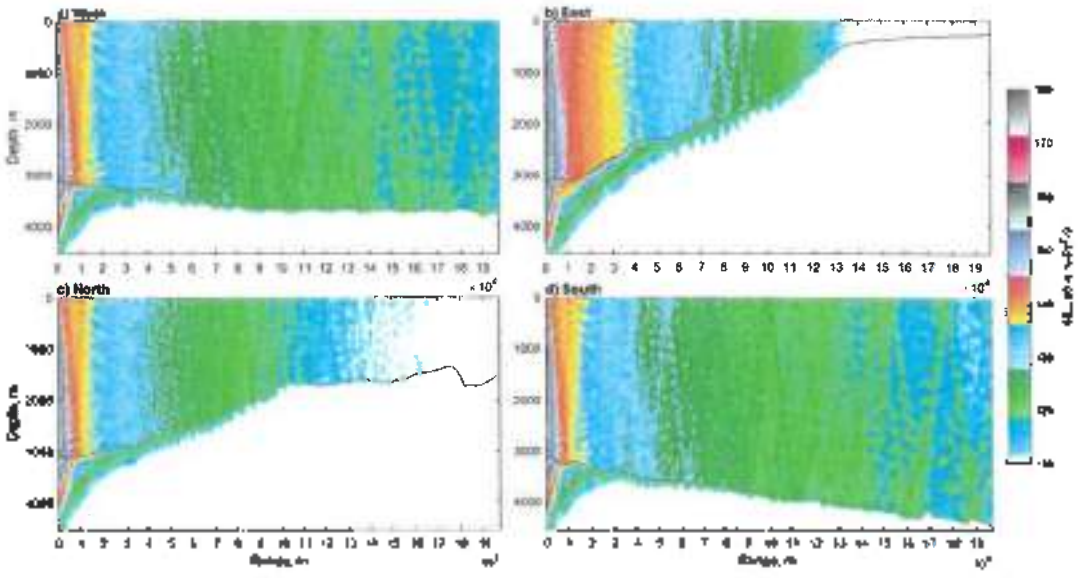

Figure 121: Modelled vertical contour images of the predicted SELs (unweighted) vs range and depth along the propagation path towards a) west b) east c) north and d) south direction from the source location L1. Black line shows the seabed depth.

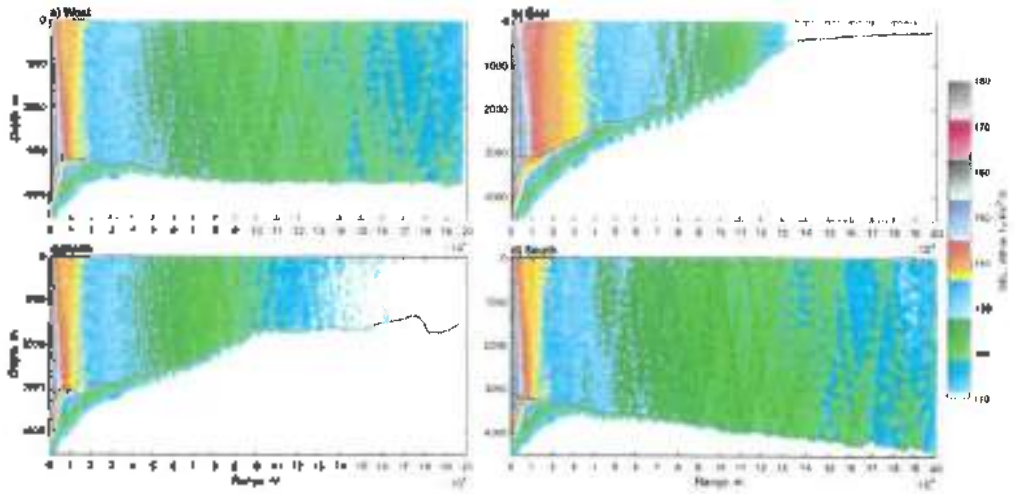

Figure 122: Modelled vertical contour images of the predicted SEL (unweighted) vs range and depth along the propagation path towards a) west b) east c) north and d) south direction from the source location L2. Black line shows the seabed depth.

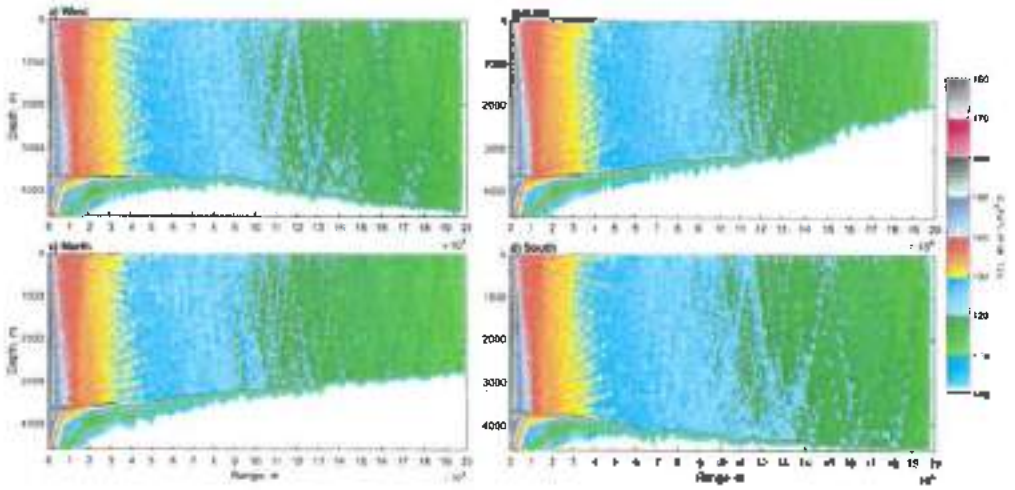

Figure 123: Modelled vertical contour images of the predicted SEL (unweighted) vs range and depth along the propagation path towards a) west b) east c) north and d) south direction from the source location L3. Black line shows the seabed depth.

In the unlikely event that up to three multiple surveys would take place at the same time within the same survey area, the risk of cumulative noise impact must be considered and is suggested to be managed as follows:

- During seismic pulse releases, maintain a distance of at least 40 kilometres from any other survey vessel until sufficient objective evidence is obtained that a reduced buffer distance is acceptable; and
- Each of the additional activities to that described in the technical noise report would be modelled or otherwise considered in terms of the cumulative noise level and with reference to the criteria described in this report (the modelling is only considered required in the case where a 40 km buffer distance between active survey ships cannot be maintained).

This 40km buffer maintained by any other survey vessels is considered sufficient on the basis that it provides a corridor between vessels where seismic source noise approaches ambient levels such that animals may pass between, and/or the potential cumulative effect beyond this distance is considered to be negligible.

11.1.2 MARINE ECOLOGY

The proposed survey activities to be undertaken by TGS are expected to result in impacts on marine invertebrate fauna in the Orange Basin, ranging from negligible to very low significance. Only in the case of potential impacts to turtles and marine mammals are impacts of low significance expected.

If all environmental guidelines, and appropriate mitigation measures recommended in this report are implemented, there is no reason why the proposed seismic survey programme should not proceed. It should also be kept in mind that some of the migratory species are now present year-round off the West Coast, and that certain baleen and toothed whales are resident and/or show seasonality opposite to the majority of the baleen whales. Data collected by independent onboard observers should form part of a survey close-out report to be forwarded to the necessary authorities, and any incidence data and seismic source output data arising from surveys should be made available for analyses of survey impacts in Southern African waters.

11.1.3 FISHERIES ASSESSMENT

The potential impacts of the seismic survey programme on fisheries relate to 1) exclusion of fishing vessels from accessing fishing ground, 2) the impact on catch rates as a result of increased noise levels associated with the seismic survey operation, 3) accidental loss of equipment from the survey array and 4) accidental release of marine diesel at sea.

Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part A, Rule 10), a seismic survey vessel that is engaged in surveying is defined as a "vessel restricted in its ability to manoeuvre" which requires that power-driven and sailing vessels give way to a vessel restricted in her ability to manoeuvre. Furthermore, under the Marine Traffic Act, 1981 (No. 2 of 1981), a vessel used for the purpose of exploiting the seabed falls under the definition of an "offshore installation" and as such it is protected by a 500 m safety zone. It is an offence for an unauthorised vessel to enter the safety zone. In addition to a statutory 500 m safety zone, a seismic contractor would request a safe operational limit (that is greater than the 500 m safety zone) that it would like other vessels to stay beyond. Safety clearances for seismic surveys are usually 6 Nm ahead and astern and 2 Nm to either side of the survey vessel, resulting in an exclusion area of approximately 185 km^2 around the survey vessel. The temporary exclusion of fisheries from the safety zone may reduce access to fishing grounds, which in turn could potentially result in a loss of catch and/or displacement of fishing effort (direct negative impact). The safety zone would be implemented around the seismic vessel for the duration of the project, resulting in an immediate impact that would endure for the duration of the proposed survey (~70 days). The impact of exclusion from fishing ground was assessed on each fishing sector based on the type of gear used and the proximity of fishing areas relative to the Reconnaissance Permit area. With the implementation of the project controls and mitigation measures, the residual impact of the proposed survey is considered to be of LOW NEGATIVE significance to large pelagic longline and tuna pole-line sectors. There is no impact expected on the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, linefish, west coast rock lobster, netfish and small-scale fishing sectors.

The impact on catch rates due to sound elevation levels was assessed and sensitivity/vulnerability differences amongst the targeted fish species identified for each sector. Sound generated during the proposed seismic survey is expected to be in the order of 255 dB re 1 µPa at 1 m at an operating frequency range of 5 – 300 Hz. This falls within the hearing range of most fish species. A sound transmission loss modelling study (SLR 2022) identified predicted zones of impact for fish species (amongst other marine fauna species of concern) based on relevant noise impact assessment criteria. The noise effects assessed included physiological effects (physical injury/permanent threshold shift (PTS) and temporary threshold shift (TTS)) and behavioural disturbance due to either immediate impact from single airgun pulses or cumulative effects of exposure to multiple airgun pulses over a period of 24 hours. Based on the current project description, sound levels for the seismic survey could notionally be expected to attenuate to below levels for behavioural disturbance at a distance of 4 km from the source. The spatial extent of the impact of sound (produced by the airgun array) on catch rates is expected to be regional, although localised at any one time. The impact is considered to be of immediate duration and reversible without additional time or cost. Based on the distance of fishing grounds from the Reconnaissance Permit area, only the large pelagic longline and tuna pole-line sectors are considered to be susceptible to the

effects of elevated sound. With the implementation of the project controls and mitigation measures, the residual impact due to seismic noise is considered to be of LOW NEGATIVE significance. There is no impact expected on the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, linefish, west coast rock lobster, netfish and small-scale fishing sectors.

The Reconnaissance Permit area is situated in the Orange Basin, offshore of the shelf break and offshore of grounds of importance for many of South Africa's commercial fishing sectors, as well as small-scale and recreational fisheries. The large pelagic longline sector operates across the extent of the Reconnaissance Permit area, with activity focussed along the continental shelf break. The Application Area does not overlap key spawning or nursery areas therefore the risk of noise disturbance to spawning behaviour and fishery recruitment is considered unlikely.

In order to mitigate the impacts on the large pelagic longline sector, it is recommended that the survey avoid taking place during June and July. Prior to the commencement of survey activities, affected parties should be informed of the navigational co-ordinates of the proposed survey acquisition area, timing and duration of proposed activities and any implications relating to the safety zone that would be requested, as well as the movements of support vessels related to the project. The relevant fishing associations include FishSA, SA Tuna Association, SA Tuna Longline Association and Fresh Tuna Exporters Association.

Other key stakeholders should be notified prior to commencement and on completion of the survey. These include; DFFE, the South African Navy Hydrographic Office (SANHO), South African Maritime Safety Association (SAMSA) and Ports Authorities. For the duration of the survey, a navigational warning should be broadcast to all vessels via Navigational Telex (Navtex) and Cape Town radio. In addition, it is recommended that updates of the scheduled weekly survey plan should be circulated to the operators of affected fishing vessels on a daily basis. A Fisheries Liaison Officer (FLO) should be present on board the seismic vessel or escort vessel for the duration of the survey in order to facilitate communications between the seismic and fishing vessels in the project area.

It is the reasoned opinion of the specialist that the reconnaissance activities may be authorised, subject to the implementation of the mitigation measures proposed.

11.1.4 HERITAGE ASSESSMENT

The scientific studies conducted for this project identified impacts on fishing stock as low for all species. By inference, a potential impact on fishing yield could be expected and thus potential economic impact on communities due to reduced caught fish volumes. The recommended mitigation measures, as listed in the specialist reports for the project, focus on the reduction of impacts on fish species and the projected reduction of the impact on the commercial and small-scale fishery catch yield. These mitigation measures should then indirectly positively impact the potential negative impacts on the cultural heritage of the communities to be impacted.

A pre-mitigation negative impact on a regional scale over the long term with a moderate intensity is predicted due to the potential indirect impact on the communities and, ultimately, their heritage, with a high probability of this impact occurring. The pre-mitigation impact on heritage resources is rated as MEDIUM. The potential residual impact on heritage resources, with mitigation measures from the scientific studies, is projected as LOW with a medium confidence factor.

Considering the assessment based on the findings of the fieldwork as well as the scientific studies relating to the impact on fisheries, the specialist is of the opinion that the impact of the proposed project on the cultural heritage resources can be mitigated through the implementation of the recommendations in this report.

11.1.5 SOCIAL ASSESSMENT

TGS's activities for this application would be of short duration if approved, and if viewed in isolation considering only technical risks as discussed in various specialist reports conducted as part of the EIA process, the impacts will be negligible. However, communities feel that there are significant gaps in the available data and from a social perspective the non-technical or social risks can potentially cause significant impacts. Although the marine fauna and fisheries specialists have indicated that the impacts on the marine fauna would be negligible, the

communities, with generations of experience in the ocean, fear that the behaviour of the fish will change and that this would affect their catch rates and consequently their livelihoods. What is seen as a minor impact in a large eco-system may be experienced as a major impact by an individual. The marine fauna might not be affected greatly, but the fishing community fear that marine fauna might change its behaviour in response and that is a main concern from a social perspective.

Another concern is the cumulative impact of activities in the ocean where these communities earn their livelihoods. Their fears about the tipping point where their source of livelihood does not recover from all the activities in the ocean, and they are no longer able to make their livelihood as fishing communities must be considered. Currently these communities are able to sustain themselves, although it is difficult. The communities are not against development, but they want to see it happen in a sustainable way that does not jeopardise their source of livelihood. They have already seen how their livelihoods are being affected by mining that is taking place in the sea, pollution, climate change, overfishing and businesses such as factories that come and go and often and do not leave in a socially responsible way.

TGS, as well as other companies that want to do surveys or exploration in the area, currently do not have social license to operate. A large part of this is due to a lack of meaningful consultation by previous applicants from a community perspective. If TGS or any other seismic survey company wants to proceed with the project, they will need to engage in meaningful conversation with the communities and try to restore relationships. From a community and social risk perspective this is not negotiable.

Seismic reconnaissance projects are controversial in South Africa and has been in the news frequently in the last year. For many stakeholders it is an emotional matter, for others the potential of impacting their livelihoods is the biggest fear. There are also stakeholders that feel that the exploration for fossil fuels is not in line with sustainable development and the fight against climate change. Other stakeholders feel that it is imperative for the growth and development of the South African economy to engage in these investigations.

From a social perspective it is clear that the communities and majority of local people are opposed to the project. If the project is considered in isolation, the impacts are negligible. However, the project does not happen in a vacuum, and the social environment is much wider than the footprint of the project. If the social risks and potential damage to cultural and indigenous rights are considered the impact on the social fabric of already vulnerable communities may be significant. At this stage communities feel that they cannot make informed decisions. Although all legal processes have been followed, the seismic survey industry is not moving at the pace of the community, and in the long run this will be detrimental to the industry. Potential future benefits and the economic development of the country should the surveys find any significant resources are not disputed. From a social perspective it is recommended that the project proceed subject to the mitigation measures (i.e. meaningful consultation, local research, education, and awareness raising in the project-affected communities) forming part of the conditions for authorisation and being implemented prior to the commencement of the actual survey.

11.2 PREFERRED ALTERNATIVES

The preferred alternatives are discussed below. The final Sensitivity Map is provided in Figure 124 below which shows all identified sensitive areas including the MPA 5km buffer zones. No no-go areas were identified within the Application Area itself. No layout or location alternatives are applicable so only technology alternatives are discussed below.

The activities proposed in this application require specialised technology and skills. The available technology alternatives are limited by most suitable technology for conducting seismic surveys. To this end, it was concluded by Weilgart (2010) that seismic source design can be optimized to reduce unwanted energy. Imaging deep geological targets requires an acoustic source outputting relatively low frequency content (200Hz) and in directions (both inline and horizontal to the plane of interest) that are not of use. During collection of seismic data for deep imaging purposes one should strive to reduce unnecessary acoustic energy (noise) through array, source, and receiver design optimization. Weilgart (2010) further concluded that that regardless of the imaging target, anyone collecting seismic data should strive to reduce unwanted energy or noise. It should be noted that even if unwanted frequencies (> 200 Hz) are removed, there will still be frequency overlap with several marine

animals (including most baleen whales) that can and should be minimized. It was further concluded that, lower source levels could be achieved through better system optimization, i.e. a better pairing of source and receiver characteristics, and better system gain(s). For example, new receiver technologies, such as fibre-optic receivers, may allow the use of lower amplitude sources through a higher receiver density and/or a lower system noise floor. Some evidence exists which indicates that re-engineered seismic sources with "mufflers" can be used to attenuate unwanted high frequency energy without affecting frequencies of interest.

The above optimisation techniques should be implemented including better seismic source design and system optimisation with the selected survey contractor. In addition, kerosene free hydro-streamers should be used. It is also important to ensure that 'turtle-friendly' tail buoys are used or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'.

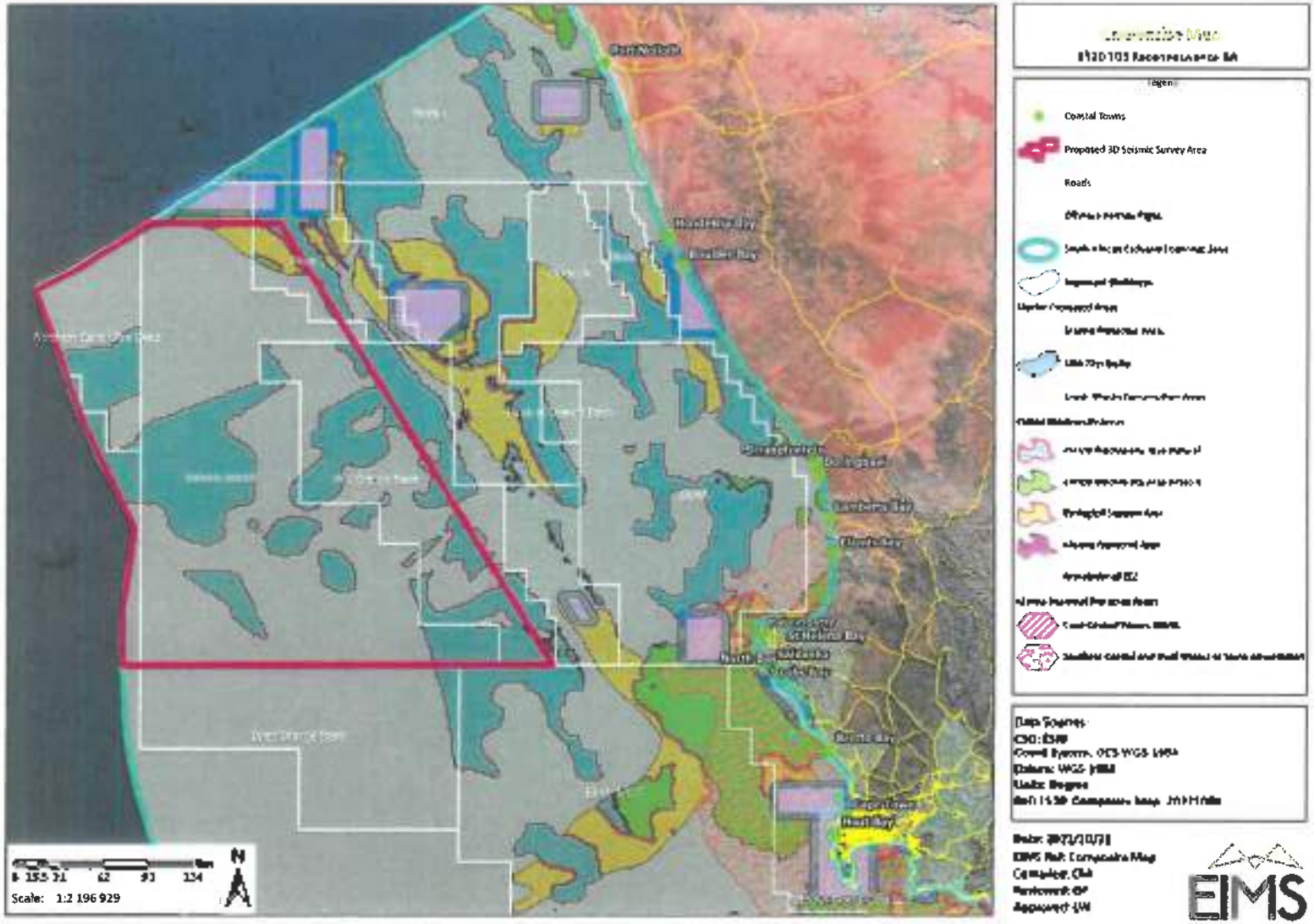

Figure 124: Final Composite Sensitivity Map

11.3 ENVIRONMENTAL IMPACT STATEMENT

The findings of the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the reconnaissance activities, the findings of the specialist studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team and the EAP that the significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures and the project should be authorized. A sensitivity map is provided in Figure 124 above and a summary showing the number of impacts and the post-mitigation significance of these identified impacts is provided in Figure 125.

Based on the findings of the Acoustics, Marine Ecology and Fisheries recommendations, it is recommended that the survey window of January – May be utilised in order to:

- Avoid sensitive areas and periods for some marine fauna: Movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (June/July and late October/November), and their aggregation on the summer feeding grounds between St Helena Bay and Dassen Island from late October to late December and ensure that migration paths are not blocked by seismic operations;
- Avoid periods of peak fishing activity during June and July in order to reduce the probability of disruption to the large pelagic longline fishing sector and tuna pole line fishing sector.

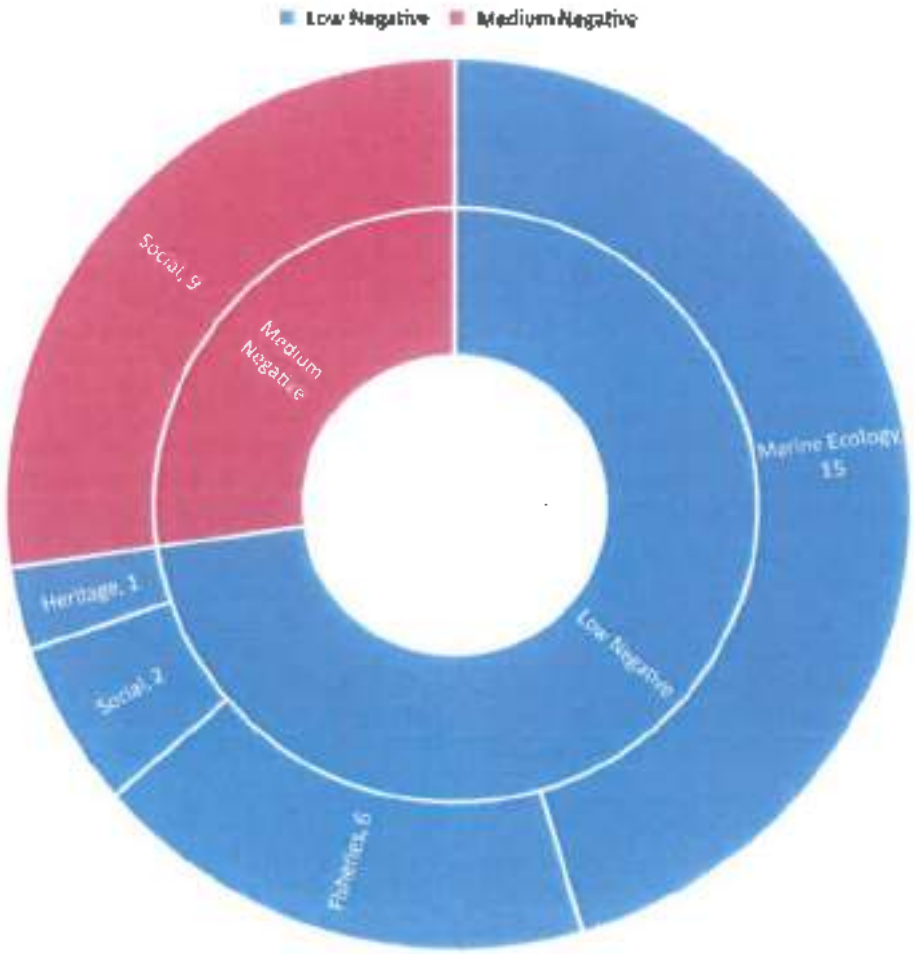

Figure 125: Impact Summary showing number and significance of impacts post mitigation

11.4 RECOMMENDATIONS FOR INCLUSION IN ENVIRONMENTAL AUTHORIZATION

This section contains recommendations from the various specialist studies for inclusion in the EA. It is recommended that these surveys and other drilling applications should be planned in such a way that the cumulative impacts would be minimised, and that the competent authority should carefully evaluate the cumulative impacts of this survey combined with other proposed seismic surveys in the same general area.

11.4.1 MARINE ECOLOGY

This section includes marine ecology recommendations for inclusion in the EA.

11.4.1.1 APPLICATION OF THE MITIGATION HIERARCHY

A key component of this EIA process is to explore practical ways of avoiding and where not possible to reducing potentially significant impacts of the proposed seismic acquisition activities. The mitigation measures put forward are aimed at preventing, minimising, or managing significant negative impacts to as low as reasonably practicable (ALARP). The mitigation measures are established through the consideration of legal requirements, project standards, best practice industry standards and specialist inputs.

The mitigation hierarchy, as specified in International Finance Corporation (IFC) Performance Standard 1, is based on a hierarchy of decisions and measures aimed at ensuring that wherever possible potential impacts are mitigated at source rather than mitigated through restoration after the impact has occurred. Any remaining significant residual impacts are then highlighted, and additional actions are proposed. With few exceptions, however, identified impacts were of low significance with very low or zero potential for further mitigation. In such cases the appropriate project Standards will be used and additional best management practices are proposed.

The operator will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and in compliance with the applicable requirements in MARPOL 73/78, as summarised below.

- The discharge of biodegradable wastes from vessels is regulated by MARPOL 73/78 Annex V, which stipulates that:
    - No disposal to occur within 3 nautical miles (± 5.5 km) of the coast.
    - Disposal between 3 nautical miles (± 5.5 km) and 12 nautical miles (± 22 km) needs to be comminated to particle sizes smaller than 25 mm.
    - Disposal overboard without macerating can occur greater than 12 nautical miles from the coast when the vessel is sailing.
- Discharges of oily water (deck drainage, bilge and mud pit wash residue) to the marine environment are regulated by MARPOL 73/78 Annex I, which stipulates that vessels must have:
    - A Shipboard Oil Pollution Emergency Plan (SOPEP).
    - A valid International Oil Pollution Prevention Certificate, as required by vessel class.
    - Equipment for the control of oil discharge from machinery space bilges and oil fuel tanks, e.g. oil separating/filtering equipment and oil content meter. Oil in water concentration must be less than 15 ppm prior to discharge overboard.
    - Oil residue holding tanks.
    - Oil discharge monitoring and control system.
- Sewage and grey water discharges from vessels are regulated by MARPOL 73/78 Annex IV, which specifies the following:
    - Vessels must have a valid International Sewage Pollution Prevention Certificate.

- Vessels must have an onboard sewage treatment plant providing primary settling, chlorination and dichlorination before discharge of treated effluent.
- The discharge depth is variable, depending upon the draught of the seismic vessel / support vessel at the time, but will be in accordance with MARPOL 73/78 Annex IV.
- Discharge of sewage beyond 12 nm requires no treatment. However, sewage effluent must not produce visible floating solids in, nor cause the discolouration of, the surrounding water.
- Sewage must be comminuted and disinfected for discharges between 3 nautical miles (± 6 km) and 12 nautical miles (± 22 km) from the coast. This will require an onboard sewage treatment plant or a sewage comminuting and disinfecting system.
- Disposal of sewage originating from holding tanks must be discharged at a moderate rate while the ship is proceeding on route at a speed not less than 4 knots.

- Sewage will be treated using a marine sanitation device to produce an effluent with:
  - A biological oxygen demand (BOD) of <25 mg/l (if the treatment plant was installed after 1/1/2010) or <50 mg/l (if installed before this date).
  - Minimal residual chlorine concentration of 1.0 mg/l.
  - No visible floating solids or oil and grease.

The project will also comply with industry best practices regarding waste management, including:

- Waste management will follow key principles: Avoidance of Waste Generation, adopting the Waste Management Hierarchy (reduce, reuse, recycle, recover, residue disposal), and use of Best Available Technology (BAT).
- An inventory will be established of all the potential waste generated, clarifying its classification (hazardous, non-hazardous or inert) and quantity, as well as identifying the adequate treatment and disposal methods.
- Waste collection and temporary storage shall be designed to minimise the risk of escape to the environment (for example by particulates, infiltration, runoff or odours).
- On-site waste storage should be limited in time and volume.
- Dedicated, clearly labelled, containers (bins, skips, etc.) will be provided in quantities adapted to anticipated waste streams and removal frequency.

Detailed mitigation measures for seismic surveys in other parts of the world are provided by Weir *et al.* (2006), Compton *et al.* (2007) and US Department of Interior (2007). Many of the international guidelines presented in these documents are extremely conservative as they are designed for areas experiencing repeated, high intensity surveys and harbouring particularly sensitive species, or species with high conservation status. A number of countries have more recently updated their guidelines, most of which are based on the Joint Nature Conservation Committee - JNCC (2010, 2017) recommendations but adapted for specific areas of operation. The guidelines currently applied to seismic surveying in South African waters are those proposed in the Generic EMPr and by Purdon (2018). Purdon highlights the importance of developing mitigation guidelines both locally and regionally and points out that if South Africa is to maintain environmental integrity, mitigation guidelines for seismic surveys specific to the country, and based on the most recent scientific data, need to be implemented.

The mitigation measures proposed for seismic surveys are as provided below for each phase of a seismic survey operation:

11.4.1.2 MOBILISATION PHASE

11.4.1.2 1 PRE-SURVEY PLANNING

- Plan seismic surveys to avoid sensitive areas and periods for some marine fauna: Movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (June/July and late October/November), and their aggregation on the summer feeding grounds

between St Helena Bay and Dassen Island from late October to late December and ensure that migration paths are not blocked by seismic operations. If possible, the survey should be undertaken from North to South to avoid these feeding aggregations.

- Plan survey, as far as possible, so that the first commencement of seismic acquisition in a new area (including seismic source tests) are undertaken during daylight hours.
- Prohibit seismic source use (including tests) outside of the area of operation (which includes line turns undertaken outside the licence area).
- Although a seismic vessel and its gear may pass through a declared Marine Protected Area, acoustic sources (seismic sources) must not be operational during this transit.
- A 5 km buffer zone where no seismic source operation is permitted is recommended around all MPAs.

11.4.1.2.2 KEY EQUIPMENT

Passive Acoustic Monitoring

- Ensure the seismic vessel is fitted with PAM technology, which detects some animals through their vocalisations.
- As the Application Area would largely be in waters deeper than 1 000 m where sperm whales and other deep-diving odontocetes are likely to be encountered, implement the use of PAM 24-hr a day when the seismic source is in operation.
- Ensure that the PAM hydrophone streamer is towed in such a way that the interference of vessel noise is minimised.
- Ensure the PAM streamer is fitted with at least four hydrophones, of which two are HF and two LF, to allow directional detection of cetaceans.
- Ensure spare PAM hydrophone streamers are readily available in the event that PAM breaks down, in order to ensure timeous redeployment.

Infra Red Cameras

- MMOs are to be equipped with infra-red cameras in order to observe mammals at night.

Seismic Source

- Define and enforce the use of the lowest practicable seismic source volume for production, and design arrays to maximise downward propagation, minimise horizontal propagation and minimise high frequencies in seismic source pulses.
- Ensure a display screen for the seismic source operations is provided to the marine observers. All information relating to the activation of the acoustic source and the power output levels must be readily available to support the observers in real time via the display screen and to ensure that operational capacity is not exceeded.
- Ensure the ramp-up noise volumes do not exceed the production volume.

Streamers

- Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'.
- Ensure that solid streamers rather than fluid-filled streamers are used to avoid leaks.

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11.4.1.2.3 KEY PERSONELL

- Make provision for the placing of qualified MMOs on board the seismic vessel. As a minimum, sufficient MMOs must be on watch to cover all hours for the pre-acquisition observations and when the acoustic source is active.
- The duties of the MMO would be to:
  - Provide effective regular briefings to crew members, and establish clear lines of communication and procedures for onboard operations;
  - Record seismic source activities, including sound levels, "soft-start" procedures and pre-start regimes;
  - Observe and record responses of marine fauna to seismic source from optimum vantage points, including seabird, large pelagic fish (e.g. shoaling tuna, sunfish, sharks), turtle, seal and cetacean incidence and behaviour and any mortality or injuries of marine fauna as a result of the seismic survey. Data captured should include species identification, position (latitude/longitude), distance/bearing from the vessel, swimming speed and direction (if applicable) and any obvious changes in behaviour (e.g. startle responses or changes in surfacing/diving frequencies, breathing patterns) as a result of the seismic activities. Both the identification and the behaviour of the animals must be recorded accurately along with current seismic sound levels. Any attraction of predatory seabirds, large pelagic fish or cetaceans (by mass disorientation or stunning of fish as a result of seismic survey activities) and incidents of feeding behaviour among the hydrophone streamers should also be recorded;
  - Sightings of any injured or dead protected species (marine mammals, large pelagic fish (e.g. sharks), seabirds and sea turtles) should be recorded regardless of whether the injury or death was caused by the seismic vessel itself. If the injury or death was caused by a collision with the seismic vessel, the date and location (latitude/longitude) of the strike, and the species identification or a description of the animal should be recorded and included as part of the daily report;
  - Record meteorological conditions at the beginning and end of the observation period, and whenever the weather conditions change significantly;
  - Request the delay of start-up or temporary termination of the seismic survey or adjusting of seismic source, as appropriate. It is important that MMO decisions on the termination of seismic source is made confidently and expediently, and following dialogue between the observers on duty at the time. A log of all termination decisions must be kept (for inclusion in both daily and "close-out" reports);
  - Use a recording spreadsheet in order to record all the above observations and decisions; and
  - Prepare daily reports of all observations, to be forwarded to the necessary authorities as required, in order to ensure compliance with the mitigation measures.
- Make provision for placing of a qualified PAM operator on board the seismic vessel. As a minimum, one must be on "watch" during the pre-acquisition observations and when the acoustic source is active.
- Ensure MMOs and PAM operators are briefed on the area-specific sensitivities and on the seismic survey planning (including roles and responsibilities, and lines of communication).
- Seabird, turtle and marine mammal incidence data and seismic source output data arising from surveys should be made available on request to the Marine Mammal Institute, DFFE, and the Petroleum Agency South Africa for analyses of survey impacts in local waters.
- The duties of the PAM operator would be to:

- Provide effective regular briefings to crew members, and establish clear lines of communication and procedures for onboard operations;
- Ensure that the hydrophone cable is optimally placed, deployed and tested for acoustic detections of marine mammals;
- Confirm that there is no marine mammal activity within 500 m of the seismic source array prior to commencing with the "soft-start" procedures;
- Record species identification, position (latitude/longitude), distance and bearing from the vessel and acoustic source, where possible;
- Record general environmental conditions;
- Record seismic source activities, including sound levels, "soft-start" procedures and pre-start regimes; and
- Request the delay of start-up and temporary termination of the seismic survey, as appropriate.

11.4.1.3 OPERATIONAL PHASE

11.4.1.3.1 SEISMIC SOURCE TESTING

- Maintain a pre-acquisition watch of 60-minutes before any instances of seismic source testing. If only a single lowest power seismic source is tested, the pre- acquisition watch period can be reduced to 30 minutes.
- Consideration is to be given to the practicality (considering the weather conditions and costs) of aerial surveys to locate feeding aggregations. The use of drones could be considered (considering the weather conditions and costs) to supplement the observations of the MMO prior to soft starts.
- Implement a "soft-start" procedure if testing multiple seismic sources.
  - The "soft-start" should be carried out over a time period proportional to the number of seismic sources being tested and not exceed 20 minutes; seismic sources should be tested in order of increasing volume;
  - If testing all seismic sources at the same time, a 20 minute "soft-start" is required;
  - If testing a single lowest power seismic source a "soft-start" is not required.

11.4.1.3.2 PRE-START PROTOCOLS

- Implement a dedicated MMO and PAM pre- acquisition watch of at least 60 minutes (to accommodate deep-diving species in water depths greater than 200 m).
- Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source if:
- during all hours it is confirmed:
  a) visually by the MMO during the pre- acquisition watch (60 minutes) that there are no penguins or feeding aggregations of diving seabirds, shoaling large pelagic fish, turtles, seals or cetaceans within 500 m of the seismic source, and
  b) by PAM technology that there are no vocalising cetaceans detected in the 500 m mitigation zone.
- During times of poor visibility or darkness it is confirmed by PAM technology that no vocalising cetaceans are present in the 500 m mitigation zone during the pre- acquisition watch (60 minutes).
- Delay "soft-starts" if penguins or feeding aggregations of diving seabirds, shoaling large pelagic fish, turtles, seals or cetaceans are observed within the mitigation zone.

- A "soft-start" should not begin until 30 minutes after cetaceans depart the 500 m mitigation zone or 30 minutes after they are last seen or acoustically detected by PAM in the mitigation zone.
- In the case of penguins, diving seabirds, shoaling large pelagic fish and turtles, delay the "soft-start" until animals are outside the 500 m mitigation zone.
- In the case of fur seals, which may occur commonly around the vessel, delay "soft-starts" for at least 10 minutes until it has been confirmed that the mitigation zone is clear of all seal activity. However, if after a period of 10 mins seals are still observed within 500 m of the seismic source, the normal "soft-start" procedure should be allowed to commence for at least a 20-minute duration. Seal activity should be carefully monitored during "soft-starts" to determine if they display any obvious negative responses to the seismic source and gear or if there are any signs of injury or mortality as a direct result of the seismic activities.

- As noted above for planning, when arriving at the survey area for the first time, survey activities should, as far as possible, only commence during daylight hours with good visibility. However, if this is not possible due to prolonged periods of poor visibility (e.g. thick fog) or unforeseen technical issue which results in a night-time start, the initial acoustic source activation (including seismic source tests) may only be undertaken if the normal 60-minute PAM pre-watch and "soft-start" procedures have been followed.
- Schedule "soft-starts" so as to minimise, as far as possible, the interval between reaching full power operation and commencing a survey line. The period between the end of the soft start and commencing with a survey line must not exceed 20 minutes. If it does exceed 20 minutes, refer to breaks in acquisition below.

11.4.1.3.3 LINE TURNS

- If line changes are expected to take longer than 40 minutes :
  - Terminate seismic source at the end of the survey line and implement a pre- acquisition search (60 minutes) and "soft-start" procedure (20 minutes) when approaching the next survey line.
  - If line turn is shorter than 80 minutes (i.e. shorter than a 60-minute pre- acquisition watch and 20-minute "soft-start" combined), the pre- acquisition watch can commence before the end of the previous survey line.
- If line changes are expected to take less than 40 minutes, seismic acquisition can continue during the line change if:
  - The power is reduced to 160 cubic inches (or as close as is practically feasible) at standard pressure. Seismic source volumes of less than 160 cubic inches can continue to discharge at their operational volume and pressure;
  - The Seismic Pulse Interval (SPI) is increased to provide a longer duration between pulses, with the SPI not to exceed 5 minutes; and
  - The power is increased and the SPI is decreased in uniform stages during the final 10 minutes of the line change (or geophone repositioning), prior to data collection re-commencing (i.e. a form of mini soft start).
  - Normal MMO and PAM observations continue during this period when reduced power seismic source is active.

11.4.1.3.4 SHUT-DOWNS

- Terminate seismic source on observation and/or detection of penguins or feeding aggregations of diving seabirds, turtles, slow swimming large pelagic fish (including whale sharks, basking sharks, manta rays) or cetaceans within the 500 m mitigation zone.

- Terminate seismic source on observation of any obvious mortality or injuries to cetaceans, turtles, seals or mass mortalities of squid and fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO to be as a direct result of the survey.
- Depending the species, specific mitigation will be implemented to continue the survey operations, as specified below:
    - For specific species such as turtles, penguins, diving seabirds and slow swimming large pelagic fish (including whale sharks, basking sharks, manta rays), terminate source until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required).
    - For cetaceans, terminate source until such time as there has been a 30-minute delay from the time the animal was last sighted within the mitigation zone before the commencement of the normal soft start procedure.

11.4.1.3.5 BREAKS IN SEISMIC SOURCE

- If after breaks in seismic acquisition, the seismic source can be restarted within 5 minutes, no soft-start is required and acquisition can recommence at the same power level provided no marine mammals have been observed or detected in the mitigation zone during the break-down period.
- For all breaks in seismic source of longer than 5 minutes, but less than 20 minutes, implement a "soft-start" of similar duration, assuming there is continuous observation by the MMO and PAM operator during the break.
- For all breaks in seismic source of 20 minutes or longer, implement a 60-minute pre- acquisition watch and 20-minute "soft-start" procedure prior to the survey operation continuing.
- For planned breaks, ensure that there is good communication between the seismic contractor and MMOs and PAM operators in order for all parties to be aware of these breaks and that early commencement of pre-watch periods can be implemented to limit delays.

11.4.1.3.6 PAM MALFUNCTIONS

- If the PAM system malfunctions or becomes damaged during night-time operations or periods of low visibility, continue operations for 30 minutes without PAM if no marine mammals were detected by PAM in the mitigation zones in the previous 2 hours, while the PAM operator diagnoses the issue. If after 30 minutes the diagnosis indicates that the PAM gear must be repaired to solve the problem, reduce power to 160 cubic inches. The reduced seismic source may continue for 30 minutes while PAM is being repaired, the last 10-minute of which is a 10-minute ramp up to full power (mini "soft-start"). If the PAM repair will take longer than 60 minutes, stop surveying until such time as a functional PAM system can be redeployed and tested.
- If the PAM system breaks down during daylight hours, continue operations for 20 minutes without PAM, while the PAM operator diagnoses the issue. If the diagnosis indicates that the PAM gear must be repaired to solve the problem, operations may continue for an additional 2 hours without PAM monitoring as long as:
    - No marine mammals were detected by PAM in the mitigation zones in the previous 2 hours;
    - Two MMOs maintain watch at all times during operations when PAM is not operational;
    - The time and location in which operations began and stop without an active PAM system is recorded.

11.4.1.4 VESSEL AND AIRCRAFT OPERATIONS

- Pre-plan flight paths to ensure that no flying occurs over seabird and seal colonies and offshore islands by at least 1 852 m (i.e. 1 nm);

- Avoid extensive low-altitude coastal flights by ensuring that the flight path is perpendicular to the coast, as far as possible;
- Brief all pilots on the ecological risks associated with flying at a low level along the coast or above marine mammals;
- The lighting on the survey and support vessels should be reduced to a minimum compatible with safe operations whenever and wherever possible. Light sources should, if possible and consistent with safe working practices, be positioned in places where emissions to the surrounding environment can be minimised;
- Keep disorientated, but otherwise unharmed, seabirds in dark containers for subsequent release during daylight hours. Ringed/banded birds should be reported to the appropriate ringing/banding scheme (details are provided on the ring);
- Avoid the unnecessary discharge of ballast water;
- Use filtration procedures during loading in order to avoid the uptake of potentially harmful aquatic organisms, pathogens and sediment that may contain such organisms;
- Ensure that routine cleaning of ballast tanks to remove sediments is carried out, where practicable, in mid-ocean or under controlled arrangements in port or dry dock, in accordance with the provisions of the ship's Ballast Water Management Plan;
- Ensure all equipment (e.g. arrays, streamers, tail buoys etc) that has been used in other regions is thoroughly cleaned prior to deployment;
- Implement a waste management system that addresses all wastes generated at the various sites, shore-based and marine. This should include:
    - Separation of wastes at source;
    - Recycling and re-use of wastes where possible;
    - Treatment of wastes at source (maceration of food wastes, compaction, incineration, treatment of sewage and oily water separation).
- Implement leak detection and repair programmes for valves, flanges, fittings, seals, etc.
- Use a low-toxicity biodegradable detergent for the cleaning of all deck spillages.
- The vessel operators should keep a constant watch for marine mammals and turtles in the path of the vessel.
- Keep watch for marine mammals behind the vessel when tension is lost on the towed equipment and either retrieve or regain tension on towed gear as rapidly as possible.
- Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'.
- Ensure vessel transit speed between the survey area and port is a maximum of 12 knots (22 km/hr), except in the MPAs where it is reduced further to 10 knots (18 km/hr) as well as when they are present in the vicinity.
- Ensuring that loads are lifted using the correct lifting procedure and within the maximum lifting capacity of crane system.
- Minimise the lifting path between vessels.
- Undertake frequent checks to ensure items and equipment are stored and secured safely on board each vessel.

- In the event that equipment is lost during the operational stage, assess safety and metocean conditions before performing any retrieval operations. Establishing a hazards database listing the type of gear left on the seabed and/or in the Survey area with the dates of abandonment/loss and locations, and where applicable, the dates of retrieval
- Use low toxicity dispersants cautiously and only with the permission of DFFE.
- As far as possible, and whenever the sea state permits, attempt to control and contain the spill at sea with suitable recovery techniques to reduce the spatial and temporal impact of the spill
- Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station.
- Ensure offshore bunkering is not undertake in the following circumstances:
  - Wind force and sea state conditions of ≥6 on the Beaufort Wind Scale;
  - During any workboat or mobilisation boat operations;
  - During helicopter operations;
  - During the transfer of in-sea equipment; and
  - At night or times of low visibility.

11.4.2 FISHERIES

- Avoid operating during June and July, in order to avoid periods of peak fishing effort by the large pelagic longline sector.
- Prior to the commencement of seismic survey activities the following key stakeholders should be consulted and informed of the proposed seismic survey programme (including navigational co-ordinates of location, timing and duration of proposed activities) and the likely implications thereof (specifically the exclusion and safety zone around the seismic vessel):
  - Fishing industry associations: SA Tuna Association; SA Tuna Longline Association and Fresh Tuna Exporters Association.
  - Other key stakeholders: SAN Hydrographer, South African Maritime Safety Association, Ports Authority and the DFFE Vessel Monitoring, Control and Surveillance Unit in Cape Town.
- These stakeholders should again be notified at the completion of the project when the survey and support vessels are off location.
- Request, in writing, the SAN Hydrographer to broadcast a navigational warning via Navigational Telex (Navtext) and Cape Town radio for the duration of the seismic survey activity.
- Distribute a Notice to Mariners prior to the commencement of the seismic survey operations. The Notice to Mariners should give notice of (1) the co-ordinates of the survey area, (2) an indication of the proposed survey timeframes, (3) the dimensions of the towed gear array and dimensions of the safety zone around the seismic vessel, and (4) provide details on the movements of support vessels servicing the project. This Notice to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.
- An experienced Fisheries Liaison Officer should be placed on board the seismic or guard vessel to facilitate communications with fishing vessels in the vicinity of the seismic survey areas.
- The lighting on the seismic and support vessels should be managed to ensure that they are sufficiently illuminated to be visible to fishing vessels, as well as ensure that it is reduced to a minimum compatible with safe operations whenever and wherever possible.

- Notify any fishing vessels at a radar range of 12 nm from the seismic vessel via radio regarding the safety requirements around the seismic vessel.
- Implement a grievance mechanism in case of disruption to fishing or navigation.

11.4.3 HERITAGE

The following recommendations are based on the UNESCO ICHC guidelines and is aimed at safeguarding the cultural heritage of the small-scale fishers and cultural groupings in influence of this project:

- Re-assess post-project the potential effects on the identified communities and their intangible cultural heritage. This will require consideration of the socio-economic baseline developed during this environmental impact process against quantified economic damage and losses and human development impacts in a follow-up socio-economic assessment. It will enable the heritage specialist to evaluate the link between the socio-economic changes induced by the proposed project as it relates to changes in the intangible cultural heritage practices of the communities. It is anticipated that this can be achieved through the implementation of the mitigation measures in the Social Impact Assessment.
- Based on the outcomes, provide resources and support for communities to develop and undertake safeguarding measures or plans to enhance the mitigation capacity of their intangible cultural heritage by fostering dialogue, mutual understanding and reconciliation between and within communities. It is anticipated that this can be achieved through the implementation of the mitigation measures in the Social Impact Assessment.
- 3D seismic surveys have the potential to locate wrecks on the surface, and sometimes below sediments on the ocean floor. Any shipwrecks or pieces thereof noted during the survey must be shared with the SAHRA MUCH Unit for inclusion into the national database. These could then be identified and be incorporated into the EMPr.

11.4.4 SOCIAL

Based on the findings, the following recommendations are made:

- TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism.
- TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. Collaboration across seismic operators with holders of hydrocarbon exploration and the industry as a whole to collectively fund pro-active research would provide opportunity for the development and implementation of a structured and experimentally sound acoustic study. This would quantitatively inform the authorities and stakeholders of acoustic impacts to the various faunal groups in South African Waters. It is recommended that the Department of Agriculture, Forestry and Fisheries, Oceans & Coasts, Research component be contacted for possible collaboration on further research on the impact so seismic surveys on the marine ecosystem.
- Consult with communities on potential ways in which to make a positive contribution to the communities.
- A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with establishing the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective. Given the risk of stakeholder fatigue, it would be most beneficial if this can take place on an industry level.

- TGS should initiate discussions in their industry. The seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.

11.4.5 ACOUSTICS

Relevant mitigation measures are recommended to minimise the seismic impact on assessed marine fauna species:

- Recommended safety zones are based on the maximum threshold distances modelled for PTS (marine mammals and sea turtles) and potential mortal injury (fish) due to immediate exposure from single pulses and cumulative exposure from multiple pulses.
- Implement a soft-start procedure if testing multiple seismic sources. Delay soft-starts if shoaling large pelagic fish, turtles, seals, or cetaceans are observed within the zone of impact.
- Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented that would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior to the commencement of the survey and then operational levels of noise during the survey.
- In the unlikely event that multiple surveys would take place at the same time, during seismic pulse releases, maintain a distance of at least 40 kilometres from any other survey vessel until sufficient objective evidence is obtained from modelling that a reduced buffer distance is acceptable.

12 ASSUMPTIONS AND LIMITATIONS

12.1 GENERAL

In determining the significance of impacts, with mitigation, it is assumed that mitigation measures proposed in the report are correctly and effectively implemented and managed throughout the life of the project.

12.2 MARINE ECOLOGY

As determined by the terms of reference, this study has adopted a 'desktop' approach. Consequently, the description of the natural baseline environment in the study area is based on a review and collation of existing information and data from the scientific literature, internal reports and the Marine Mammal Observer (MMO) Reports. The sources consulted are listed in the Reference chapter.

The assumptions made in this specialist assessment are:

- The study is based on the project description made available to the specialist at the time of the commencement of the study.
- Some important conclusions regarding the extent of the zones of impact of seismic sound and associated assessments on marine fauna are based on the results of the Underwater Acoustic Modelling Study (SLR 2022).
- Potential changes in the marine environment such as sea-level rise and/or increases in the severity and frequency of storms related to climate change are not included in the terms of reference and therefore not dealt with in this report.
- All identified marine impacts are summarised, categorised and ranked in appropriate impact assessment tables, to be incorporated in the overall EIA Report.

Information gaps include:

- details of the benthic macrofaunal communities beyond the shelf break;
- details on demersal fish communities beyond the shelf break;
- information specific to the marine communities of seamounts (Tripp Seamount, Child's Bank) and submarine canyons (Cape Canyon and Cape Point Canyon); and
- current information on the distribution, population sizes and trends of most cetacean species occurring in South African waters and the project area in particular.

Keeping these information gaps in mind, the assessment of impacts has adopted a strongly precautionary approach.

12.3 FISHERIES

The study is based on a number of assumptions and is subject to certain limitations, which should be noted when considering information presented in this report. The validity of the findings of the study is not expected to be affected by these assumptions and limitations:

- The official governmental record of fisheries data was used to display fishing catch and effort relative to the proposed project area. These data are derived from logbooks that are completed by skippers, and it is assumed that there will be a proportion of erroneous data due to mistakes in the capturing of these data into electronic format. The proportion of erroneous data is estimated to be up to 10 % of the total dataset and would be primarily related to the accurate recording or transcription of the fishing position (latitude and longitude). Where obvious errors in the reporting of fishing positions were identified these were excluded from the analysis.

- In assessing the impact of the proposed exclusion zone on fishing operations, catch and effort figures are quoted across the entire extent of the Application Areas. In practice, the exclusion area would be a moving exclusion zone of approximately 165 km^2 extending around the vessel (based on the required safety clearances shown in Figure 2.1 of the Fisheries report). The approach adopted for this report is likely to be an overestimate of the potential impact on fishing operations which in reality could continue within certain portions of the Application Area.
- The acoustic impact is transitory i.e. the sound source moves in space and time as the survey progresses within the target area.
- The effects of seismic sound on the CPUE of fish and invertebrates have been drawn from the findings of international studies. To date there have been no studies focused directly on the species found locally. Although the results from international studies are likely also to be representative for local species, current gaps in knowledge on the topic lead to uncertainty when attempting to accurately quantify the potential loss of catch for each type of fishery. Research into the effects of seismic sound on marine fauna is ongoing.

12.4 HERITAGE

Not detracting from the stakeholder engagement completed, it is necessary to realise that the intangible heritage elements identified during engagements do not necessarily represent all possible intangible cultural heritage elements present in this region. Various factors account for this, including the layered histories (e.g., memory of conflict, dispossession, and disempowerment through time) associated with the West Coast region, specifically in terms of intangible and living heritage resources associated with the ocean landscape. The values attributed to the ocean by the communities do not necessarily align to provide one definitive single significance to the ocean. Instead, the depth and complexity of values assigned to intangible heritage in this landscape depends on peoples' relationship to the ocean and their feelings about the proposed project.

12.5 SOCIAL

The following assumptions and limitations were relevant:

- Not every individual in the community could be interviewed therefore only key people in the community were approached for discussion. Additional information was obtained using existing data.
- The social environment constantly changes and adapts to change, and external factors outside the scope of the project can offset social changes, for example changes in local political leadership, droughts or economic conditions. It is therefore difficult to predict all impacts to a high level of accuracy, although care has been taken to identify and address the most likely impacts in the most appropriate way for the current local context within the limitations.
- Given that the survey will be conducted over a short period of time, the impacts will be short term and from an outsiders perspective may appear as inconsequential. However, the outcomes of the survey will introduce new social impacts, and the potential of these impacts occurring is already causing fear and uncertainty amongst coastal communities. Communities view the survey as the beginning of potentially significant changes in their socio-economic environment.
- Social impacts can be felt on an actual or perceptual level, and therefore it is not always straightforward to measure the impacts in a quantitative manner.
- Social impacts commence when the project enters the public domain. Some of these impacts will occur irrespective of whether the project continues or not, and other impacts have already started. These impacts are difficult to mitigate and some would require immediate action to minimise the risk.
- There are different groups with different interests in the community, and what one group may experience as a positive social impact, another group may experience as a negative impact. This duality will be pointed out in the impact assessment phase of the report.

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- Social impacts are not site-specific, but take place in the communities surrounding the proposed development.
- Limited time was available for conducting the assessment.

12.6 NOISE / ACOUSTICS

The assumptions made in the noise technical report are as follows:

- One survey line section is assumed to be acquired within the 24-hour period for each scenario.
- For marine seismic surveys, the cumulative exposure level at certain locations is modelled based on the assumption that the animals are constantly exposed to the survey airgun noise at a fixed location over the entire 24-hour period.

13 AFFIRMATION REGARDING CORRECTNESS OF INFORMATION

We Liam Whitlow and Gideon Petrus Kriel, herewith undertake that the information provided in the foregoing report is correct to the best of our knowledge, and that the comments and inputs from stakeholders and Interested and Affected Parties has been correctly recorded in the report where applicable as well as inputs and recommendations from the specialist reports completed as part of this assessment.

Signature of the EAP:

Liam Whitlow

Date: 6 December 2022

Signature of the EAP:

Gideon Petrus Kriel

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15 APPENDICES

Appendix 1: EAP CV

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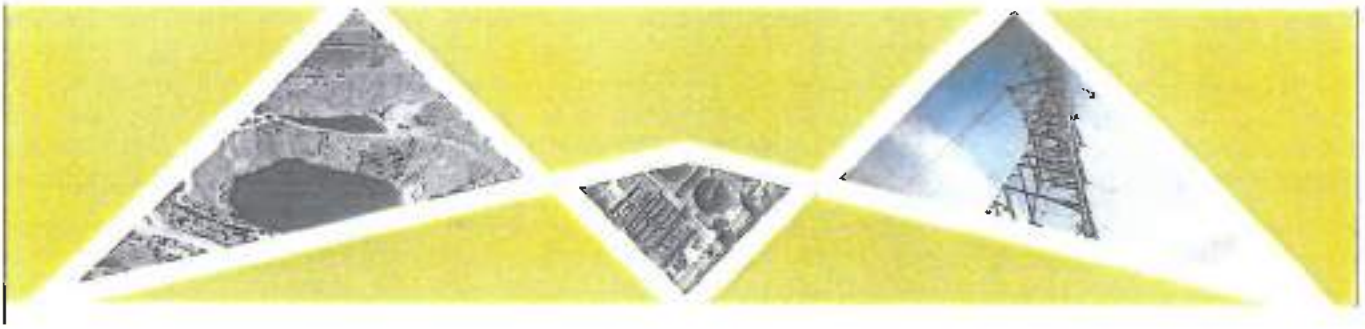
EIMS | ENVIROnmENTAL IMPACT MANAGEMENT SERVICES

Voorgestelde TGS Orange Basin Verkennings Permit Basiese Assessering

29 Augustus – 3 September 2022



Agenda

Vergadering Reëls	Projek Beskrywing	Projek Span	Aanvraag Proses
Publieke Deelname	Impak Sessies	Pad Vorentoe	Vrae

Vergadering Reëls

3

Vergadering Reëls

- Respekteer die ander
- Moet asseblief nie ander sprekers onderbreek nie
- Hou asseblief vrae vir die einde van die aanbieding
- Noem asseblief eers jou naam voor jou kommentaar of vraag
- Hou kommentaar en vrae tot die punt van die vergadering
- Praat hard en duidelik

4

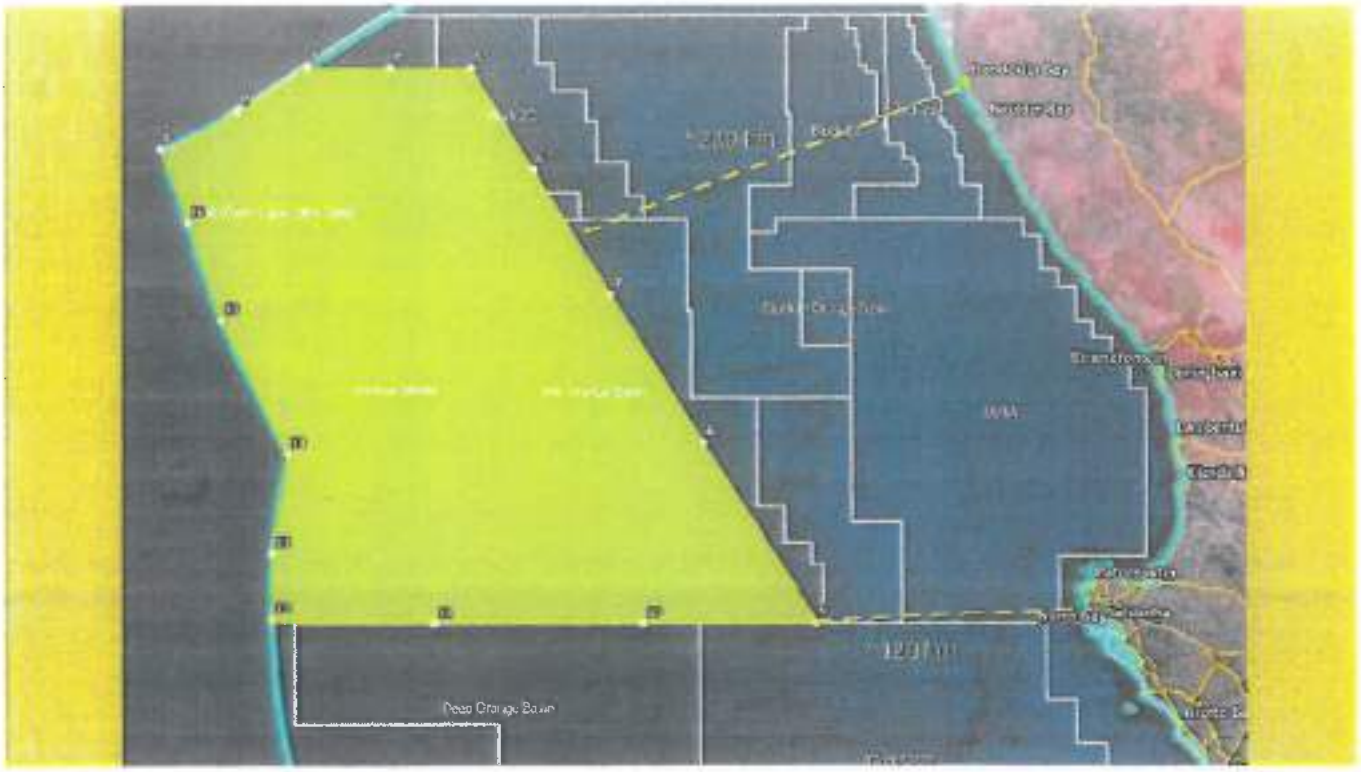
Projek Beskrywing

5

Projek Beskrywing

- TGS Geophysical Company (UK) Limited stel voor om 'n 3D seismiese opname aan die Weskus van Suid-Afrika te onderneem.
- Die voorgestelde projekgebied is tussen ongeveer 120 km seewaarts van St Helenabaai gelee, wat noord langs die westelike kuslyn strek, tot ongeveer 230 km seewaarts van Hondeklipbaai oor 'n aantal petroleumlisensieblokke.
- EIMS is aangestel as EAP om aansoek te doen vir Omgewingmagtiging O/S Regulasies, 2014 - NEMA.
- Die doel van hierdie aanvanklike ronde van konsultasie is om te verseker dat ons aanvanklike bekommernisse van die publiek en belangrike I&APs vasvang.

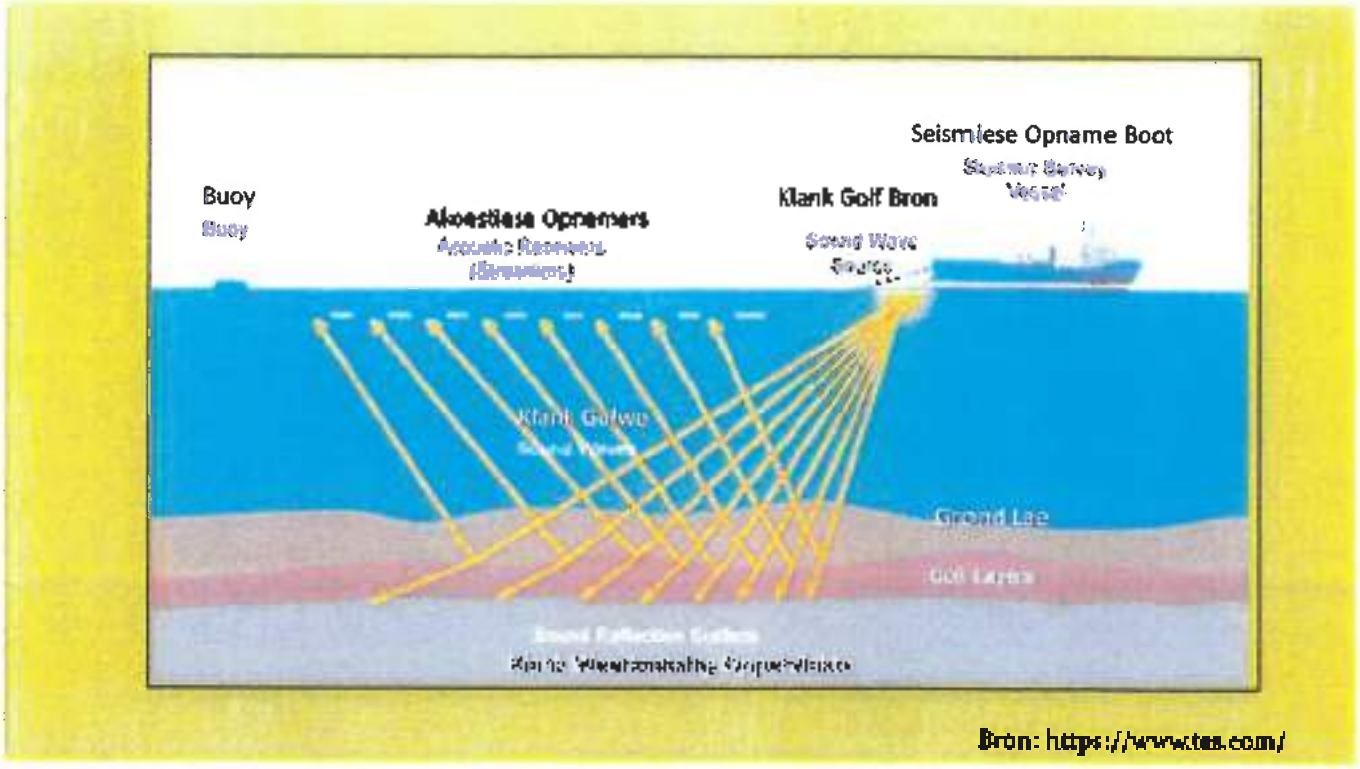
6



7

Projek Beskrywing

- Die beoogde ontwikkeling behels die vestiging van 'n [illegible] aanlegfasiliteit [illegible]
- Daar word voorgestel dat 'n [illegible] aanlegfasiliteit [illegible] die ontwikkeling van die aanlegfasiliteit [illegible] die ontwikkeling van die [illegible] en die [illegible] en [illegible] en [illegible] en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Bron: https://www.tes.com/

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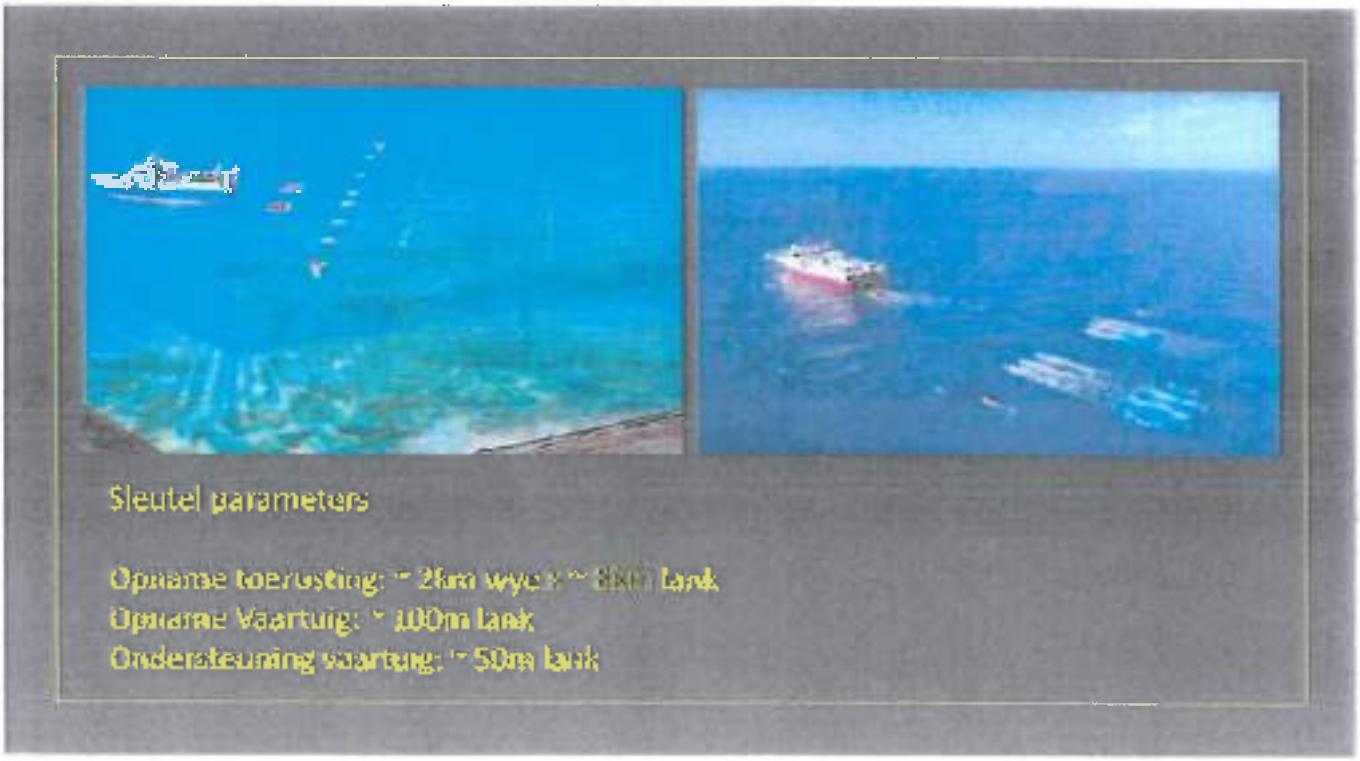
Sleutel parameters
Opname Vaartuig: ~ 100m lank
Ondersteuning vaartuig: ~ 50m lank

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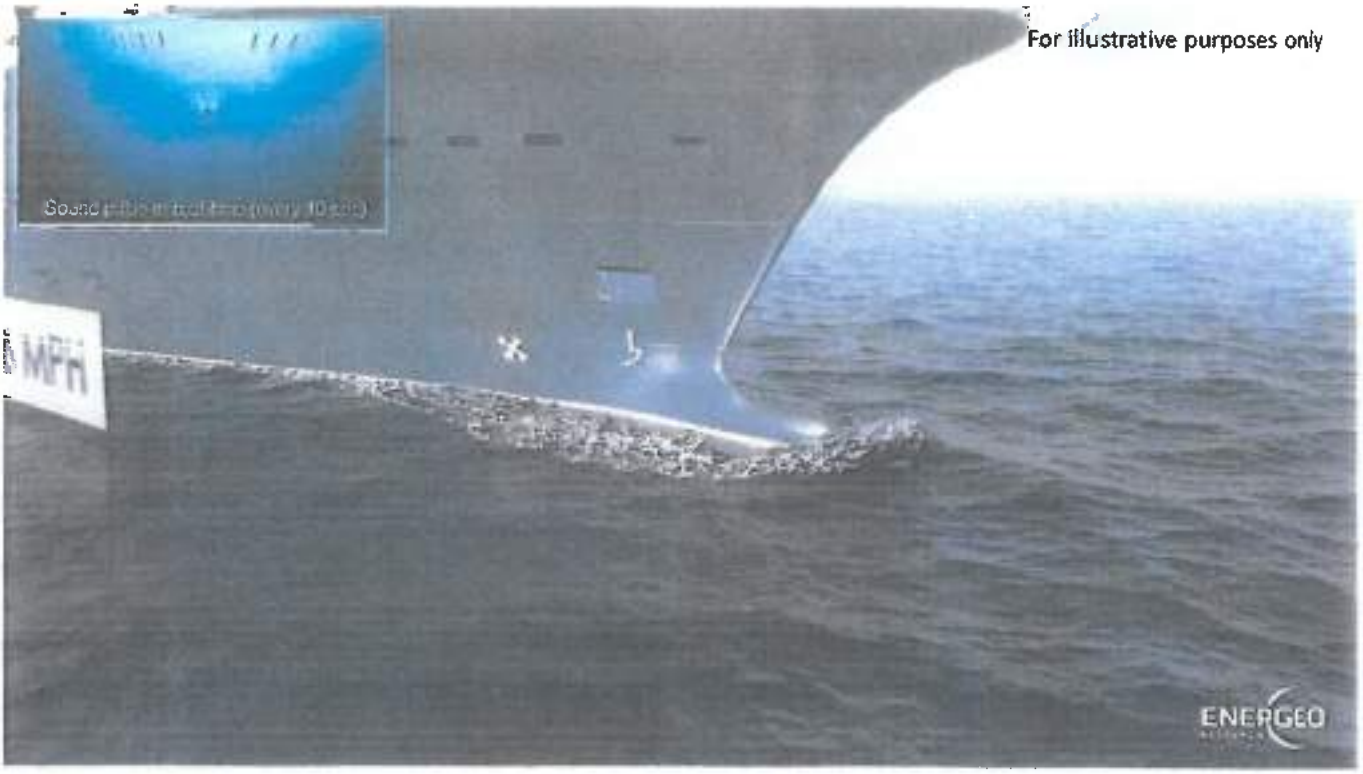


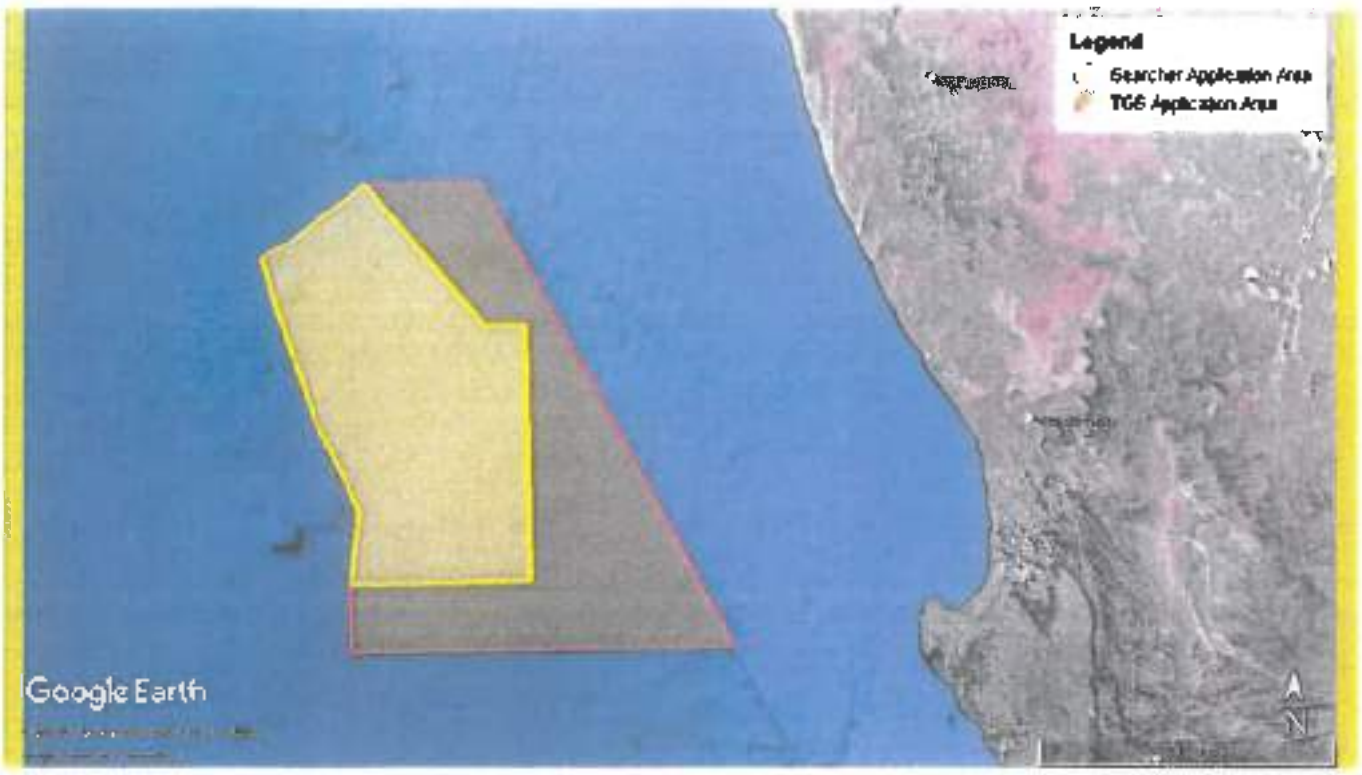
11

Projek Beskrywing

- EIMS sal 'n omvattende openbare deelnameproses uitvoer in ooreenstemming met die NEMA-vereistes. As deel van ons konsultasie is pogings aangewend om waarnemingsmoontlikhede en kleinskaalse vissers spesifiek as sleutelpartye vir konsultasie te identifiseer.
- Ingeval 'n moontlikheid bestaan dat EIMS ook aangestel kan word vir soortgelyke proses aanvaar te doen vir 'n gebied wat aanvullend met die TGS-aanvraaggebied

EIMS

12


Legend
Searcher Application Area
TGS Application Area
Google Earth
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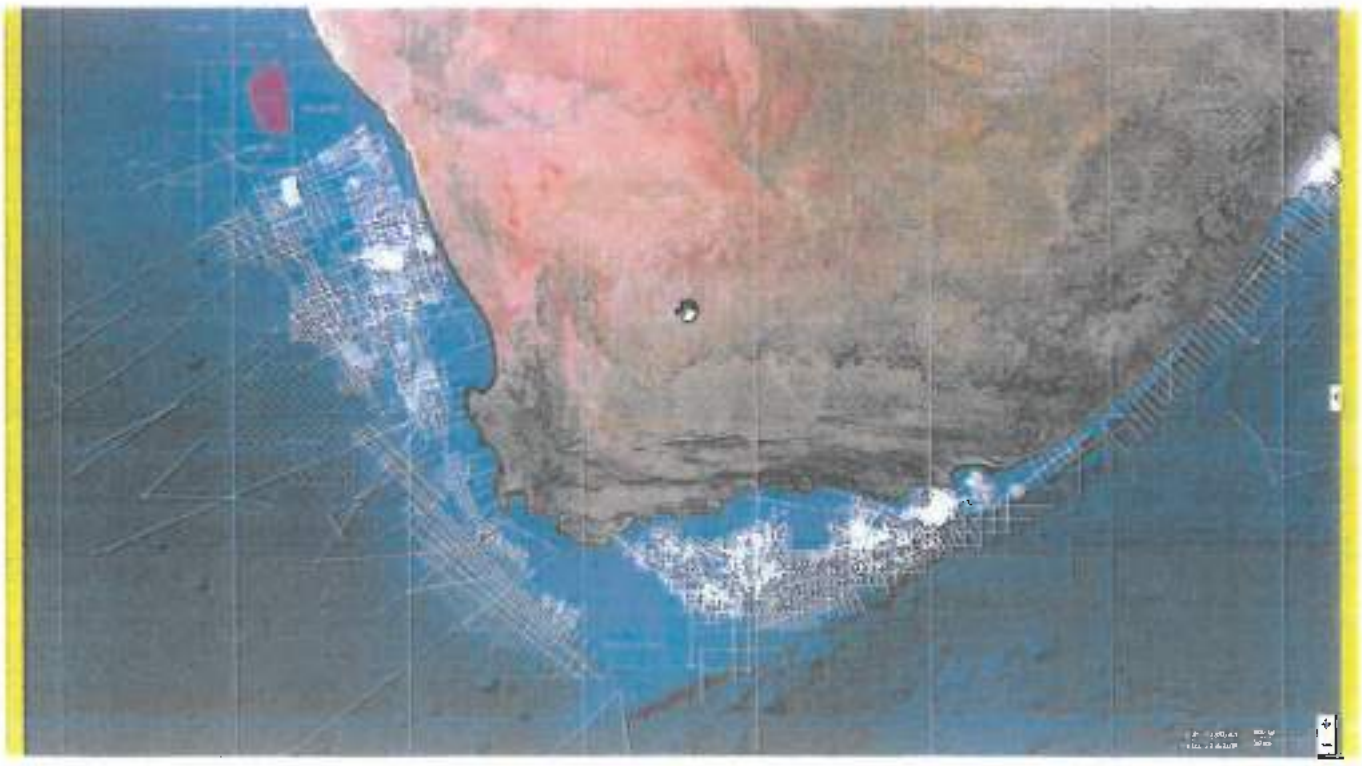
13



14

Projek Span

15

Projek Span

EIMS	GP Kriel	Omgewings Konsultant
	Andriëtte Xaxa	Omgewings Bestuurs Konsultant
PISCES	Dr Andrea Pulfrich	Marine Biology
CapMarine	Sarah Wilkinson	Visuele Bestuurder

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Omgewingsprojekspan

SLR	Luke Zoontjens	Akoestiek
PGS	Wouter Fourie	Erfenis
	Dr Ilse Aucamp San-Marie Aucamp	Sosiale

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Aansoek Proses

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OM Aansoek Proses

- BA Proses: NEMA OIS Regulasies, 2014:
- Gelyste Aktiwiteite in Noteringskennisgewings (LN) 1:

Aktiwiteit	Beskrywing:
NEMA: GNR983 – Noterings Kennisgewing 1	
21(b)	*Enige aktiwiteit, insluitend die werking van aparate aktiwiteit wat 'n verkenningspermit ingevolge artikel 74 van die Wet op die Ontwikkeling van Minerale en Petroleumhulpbronne vereis, asook enige ander toepaslike aktiwiteit soos vervat in hierdie Noteringskennisgewing of Noteringskennisgewing 3 van 2014, wat vereis word om die verkenningspermit uit te oefen, uitsluitend–,* *(a) enige "desktop" opname; en (b) enige lug opname*

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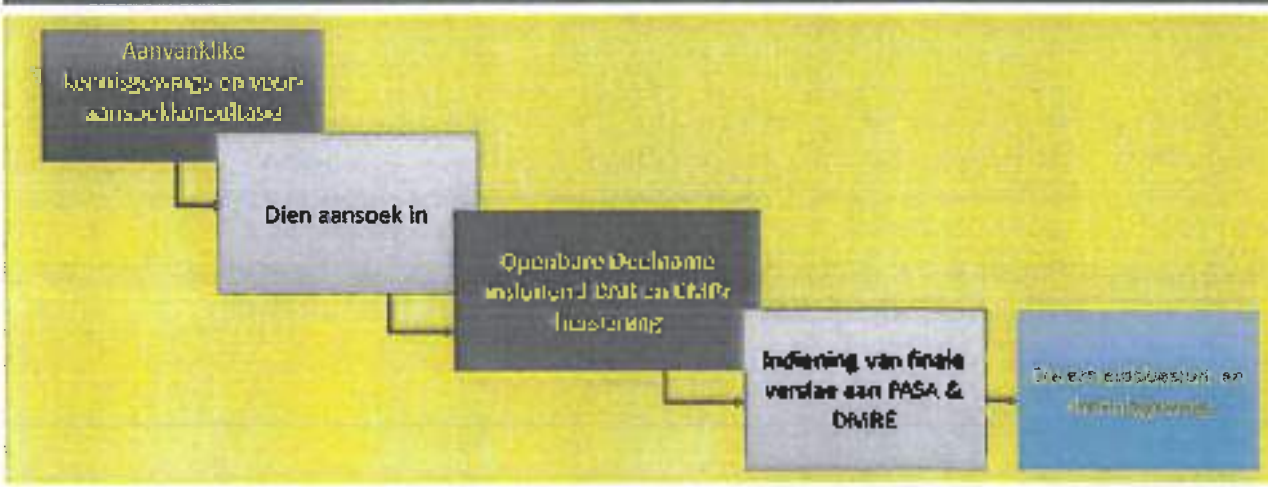
Tipiese BA Aansoek Proses



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Publieke Deelname

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Publieke Deelname

AKSIE	BESKRYWING	PUBLIKASIE/PLEK
Aanvanklike Publieke Kennisgewing (Identifisering van projek en oproep om te registreer)	Koerantadvertensies	Cape Times – Engels en Afrikaans Sentinel News – Engels en Afrikaans Weslander – Engels en Afrikaans Oos Kontrei – Engels en Afrikaans Die Plattelander – Engels en Afrikaans
	Koerant advertensies	Nasionale Gazette
	Radio advertensies	RSM – Engels, Radio Namakwaland – Afrikaans, Radio MFM – Engels en Afrikaans, Radio Wesland – Engels en Afrikaans.
	Plasing van kennisgewings	300 A2-kennisgewings (Engels en Afrikaans) langs en om die studiegebied (verskillende plasingsplekke).
	Kennisgewing van sleutel B&GPs	Sleutel B&GPs is per e-pos, faks en / of pos en kennis gestel.
Eerste Ronde van Publieke Vergaderings Kennisgewings	Kennisgewing van sleutel B&GPs	Sleutel B&GPs is per e-pos, faks en / of pos en kennis gestel.
30 Dag BAR Oorsigtydperk	Kennisgewing van sleutel B&GPs	moet nog aangekondig word
Tweede Ronde Publieke Vergaderings	Kennisgewing van sleutel B&GPs	moet nog aangekondig word

22

Impak
Bepaling
EIMS

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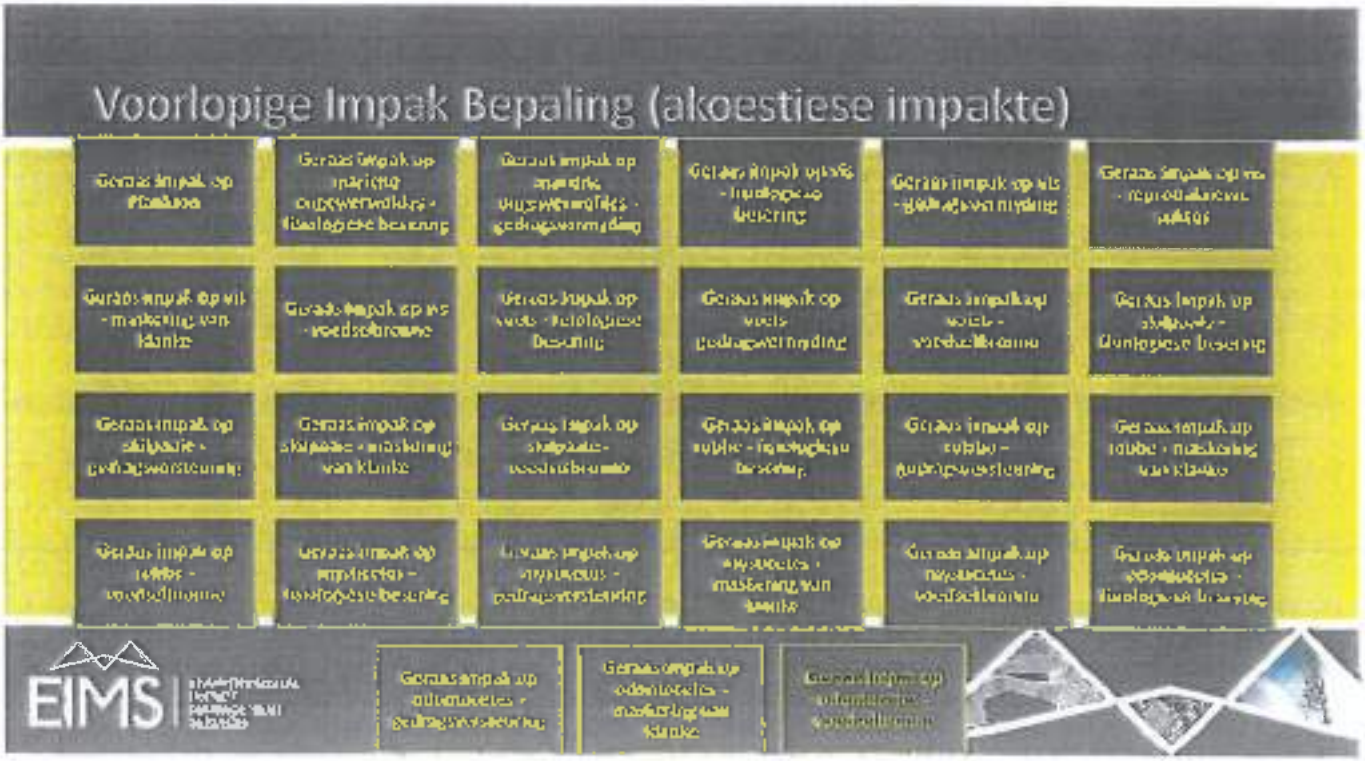
Voorlopige Impak Bepaling (akoestiese impakte)
EIMS

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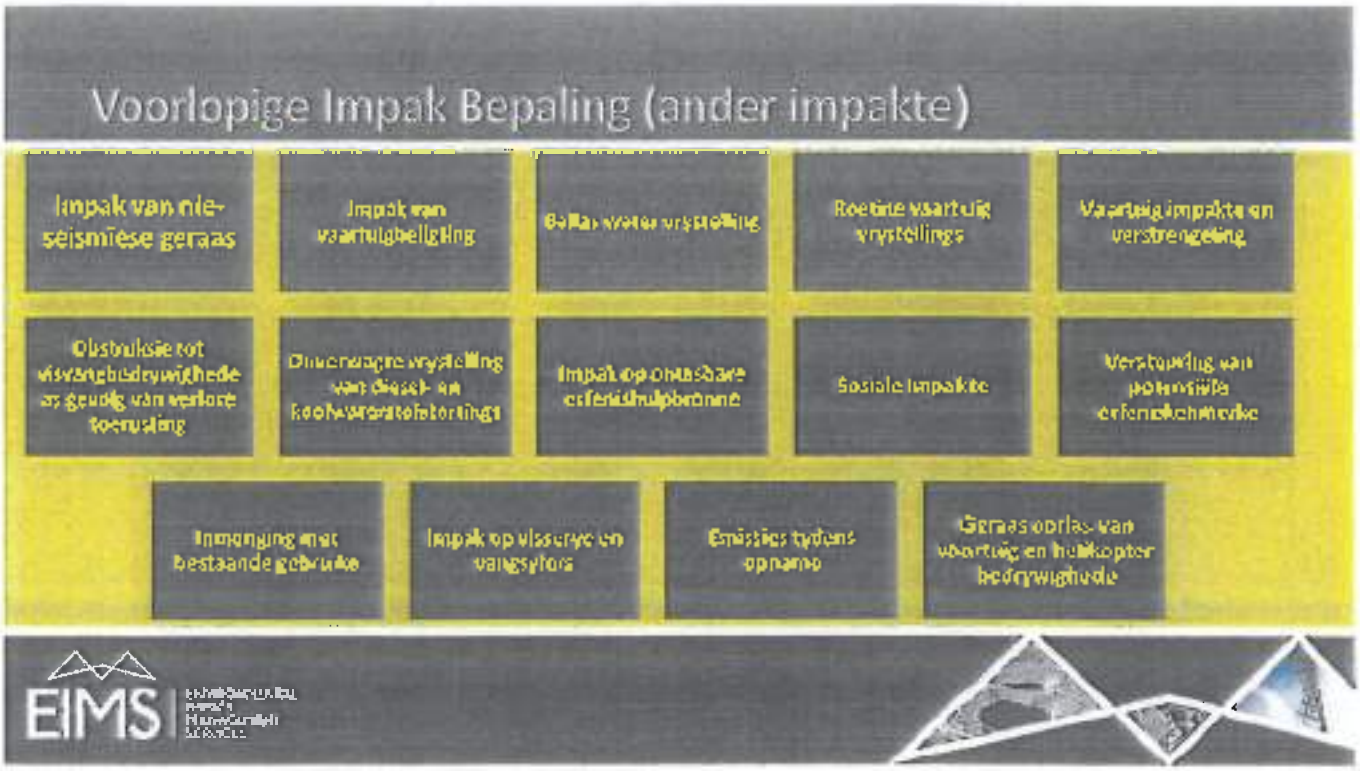
Voorlopige Impak Bepaling (ander impakte)
Impak van nie-seismiese geraas
Impak van vaartuigbeligting
Ballas water vrystelling
Roetine vaartuig vrystellings
Vaartuig impakte en verstrengeling
Ontbruikse tot visvangbedrywighede as gevolg van verlore toerusting
Onopsetlike vrystelling van diesel- en koolwaterstofbrandstof
Impak op onderwater erfenishulpbronne
Sosiale impakte
Verstoring van potensiële erfenisbestanddele
Inmenging met bestaande gebruike
Impak op visseryne en vangsyfers
Emissies tydens opname
Geraas oorlas van vaartuie en helikopter bedrywighede
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Pad Vorentoe
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Pad Vorentoe

Aanvanklike PPP	16 Aug – 19 Sep 2022
Aansoek	Indiening woeg Sep 2022
BAR Hersiening	Sep - Oct 2022
Besluitnemingsfase	107 dae van indiening

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Vrae

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28

Vrae

- **Environmental Impact Management Services (Pty) Ltd (EIMS)**
  - Kontak Persoon: Andisiwe Xuma
  - Posbus 2089 Pinegowrie 2123
  - Telefoon: 011 789 7170
  - Faks: 086 571 9047
  - E-pos: [redacted]
  - Verwysing: 1520

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EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

Proposed TGS Orange Basin Reconnaissance Basic Assessment Project

29 August – 3 September 2022

1

Project Outline

- Ground Rules
- Project Description
- Project Team
- Application Process
- Public Participation
- Impact Assessment
- Way Forward
- Questions

2

Ground Rules

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3

Ground Rules

- Please be respectful of those around you
- Please do not interrupt other speakers
- Please keep questions to the end of the presentation
- Please first state your name before your comment or question
- Keep comments and questions to the point of the meeting
- Please speak up and clearly

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Project Description

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5

Introduction

- TGS Geophysical Company (UK) Limited proposes to undertake a 3D seismic survey off the West Coast of South Africa.
- The proposed project area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 280 km offshore of Hondeklip Bay over a number of petroleum licence blocks.
- EIMS was appointed as EAP to apply for Environmental Authorisation (EIA Regulations, 2014 NEMA).
- The aim of this initial round of consultation is to ensure we capture initial concerns from the public and key I&APs.

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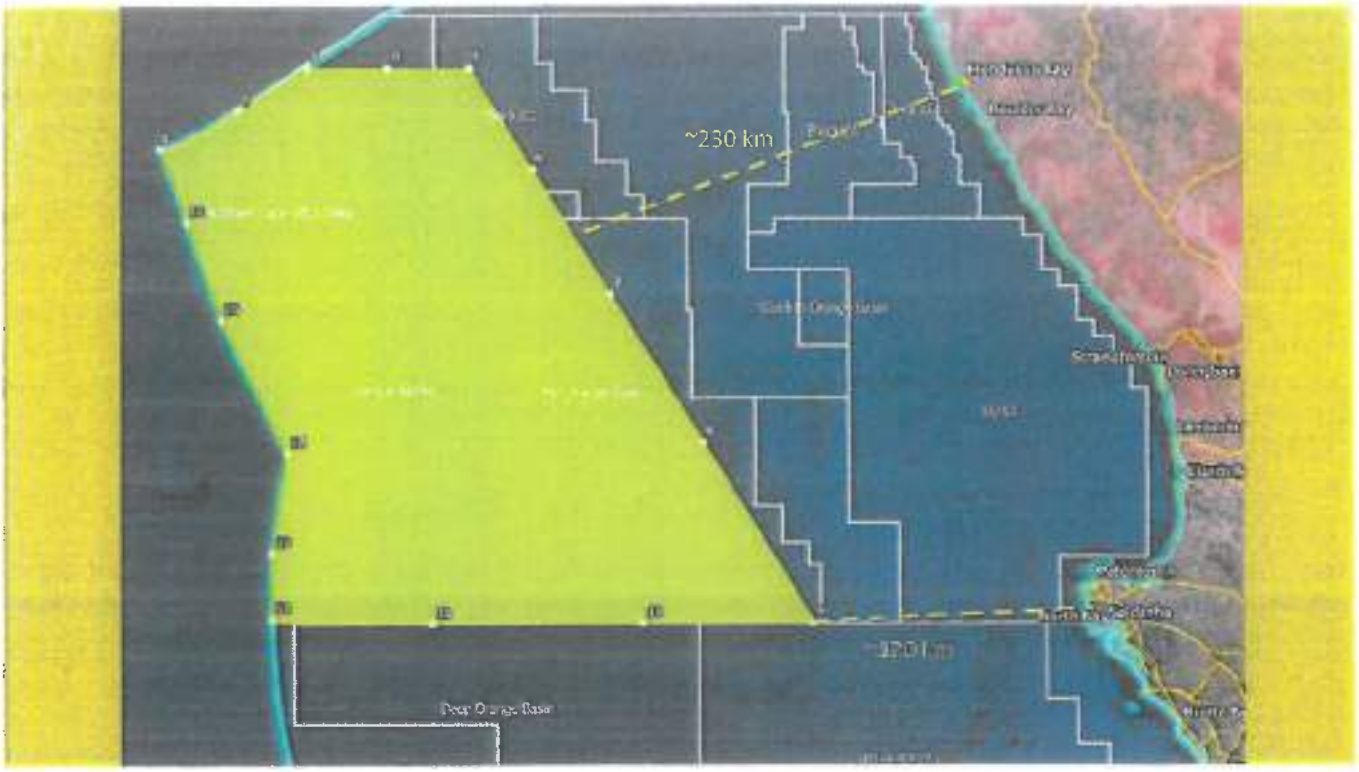

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Project Description

- The area of interest for the proposed 3D seismic survey is approximately 7,400 km² in extent.
- It is proposed that a single survey vessel equipped with seismic sources and streamers be used. The proposed 3D survey would be supported by two escort vessels. The escort vessel will assist in monitoring for and warning other vessels (e.g. fishing, transport, etc.) about the survey and in the case of maneuverability of the survey vessel.
- As a minimum, one Namibian Liaison Officer (person speaking English and Afrikaans) will be on board either the survey or the escort vessel to facilitate communication in the local language with the fishing (or other) vessels that are in the area.
- Additionally, there will be Marine Mammal Observers on board the survey vessel to monitor for marine mammals and turtles visually and ensure that the survey is conducted in compliance with the specified guidelines as stated in the Environmental Management Programme.
- The 3D survey will take a maximum of 70 days including downtime.

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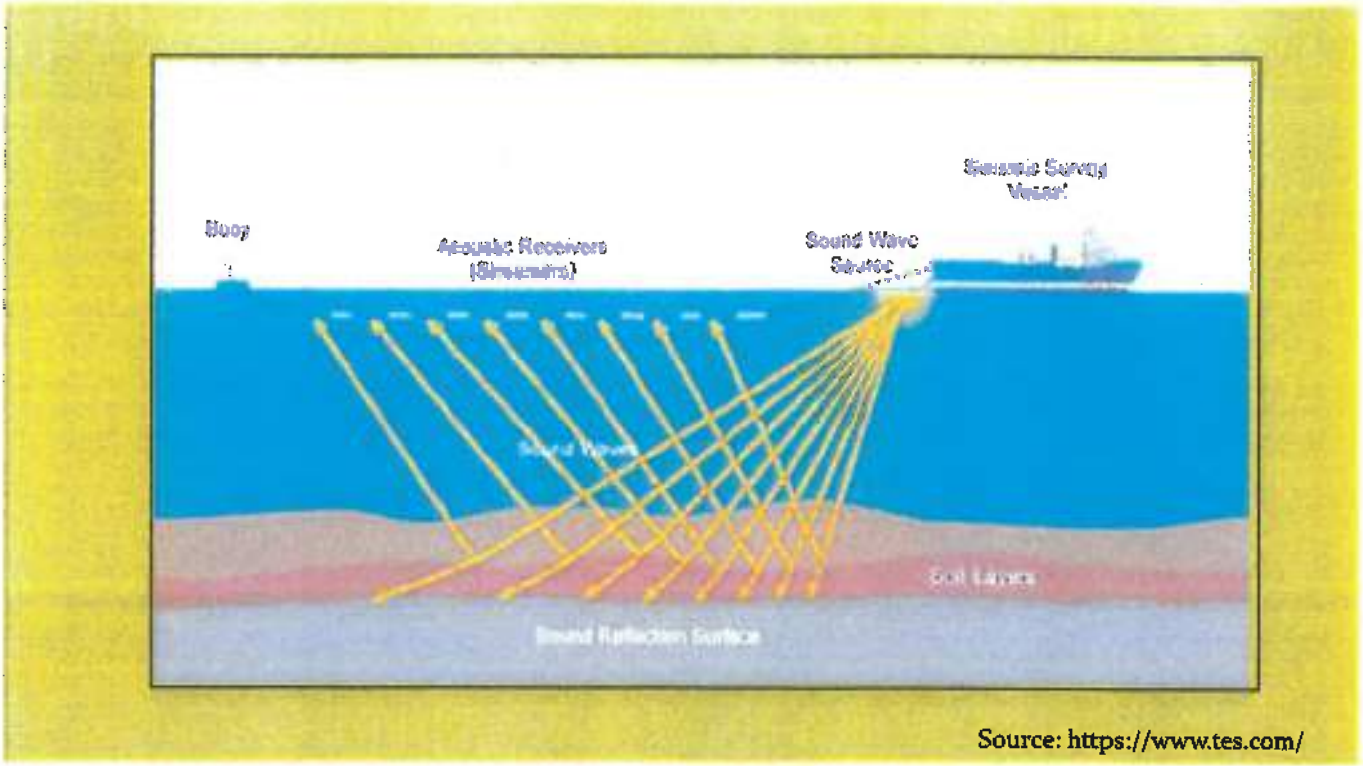

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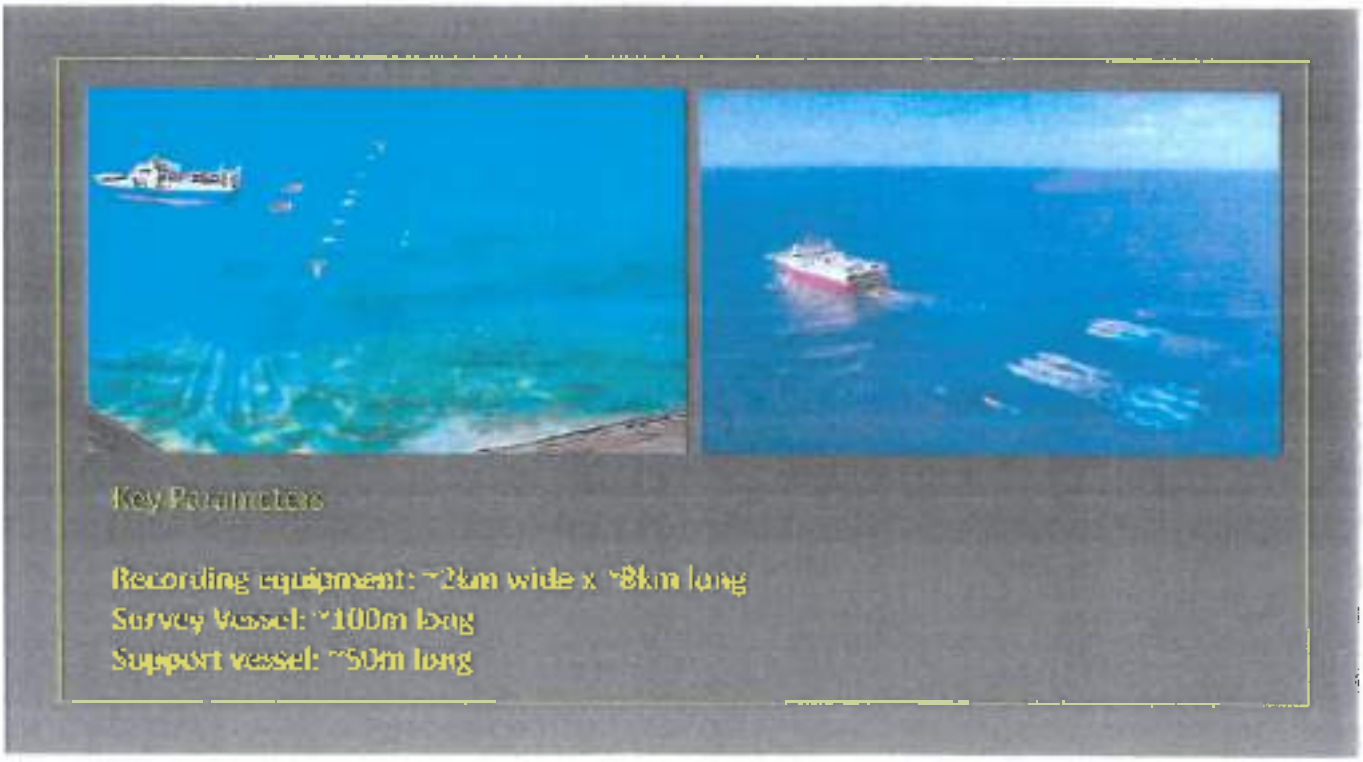

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Project Description

- EIMS will be conducting a comprehensive Public Participation process in line with the NEMA requirements. As part of our consultation attempts have been made to specifically identify fishing communities and small scale fishers as key parties for consultation.
- Another company, Searcher Seismic, is also in the process of applying for an area that overlaps with the TGS application area.

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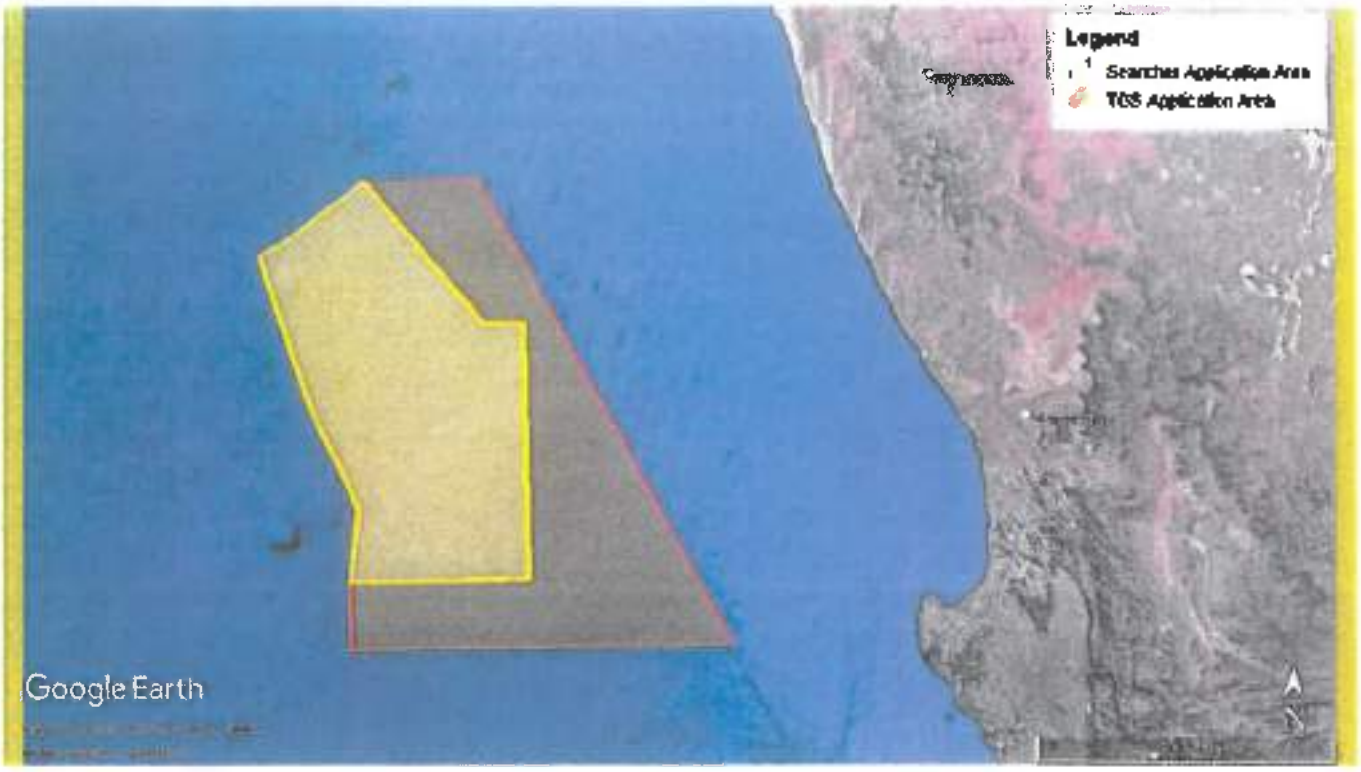
Legend
Searches Application Area
TGS Application Area
Google Earth

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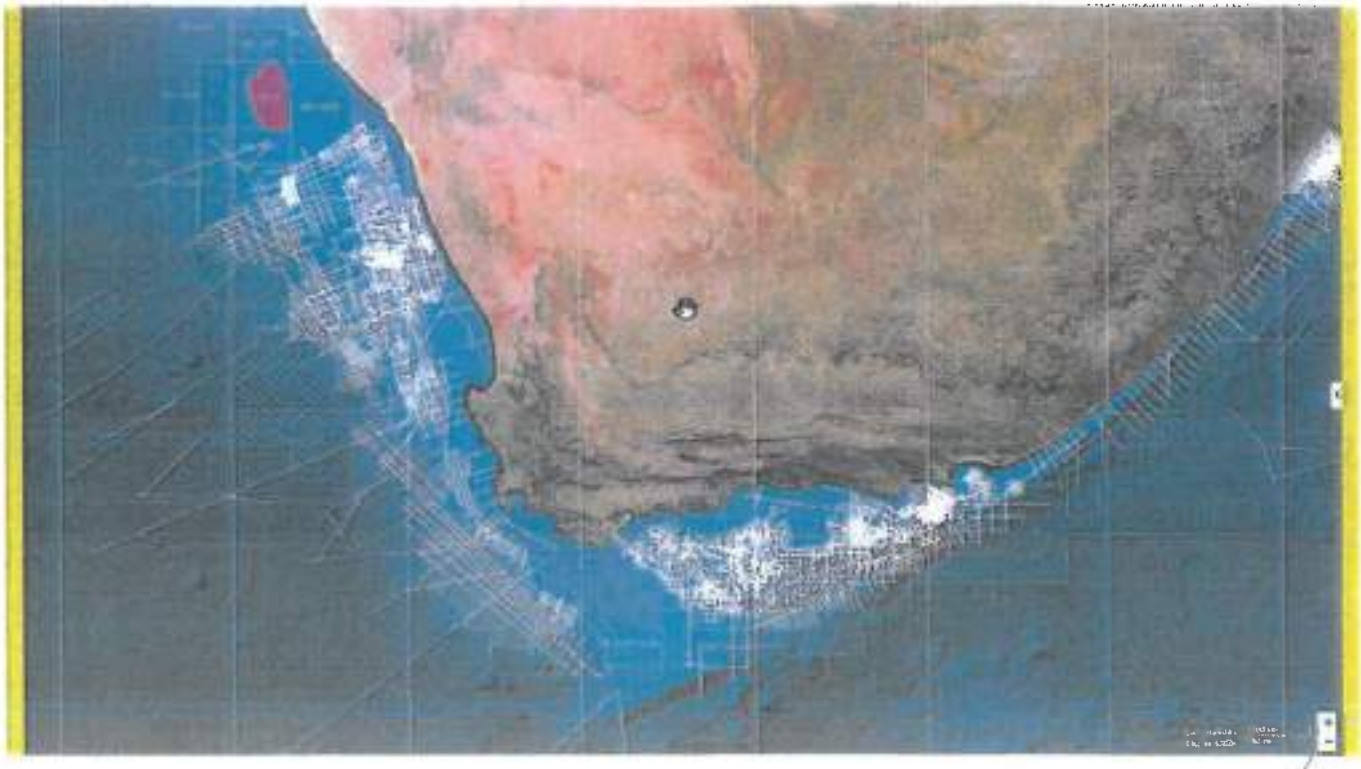

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Project Team

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Environmental Project Team

Company	Name	Project Responsibility
EIMS	Mr GP Friel	Environmental Consultant
	Mrs Andrichen Burns	Public Participation Consultant
PISCES	Dr Andrew Pollitch	Marine Ecologist
CapSpring	Ms Sarah Wilkinson	Fisheries Expert

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Environmental Project Team

Company	Name	Project Responsibility
SLR	Mr Luke Zoontjens	Acoustics
PGS HERITAGE	Mr Wouter Fourie	Heritage
[illegible]	Dr Ilse Aucamp	Social

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Application Process

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EA Application Process

- BA Process– NEMA EIA Regulations, 2014
- Listed Activities in Listing Notices (LN) 1:

Activity	Description
NEMA: GNR983 – Listing Notice 1	
21(b)	*Any activity including the operation of that activity which requires a reconnaissance permit in terms of section 78 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice or in Listing Notice 3 of 2014, required to exercise the reconnaissance permit, excluding-* *(a) any desktop study; and (b) any aerial survey*

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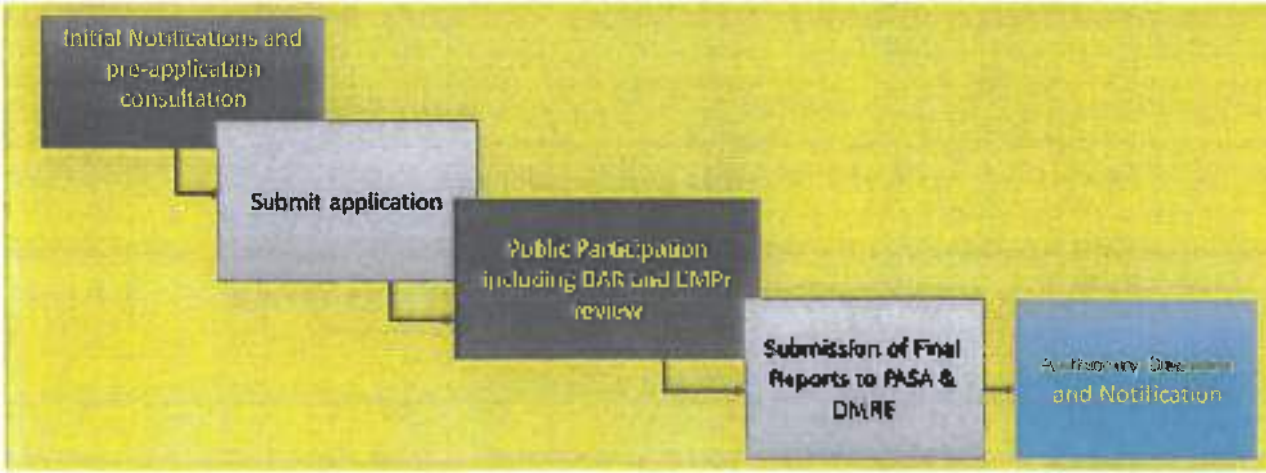
Typical BA Application Process



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Public Participation

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Public Participation

ACTION	DESCRIPTION	PUBLICATION/PLACE
Initial Public Notification (announcement of project and call to register)	Newspaper advertisements	Cape Times – English and isiXhosa Sarstaal News – English and Afrikaans Weslander - English and Afrikaans Ons Kontrei – English and Afrikaans Die Plattelander – English and Afrikaans
	Newspaper advertisements	National Gazette
	Radio adverts	KFM – English, Radio Namakwaland – Afrikaans, Radio NFM – English and Afrikaans, Radio West Coast – English and isiXhosa.
	Placement of site notices.	100 A2 site notices (English and Afrikaans) along and around the study area (various placement locations).
	Notification of key I&APs.	Key I&APs were notified via email, fax, and/or post
First Round of Public Meeting Notifications	Notification of key I&APs.	Key I&APs were notified via email, fax, and/or post.
30 Day EAR review	Notification of key I&APs.	TBC
Second Round of Public Meetings	Notification of key I&APs.	TBC

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Impact Assessment

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Preliminary Impact Assessment (acoustic impacts)

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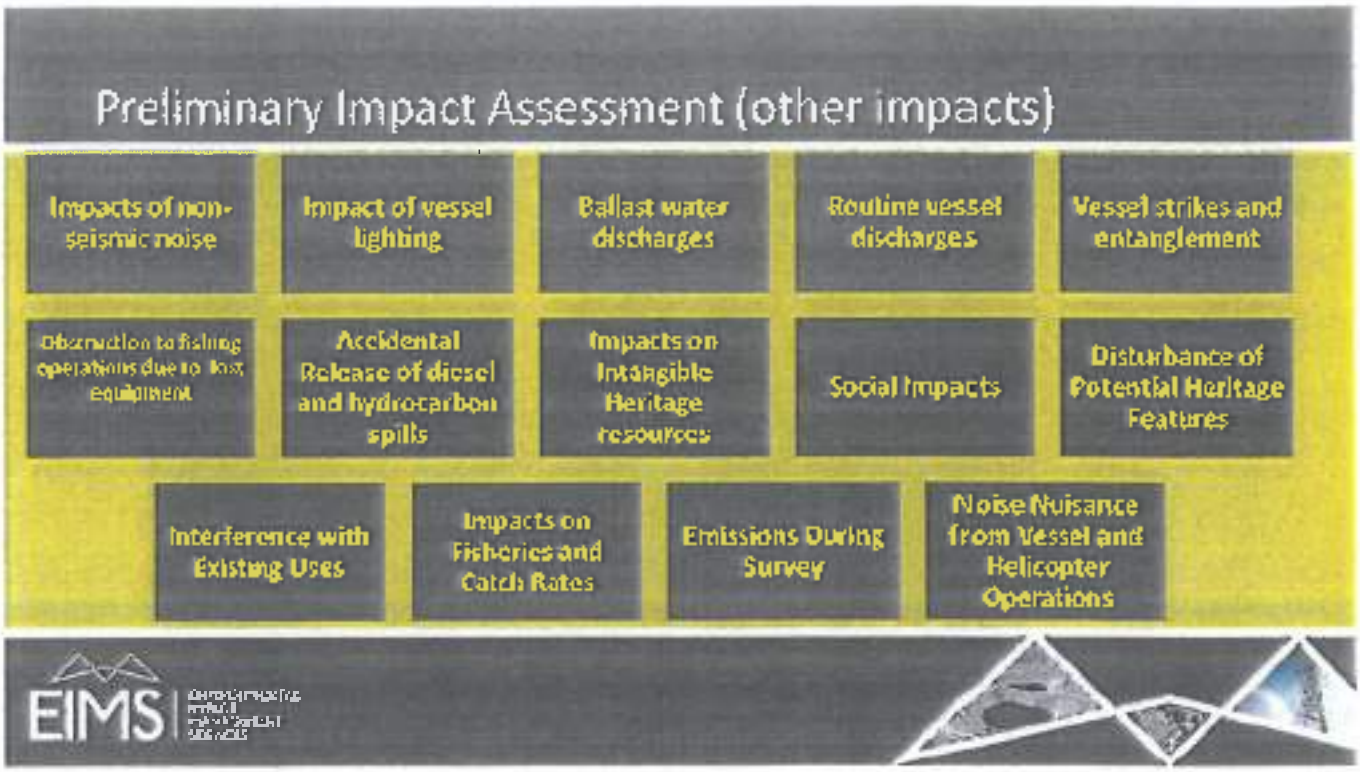
Preliminary Impact Assessment (other impacts)
Impacts of non-seismic noise
Impact of vessel lighting
Ballast water discharges
Routine vessel discharges
Vessel strikes and entanglement
Obstruction to fishing operations due to lost equipment
Accidental Release of diesel and hydrocarbon spills
Impacts on Intangible Heritage resources
Social Impacts
Disturbance of Potential Heritage Features
Interference with Existing Uses
Impacts on Fisheries and Catch Rates
Emissions During Survey
Noise Nuisance from Vessel and Helicopter Operations
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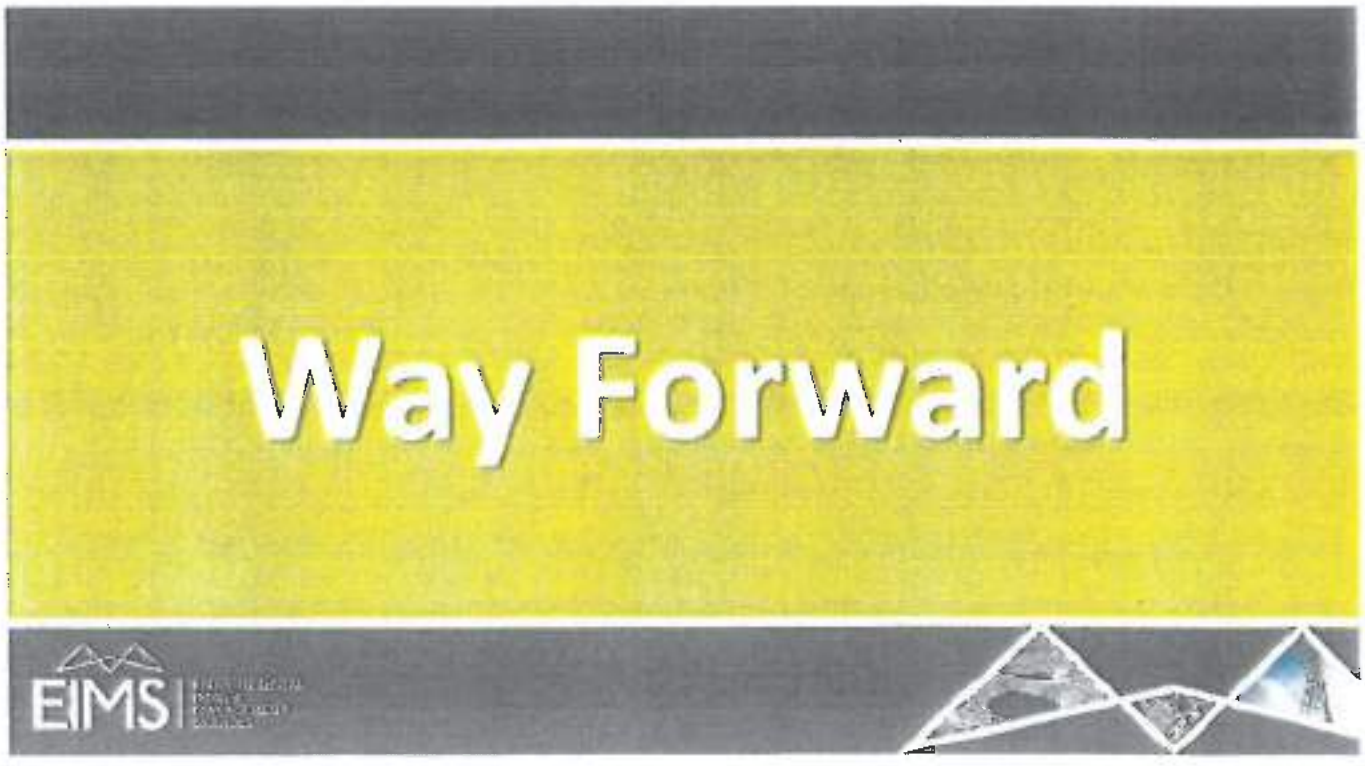
Way Forward
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Way Forward

Initial PPP	16 Aug – 19 Sep 2022
Application	Submission by early Sep 2022
BAR Review	Sep - Oct 2022
Decision Phase	107 days from submission

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Questions

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Questions

- **Environmental Impact Management Services (Pty) Ltd (EIMS)**
  - Contact Person: Andiswe Xuma
  - P.O. Box 2083 Pinegowrie 2123
  - Phone: 011 789 7170
  - Fax: 086 571 9047
  - Email: jas@eims.co.za
  - Reference: 1520

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SEICHE WATER TECHNOLOGY GROUP

Omgewingsversagting tydens Aflandige Opnames

Michelle Rolfe – Seiche Ltd
Rudiaan Daly- PAM/TLO Konsultant
Callen Clokie- MMO Konsultant

Seiche

1

2

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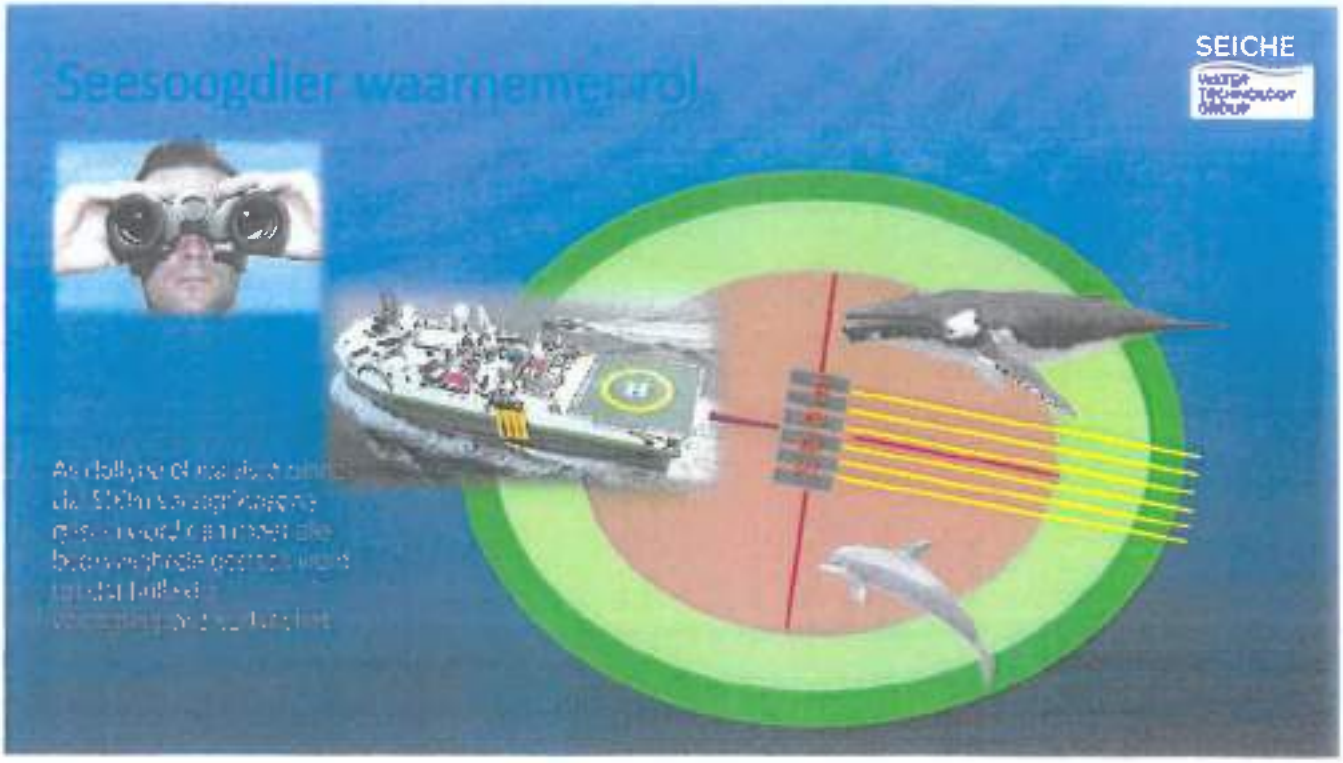

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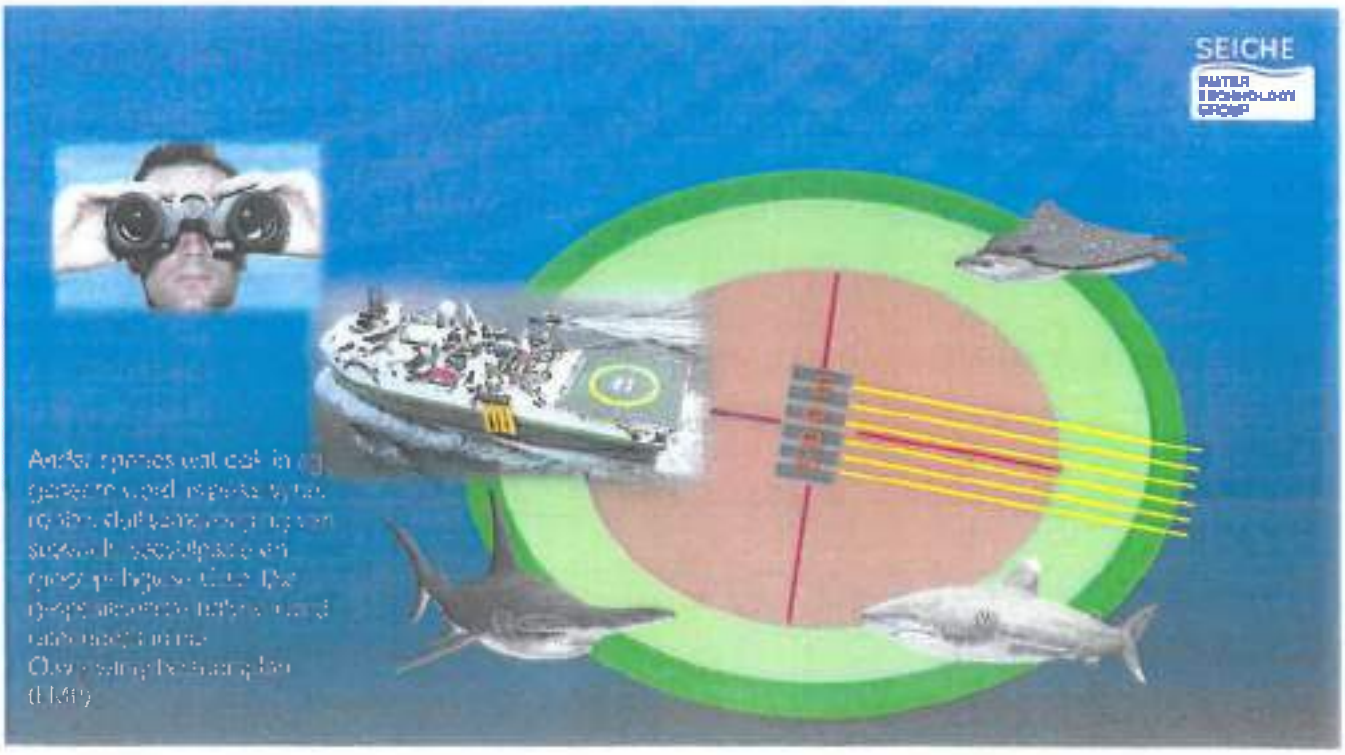

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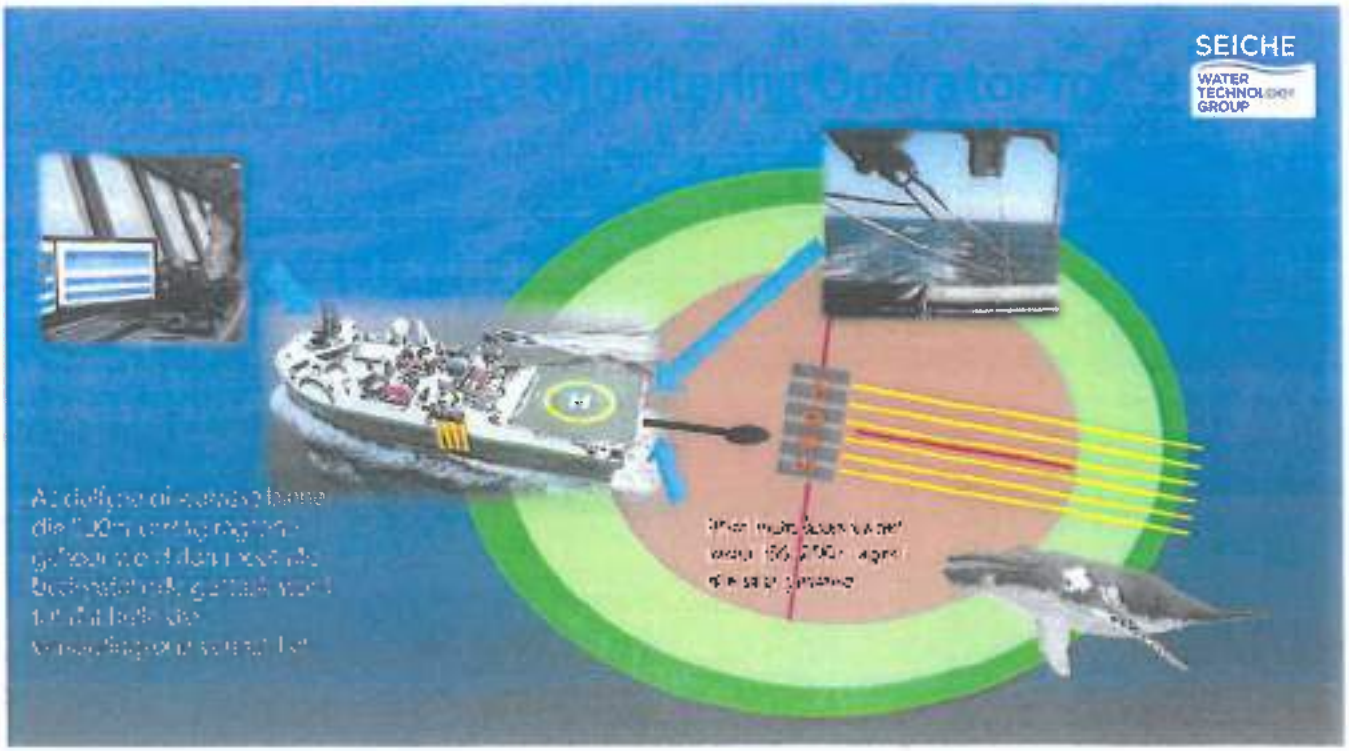

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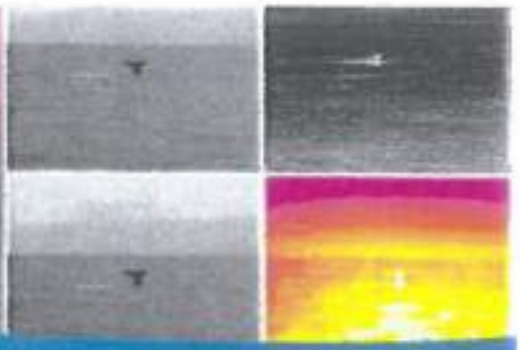
SEICHE

- Voer visuele en akoestiese monitering uit vir seesoogdiere en fauna.
- Kort vaartuigbenaming van die verskaffingsvereistes vir die aanvang van die opname om rakoming tydens bedrywighede te verseker.
- Teken waarnemings en akoestiese rekords van seesoogdiere en –fauna, insluitend foto's waar moontlik.
- MMO/PAM- verslae word daagliks vir die duur van die opname aan die Petroleumagentskap van Suid-Afrika (PASA) se dispetkoerant vir ongeag ngs oldoening gestuur, dus veld deurlopende monitoring van voldoening van lisensievoorwaardes deur die geïdentifiseerde persoon/e met die nodige kundigheid ensiklopedie gekwalifiseer

- MMO- en PAM- operateurs is onafhanklike kontrakteurs, wat [illegible] deur die [illegible] en [illegible] van volle gesag om enige bedrywighede te staak [illegible]

7



- HD- [illegible]
- 24-uur [illegible]
- [illegible]
- [illegible]
- [illegible]

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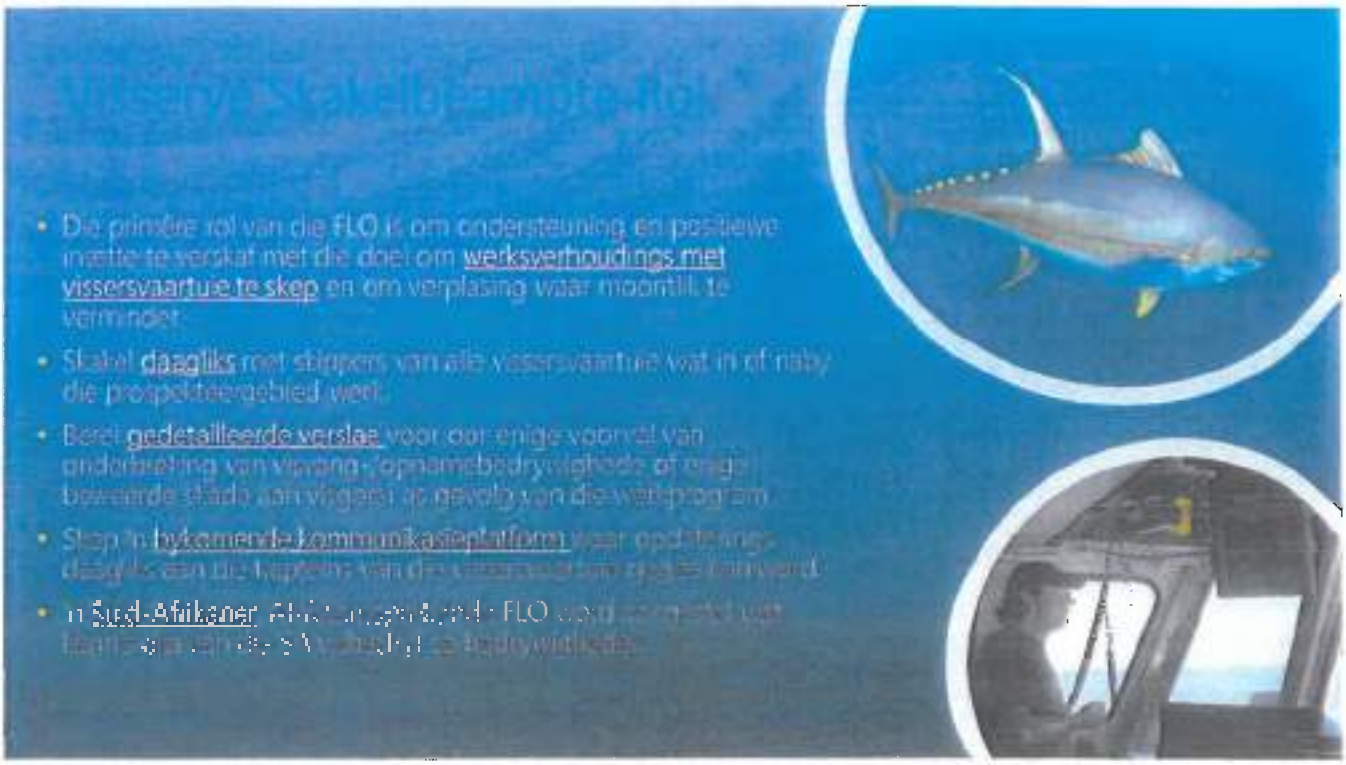
• Die primêre rol van die FLO is om ondersteuning en positiewe insette te verskaf met die doel om werksverhoudings met vissersvaartuie te skep en om verplasing waar moontlik te verminder.
• Skakel daagliks met skippers van alle vissersvaartuie wat in of naby die prospekteergebied werk.
• Berei gedetailleerde verslae voor oor enige voorval van onderbreking van visvang-/opnamebedrywighede of enige bewerende stappe aangeteken as gevolg van die werksprogram.
• Stap in bykomende kommunikasieplatforms waar opdaterings daagliks en die koppens van die vroeëoggend-spele bevind.
• In Suid-Afrikaner

9

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WATER TECHNOLOGY GROUP
• E-pos om kennisgewing en 24 uur operasionele planne te versprei.
• WhatsApp en Telegram boodskappe vir operasionele bywerings.
• Vaartuig Outomatiese identifikasiestelsel (AIS).
• VHF Kanaal 16
• Infrarooi kameras gebruik om die vaartuie te sien wanneer daar nie VHF of AIS aan boord is nie
GmailM
WhatsApp
Telegram

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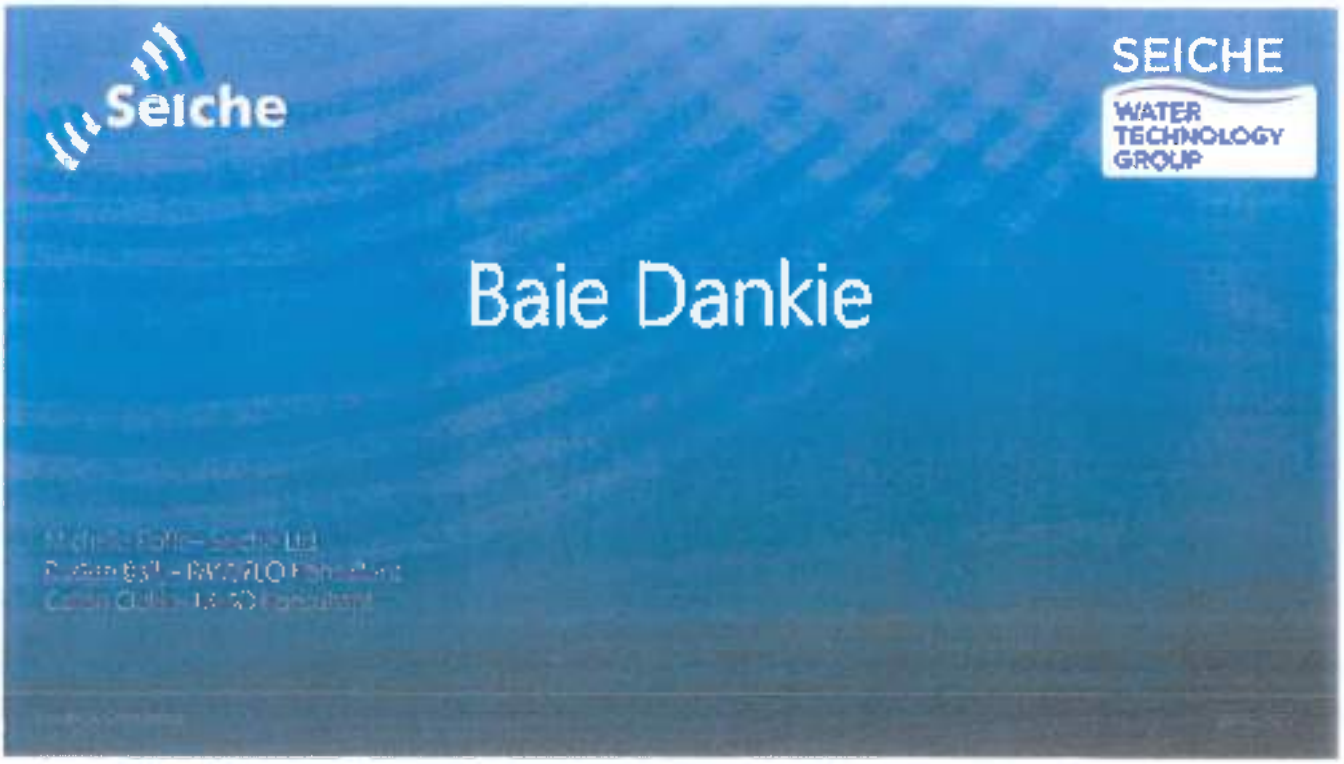

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SEICHE

WATER TECHNOLOGY GROUP

Environmental Mitigation during Offshore Surveys

Michelle Roffe – Seiche Ltd

Rudian Daily- PAM/FLO consultant

Callen Cloke- MMO consultant

Seiche

1

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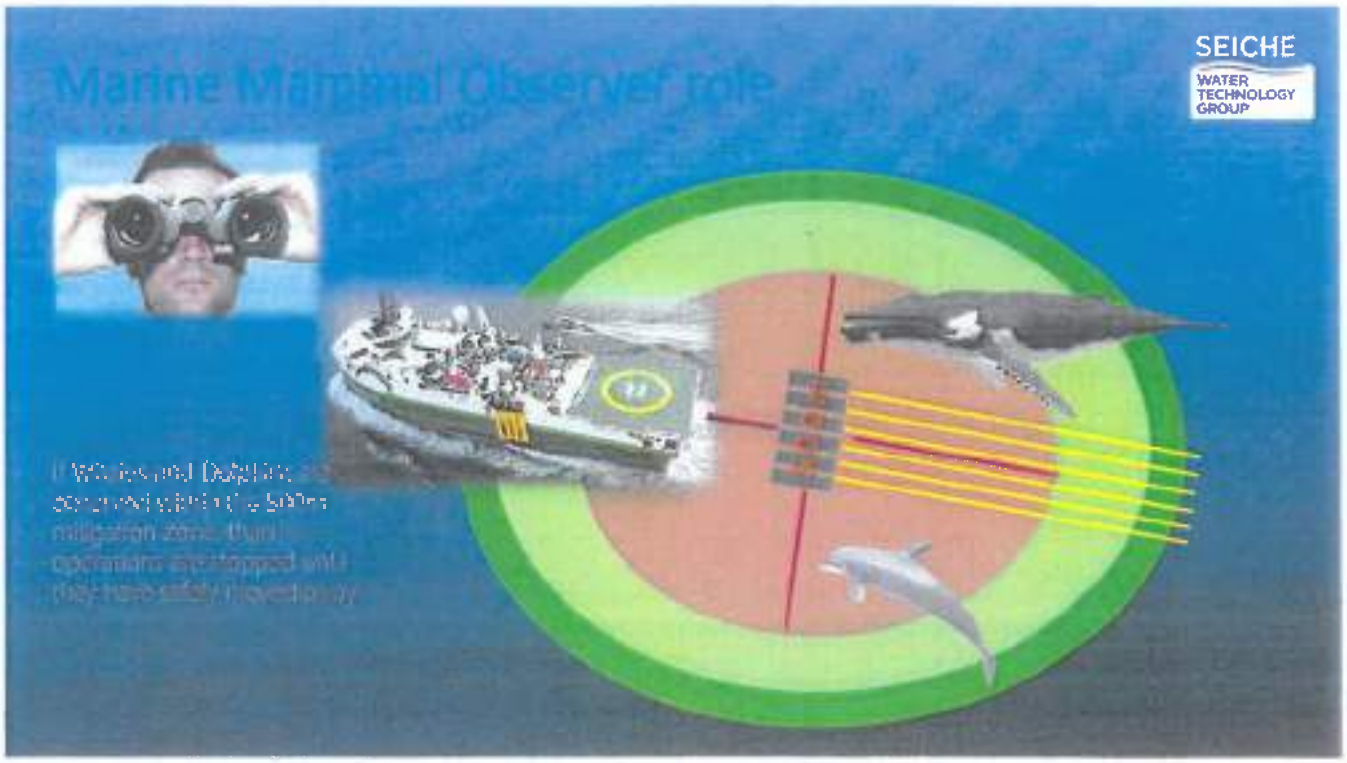
Marine Mammal Observer role
SEICHE
WATER TECHNOLOGY GROUP

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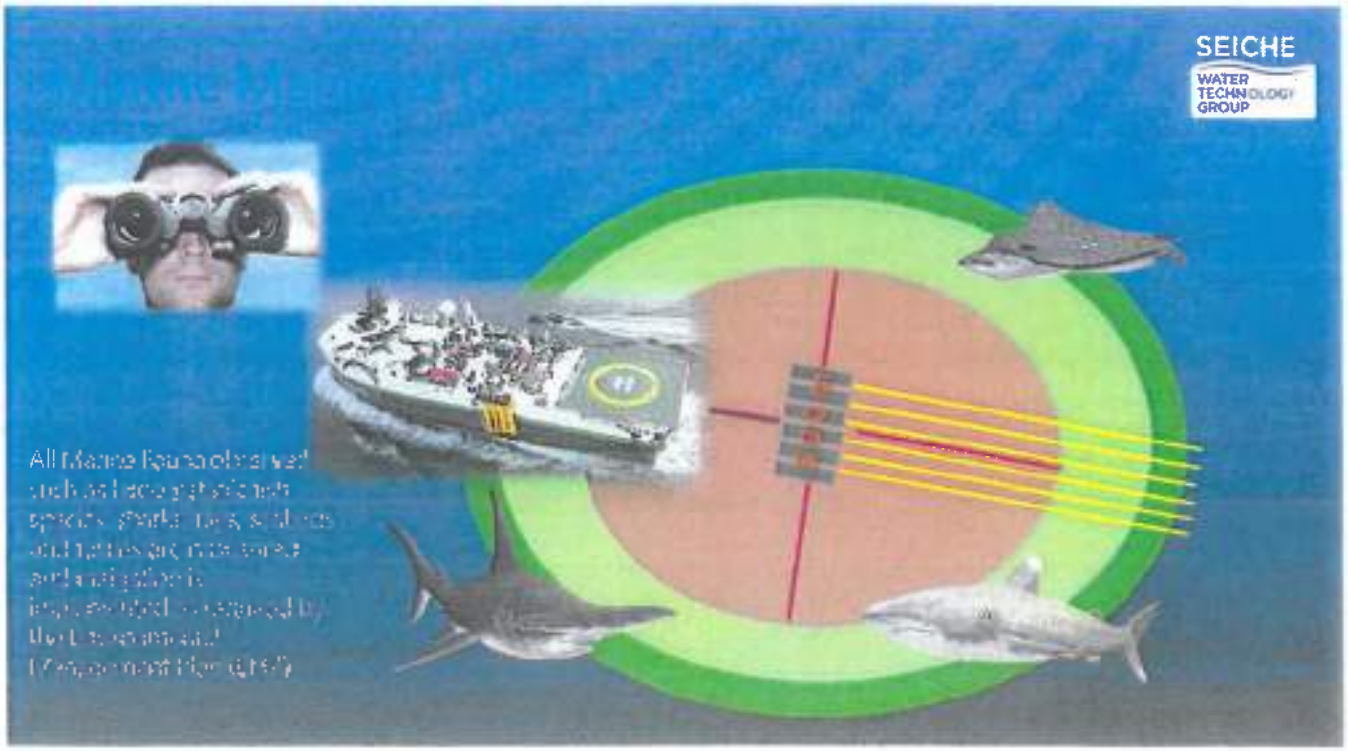
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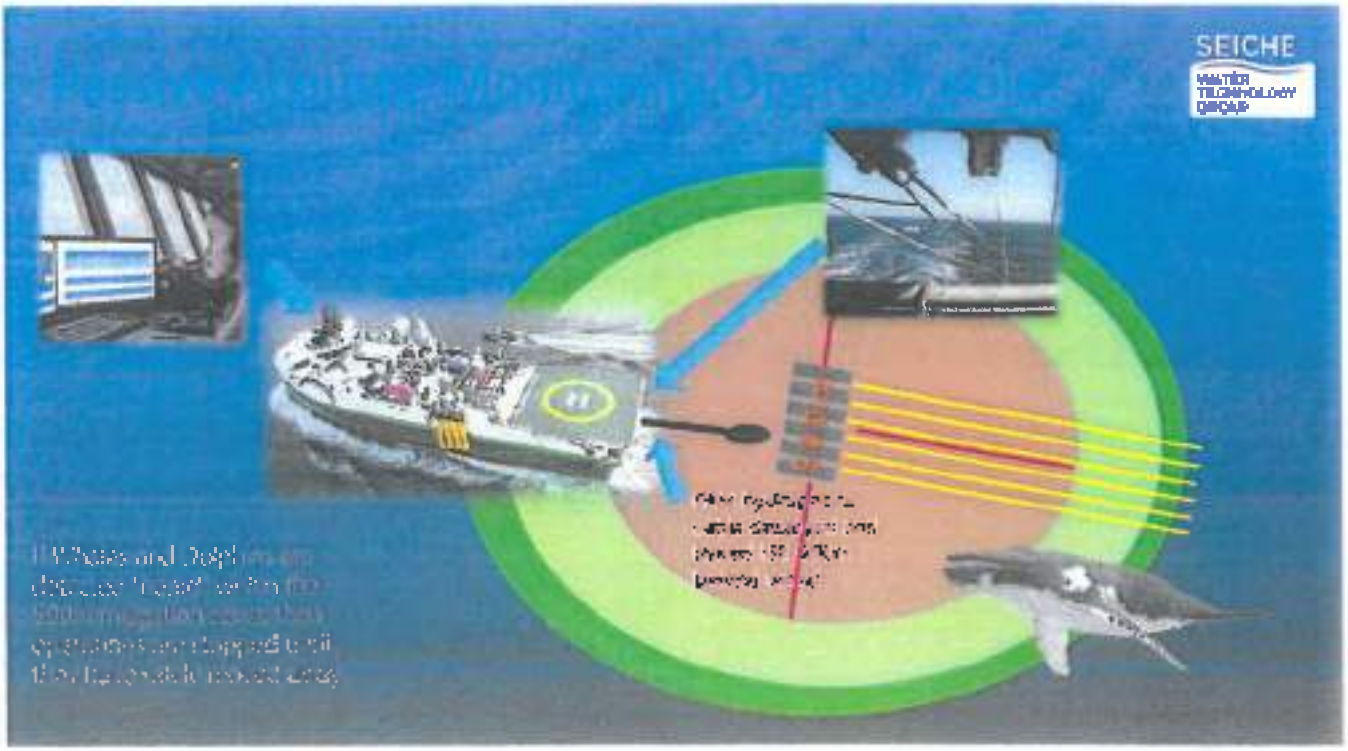
The primary function of Passive Acoustic Monitoring Operators (PAMOs) is to monitor acoustically for marine mammals and ensure that the survey is conducted in compliance with the specified guidelines as stated in the Environmental Management Plan (EMP).

5


SEICHE

6

Responsibilities of MMO and PAM Operators

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- Conduct visual and acoustic monitoring for marine mammals and sea turtles
- Brief vessel crew of the mitigation requirements prior to the start of the survey to ensure compliance during operations
- Record sightings and acoustic detections of marine mammals and turtles including photos where possible.
- MMO/PAM reports are sent to Petroleum Agency of South Africa (PASA) environmental compliance department daily for the duration of the survey. Also continuous onshore monitoring of compliance is maintained by the regulatory authority.
- MMO and PAM operators are independent South African contractors and supplied with all equipment and personnel. They are given full authority to stop operations when marine mammals or sea turtles are within the mitigation zones.

7

- HD or 4K video & still imagery
- Compact, [illegible] and easy to mount and fast to deploy
- Remote Activated Device Connection at Sea (RADS) solution
- [illegible]
- [illegible]

8

Fisheries Liaison Officer role

- The primary role of the FLO is to provide support and passive input to create working relationships with fishing vessels which would allow both industries to work side-by-side minimising disruption where possible
- Liaise with skippers of all fishing vessels operating in or near the proposed area daily
- Prepare detailed reports on any incident of interruption to towing operations or any alleged damage to towing gear
- Create an additional communication platform where updates can be given to the Captains of any fishing vessels in the area as well as inform operations when complete
- A Senegalese national speaking FLO [illegible]

9

Communication with fishermen

SEICHE WATER TECHNOLOGY GROUP

- Email to distribute Notice to Mariner and 24hr operational plans.
- WhatsApp and Telegram messages for operational updates
- Automatic Identification System (AIS).
- VHF Channel 16.
- Thermal camera to detect smaller vessels that don't have VHF or Automatic Identification System (AIS) on board.

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11

EIMS	MINUTES OF MEETING		
EIMS Ref	1520	Project Name	TGS RECONNAISSANCE 6A

MEETING DETAILS

Meeting	1520 Pre-application Consultation Public Meeting		
Meeting Venue	Hout Bay Public Library	Date	2022/08/29
		Time	16h00-18h00

A Public Meeting was scheduled during the pre-application phase with the Interested and Affected Parties (I&APs). The aim of the meeting was to capture the initial concerns from the members of the public and key I&APs. During the public meeting which took place between 16h00 and 18h00, a presentation of the project description, preliminary impact assessment, project team and project timeframes was delivered to all attendees of the meeting by Environmental Impact Management Services (EIMS) Pty (Ltd). The presentation was delivered by Mr GP Kriel from EIMS in English, with Andisiwe Xuma available to translation to isiXhosa where required. SEICHE delivered a presentation on the environmental mitigation carried out during seismic surveys in terms of the Marine Mammal Observer (MMO) and Fishing Liaison Officer (FLO) in English. The presentation was delivered by Michelle Rosch. After the presentations were delivered, a question-and-answer session was opened where attendees asked questions or expressed their comments regarding the project. The presentation and attendance register have been attached as an appendix to this document.

AGENDA

Item
1. Opening and welcome GP welcomed all in attendance and explained that it is understood that the low turnout is due to conflicting meeting schedules with the DMRE/PASA and the small-scale fishers. Attendees were informed that if they have specific language preferences other than English then this would be accommodated. General ground rules of the meeting were highlighted and the difference between the Searcher and TGS Application area explained.
2. *EIMS Presentation (Attached)* a. Introducing the project team b. Project Description c. Legal Application Process d. Public Participation e. Impact Assessment f. Project Contact Details g. Presentation from SEICHE
3. *Questions and Answers* The audience were invited to ask questions in any language of preference including English, Afrikaans and isiXhosa.

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EIMS ENVIRONMENTAL IMPACT MANAGEMENT SERVICES	MINUTES OF MEETING	
EIMS Ref: 1520	Project Name	TGS RECONNAISSANCE BA

NOTULE/ MINUTES

Item No	Item
1.	*All attendees were requested to sign the attendance register as they entered. Presentations from EIMS and SEICHE of the project description, application process and environmental mitigations during seismic survey were delivered as per the agenda above to the meeting attendees. It was indicated that the meeting would be recorded for the purposes of accurate minute taking. Background Information Documents (in English, Afrikaans and isiXhosa), comments forms, registration, information handouts and attendance registers, were made available at the meeting.* *The attendees were encouraged to submit their comments and concerns through filling in the comment forms provided or by submitting comments to the project email address provided. It was noted that all attendees who have provided their contact details would be registered by default on the I&AP database maintained by EIMS. Following the presentations, the floor was opened for a discussion and the attendees were encouraged to bring up any questions or concerns they had about the project.*
2.	**Questions and Answers**
a.	**IAP1 (American student at UCT)** *IAP 1 asked about the overlap of Searcher and TGS application areas and whether there would be one survey or two conducted.* **GP Kriel** As far as EIMS understands, there will only be one survey in the overlapping area. The reconnaissance permit is only valid for a defined period, which cannot be extended. Once the permit expires then you have to reapply, which is what happened with Searcher.
b.	**IAP2 (Veronica from Bengwela Fishing)** IAP 2 who had arrived late in the presentation asked (in isiXhosa) what is being assessed in the Basic Assessment process. Is the focus on humans, animal, water etc? **GP Kriel** EIMS is the appointed Environmental Assessment Practitioner responsible for managing the environmental application process and associated studies. Ms Xuma explained in isiXhosa that specialists from various fields have been appointed including social, cultural and heritage, acoustics, marine ecology and fisheries to assess how the environment will be impacted by the survey and associated activities. It was explained that the purpose of the survey is to understand the geological composition of the seabed within the application area.
c.	**IAP2 (Veronica from Bengwela Fishing)** Is it the first time this type of survey is being done? **Andiswa Xuma** Ms Xuma explained that it is the first time that TGS is doing this application in the specific application area, however another applicant (Searcher) has applied for a reconnaissance permit in the similar application area. There was a previous permit issued to Searcher that was appealed by the public and thus the permit lapsed before the survey could commence.

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EIMS

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d.	**IAP2 (Veronica from Benguela Fishing)** Will this survey cause dying of fish, penguins and whales which could be washed up to the shore as this has happened in previous years and the cause was unknown. How will they able to observe these marine animals in the ocean? **Andiswe Xuma** Ms Xuma explained that if the applicant is granted the reconnaissance permit, they will do the 3D seismic survey. As explained by Michelle, MMOs and PAMOs are usually appointed on the survey vessels to monitor the marine animals visually and acoustically and if any are detected within 500 m of the vessel, the survey is paused until the animal has cleared the area. This is a mitigation measure used to minimize the negative impact of survey activity, as a result the survey takes longer due to the stoppages.
e.	**IAP2 (Veronica from Benguela Fishing)** Is this a oil and gas project? Will this survey affect young children? **Andiswe Xuma** Ms Xuma explained that TGS will be conducting the survey in order to determine if there are oil and gas reserves in the ocean at the specified application area. It was explained that the survey will be done 120km offshore and this it is not anticipate that there will be a physical impact on the coastal properties or onshore. A map of the survey application area was displayed
f.	**IAP2 (Veronica from Benguela Fishing)** What type of studies/training should young children from disadvantages communities take in university in order to work in such surveys?. **GP Kriel** It was explained that the reconnaissance survey is a scientific process which requires specialised jobs which requires skills such as geophysics and geologists. Even FMOs, MMOs and PAMOs require specific training and experience so there may not be many jobs in this phase. Should the presence of significant reserves be confirmed, then there would be stimulus of the economy and more general jobs would be created indirectly through support industries such as clinics, hotels, shops, fuel stations etc. But that assessment can only be done once reserves are quantified, but there is so many things that need to happen before oil/gas production occurs. Ms Xuma further explained that job opportunities are limited in the short term. Careers in this line of work include marine biologists, geologists and ecologists. These are long terms studies that require communities to prepare themselves in anticipation of future requirements of the industry.
g.	**IAP2 (Veronica from Benguela Fishing)** How does this survey link to climate change events such as flooding, storms and other disasters. Will the noise not upset the ocean? **GP Kriel** GP explained that every activity we do has an impact on the environment. The role of EIMS is to quantify that impact for this survey. That is why specialists are appointed to understand the impact on the ocean. The carbon impact is difficult to quantify at this stage because there are many other vessels operating in

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EIMS	MINUTES OF MEETING		
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Item No	Item
	the ocean. Climate change assessments are more applicable at production stage, however assessment of cumulative impacts of all the activities taking place in the vicinity of the application area will be done.
h.	**IAP2 (Veronica from Benguela Fishing)** Why are there few people in attendance when they are missing an opportunity to hear such important information **Andiswa Xuma** EIMS sent out notifications to pre-identified IAPS and distributed invitations to fisherman and people in and around Hout Bay. Newspaper and radio adverts were also published but it is suspected that the main cause for the low turnout is the meeting between PASA and the small-scale fishers in the area which was scheduled at the same time as this public meeting. Similar type of meeting will be held at Sea Point for those who missed today's and all along the West Coast up to Porth Nolloth.
i.	**IAP2 (Veronica from Benguela Fishing)** If oil is discovered, where will it be taken for processing and consumption? Is it processed locally or internationally? **GP Kriel** GP explained that the answer to that is not known at present. There are a few refineries in South Africa. Typically, the oil is brought onshore through a pipeline however the specifics are decided by government and industry players at production stage. Another EIA process would need to be done for that, but those aspects cannot be assessed during this phase of the project.
j.	**IAP2 (Veronica from Benguela Fishing)** Can renewable energy such as solar be considered as an alternative to this type of project? **GP Kriel** GP explained that energy transition to renewables is necessary, however currently South Africa gets their energy mostly from fossil fuels such as coal due to affordability. Getting to 100% renewable will take some time. There are also numerous solar and wind energy projects that add to the energy supply of the country. That's why this type of project is being done because the energy plan is mixed for the short to medium term.
4.	**General** GP thanked everyone for attending and requested that IAPs must please advise if there's anyone who should be consulted or notified during this process..
5.	**Closure** The meeting was closed at 18:05. Two local fisherman approached the meeting venue after it had been closed and explained that they could attend because they were in another meeting regarding coexistance of oil/gas with the fishing industry.

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APPENDICES

1. Attendance Register
2. Presentation

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EIMS	MINUTES OF MEETING		
EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

MEETING DETAILS

Meeting	1520 Pre-application Consultation Public Meeting		
Meeting Venue	Life Conference Centre (Three Anchor Bay)	Date	2022/08/30
		Time	16h00-18h00

A Public Meeting was scheduled during the pre-application phase with the Interested and Affected Parties (I&APs). The aim of the meeting was to capture the initial concerns from the members of the public and key I&APs. During the public meeting which took place between 16h00 and 18h00, a presentation of the project description, preliminary impact assessment, project team and project timeframes was delivered to all attendees of the meeting by Environmental Impact Management Services (EIMS) Pty (Ltd). The presentation was delivered by Mr GP Kriel from EIMS in English, with Andiswe Xuma available to translation to isiXhosa where required. SEICHE delivered a presentation on the environmental mitigation carried out during seismic surveys in terms of the Marine Mammal Observer (MMO) and Fishing Liaison Officer (FLO) in English. The presentation was delivered by Michelle Rosch. After the presentations were delivered, a question-and-answer session was opened where attendees asked questions or expressed their comments regarding the project. The presentation and attendance register have been attached as an appendix to this document.

AGENDA

Item
1. **Opening and welcome** GP welcomed all in attendance and thanked them for attending. Attendees were informed that if they have specific language preferences other than English then this would be accommodated. General ground rules of the meeting were highlighted and the difference between the Searcher and TGS Application area explained. All attended were requested to complete and sign the attendance register.
2. ***EIMS Presentation (Attached)*** a. **Project Description** b. **Introducing the project team** c. **Legal Application Process** d. **Public Participation** e. **Impact Assessment** f. **Project Contact Details** g. **Presentation from SEICHE**
3. ***Questions and Answers*** The audience were invited to ask questions in any language of preference including English, Afrikaans and isiXhosa.

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EIMS	MINUTES OF MEETING		
EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

NOTULE/ *MINUTES*

Item No	Item
1.	*All attendees were requested to sign the attendance register as they entered. Presentations from EIMS and SEACHE of the project description, application process and environmental mitigations during seismic survey were delivered as per the agenda above to the meeting attendees. It was indicated that the meeting would be recorded for the purposes of accurate minute taking. Background information Documents (in English, Afrikaans and Isikhosa), comments forms, registration, information handouts and attendance registers, were made available at the meeting.* *The attendees were encouraged to submit their comments and concerns through filling in the comment forms provided or by submitting comments to the project email address provided. It was noted that all attendees who have provided their contact details would be registered by default on the I&AP database maintained by EIMS. Following the presentations, the floor was opened for a discussion and the attendees were encouraged to bring up any questions or concerns they had about the project.*
2.	**Questions and Answers**
a.	**IAP1 -Chris Harmer (ADR Fishing)** *Mr Harmer asked about the overlap of Searcher and TGS application areas and whether there would be two separate surveys conducted.* **GP Kriel** As far as EIMS understands, there will only be one survey in the overlapping area. Possibly for the areas outside the overlap there additional survey would be required because the TGS survey area is bigger.
b.	**IAP1 -Chris Harmer (ADR Fishing)** Chris Harmer asked what time of the year would the survey potentially take place. **GP Kriel** GP stated that the timing of the survey is still being considered, taking into account several factors such as migration routes and other logistics of the site. Typically, the season that would look at is around December to March/April. **IAP1 -Chris Harmer (ADR Fishing)** In the fishing industry, it is also seasonal. What is the procedure to lodge our concern as a tuna fishing industry that the high seas is during December to April as well. **GP Kriel** Well you can start by send that concern to us as the Environmental Consultants, obviously there are some scheduling and location options that can be considered to see if there's a way for the survey and the fishing operations can take place at the same time. The surv will not be done across the whole application area at the same time, so a specific area might be targeted for a certain period. So start by send that concern to us, then we will forward it to TGS, they can look at it and provide feedback. **IAP1 -Chris Harmer (ADR Fishing)** The December to April period that has been indicated, is that based on mammal migration at the moment? What's setting that, is it weather or migration.

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	GP Kriel Yes, its based on usual migrations and other factors including the best time to go out to do survey. **IAP1 -Chris Hamner (ADR Fishing)** So are you saying theres a low possibility of a May to September period for the survey? **GP Kriel** Yes, typically they would do the survey between December to April. However, we will have a look, our specialists will also take a look at the actual migration routes of the various species and fishing that happens. Once we have a clear picture of that, we'll put that in the Basic Assessment Report for review. **IAP1 -Chris Hamner (ADR Fishing)** December to March works best for the Fishing industry, im aware of some other pelagic fishers that fish off the West Coast, thats the biggest there. Then there's the hake trawl and tuna fisheries and December-Jan-Feb are pretty much quieter months of the year. So if that was possible, it would offer these businesses, if the industry were to put up any resistance.
c.	**IAP2- Liz McDaid (Green Connection)** I have alot of questions, I dont know who else wants to ask questions but my question is who commissioned TGS. **GP Kriel** We are not sure about that. **IAP2- Liz McDaid (Green Connection)** Who owns TGS, it sounds like Total something something. **GP Kriel** Again, I'm not 100% sure who TGS is owned by but as far as we understand they are a geophysical company, they do surveys not just for the oil and gas industry but wind and offshore wind projects. **IAP2- Liz McDaid (Green Connection)** So can we ask for their biography to be included in the report, like who they are etc. **GP Kriel** Yes, they are an international company who work all around the world, so we can include that. **IAP2- Liz McDaid (Green Connection)** Climate change is not mentioned in the BID, why not? **GP Kriel** At this stage, the climate change issue we recognise that would be a bigger thing to consider during the production phase of the project. We can't really quantify the climate change impact because we don't know what the resources isand how much of that would be extracted. So I think for us to assess that right now as part of the reconnaissance is not really accurate.

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	IAP2- Liz McDaid (Green Connection) My other question is needs and desirability, which acts as an indication of climate change but on what basis, presumably you do have a needs and desirability motivation. **GP Kriel** Yes,we are going to have a section designed according to the needs and desirability guidlines , we'll havedetailed table for needs and desirability where we will assess different policies and documents that motivate for it. There's the Integrated Resource Plan that says that we need to identify potential resources then there's climate change agreements that we have made as a country.
d.	**IAP2- Liz McDaid (Green Connection)** Peer Review, the studies that you have done, we know that there are serious concerns about the consultants that you have appointed, so we will obviously put in objections. They are facing allegations of bias, but what I want to know is will you do independent peer reviews? Will you allow civil society to put forward peer reviews of the studies? **GP Kriel** At the moment we haven't put that in, but thats something we can have a look at. We obviously know that the information that goes into the reports will be made available to everyone for review. **IAP2- Liz McDaid (Green Connection)** Can we have the terms of reference of the specialist studies now? **GP Kriel** I'll have to get back to you on that, but all the reports will have a specified terms of reference included in them. **IAP2- Liz McDaid (Green Connection)** Will you pecify the terms of reference yourself? Youre asking us to comment at this stage and we would want to comment on the terms of reference. Last time we asked that question, the company said sorry talk to our lawyers. **GP Kriel** Alright, we can take a look at that. Yes, I think terms of reference should be open information .
e.	**IAP2- Liz McDaid (Green Connection)** You have explained your community engagement process, but what I wanted to understand is what lesson are you taking from the court cases? **GP Kriel** What we've learnt is that there was probably insufficient consultation especially with indigenous leaders. So we have Wouter and the Social impact specialists having a look at that. We realize that the social aspect was maybe looked at in passing instead of appreciating a detailed look at that. So we are trying to have a better look at the social component, the cultural heritage impact to see what the community members are saying. We are trying to make contact with as many people as possible, meeting and speaking with traditional leaders because that is important. Similarly with the fishing communities, we are trying to engage with them as much as possible.

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EIMS

MINUTES OF MEETING

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Item No	Item
f.	**IAP2- Liz McDaid (Green Connection)** Can I just come back to this issue of the overlap, the Searcher process is probably one week ahead. Are you saying that these two companies are running the same seismic survey over what looks like 70% of the same area. Or are you saying that Searcher is going to stick to the yellow block and TGS will stick to the areas outside of the Searcher application area (brown block). How does it actually work because presumably someone has permission, and in my mind thats the same owners of those blocks that commission two separate companies, can you explain? **GP Kriel** It's probably a case of both TGS and Search trying to position themselves to be able to do those surveys but then who gets the contact to do the surveys is not known. **IAP2- Liz McDaid (Green Connection)** What I'm trying to understand is if the guy who owns the block has to give permission, do they have to apply or are Searcher and TGS applying on their own. **GP Kriel** Searcher and TGS are applying on their own, but that's just reconnaissance / 3D Seismics. **IAP2- Liz McDaid (Green Connection)** So PASA can allow anybody to come into the sea to do seismic surveys without any permission from the block owners? **GP Kriel** Yes, so the license block holders would have to give their reports and to the application they would need to give permission as far as I understand. **IAP2- Liz McDaid (Green Connection)** So the license block owners are giving permission to two companies to operate in the same area **GP Kriel** Well they wont have permission to operate concurrently, its not going to happen at the same time.
g.	**IAP2- Liz McDaid (Green Connection)** Okay so now this is where I want to get to the cumulative decision making, presmably youre going to have to look at the worst case scenario they do get permits to operate at the same time. **GP Kriel** Yes we are going to look at that, obviously where the areas are overlapping, there the cumulative impacts wont be assessed, but only in the areas outside the overlap. **IAP2- Liz McDaid (Green Connection)** But thats what I dont understand, whats to stop both companies getting the rights to do the survey in the overlap area at the same time because there's only a short window. **GP Kriel** Yes , they could but they are not going to be doing that. Because it depends on whoever comissions the survey. GP requested Micheal to give further inputs.

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TGS

EIMS | Environmental Impact Management Services

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EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

Item No	Item
	Micheal (TGS) There will not be two overlapping surveys, there will be one survey shot in the area whether it be by Searcher or TGS. **IAP2- Liz McDaid (Green Connection)** So how do you know that? **Micheal (TGS)** Because usualy the validity is over a financial year
h.	**IAP 3- Kim Day (Birdlife)** So can I just clarify this, so TGS and Searcher are both vying for the same prospecting contract. So it is a hypothetical situation which will only come into effect depending on which company gets permission. So why are we here? Is this something that is actually going ahead or are we here on a hypothetical thing that if you get permission before Searcher does, then TGS will get the contract. **Micheal (TGS)** Yes, hypothetically. **IAP 3- Kim Day (Birdlife)** I have a problem with that because it is not clear at all the BID. That is something that has not been transparently communicated in any way. This is an incredibly confusing situation, we are here now as part of a competitive bid for this contract. Now why is that not put on the table? It needs to be transparent, you cant even tell us who owns TGS, whose paying your fees. **GP Kriel** The client is TGS, EIMS is working for them, they commissioned the study. Similarly to the Searcher, they commissioned the study. As to who their client are, that we do not know. **IAP1 -Chris Harmer (ADR Fishing)** Can I ask everyone to identify themselves, I think you made that point in the beginning, the gentleman in the back I don't know him. **Micheal (TGS)** Yes , I am Mike Fayard, I work for TGS in the U.S. TGS is a wholly publicly trading company . **IAP 3- Kim Day (Birdlife)** Sir who are you doing the survey on behalf of? **Micheal (TGS)** TGS hasn't been commissioned by anyone to do the survey, we are applying for a permit over a prospective area. If the permit is issued, then we will look at who basically would fund the survey.
i.	**IAP2- Liz McDaid (Green Connection)**

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EIMS	MINUTES OF MEETING		
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Item No	Item
	Ijust want to understand something the, can I ask directly. When you applied to PASA,or have tou not applied, didnt you have to get permission of the people who own those blocks? **GP Kriel** The reconnaissance permit application has been submitted but the environmental authorisation (EA) application has not. **IAP2- Liz McDaid (Green Connection)** But for the re connaissance permit, you didnt have to get permission from the people who own those blocks? **Micheal (TGS)** Not to apply for a permit, as far as I understand. **IAP2- Liz McDaid (Green Connection)** And PASA accepts that? **GP Kriel** I can revert to you on that, I dont know the logistics of the reconnaissance permit application, ours was just to do the EA application
j.	**IAP 8- Kim Dey (Birdlife)** So TGS only does reconnaissance, it doesnt do exploration? So at that point the permit application would be awarded to a different company. **GP Kriel** So remember they are a geophysical company, they would get data and if someone wants to utilize that data they can but that and they use that for where the would want to drill etc. An exploration company would do that **IAP2- Liz McDaid (Green Connection)** So I just want to be clear, that as we stand in this room, it seems that a hundred companies could arrive and apply for the same area to do the seismic survey. **GP Kriel** Yes, unfortunately, it works like that with recolnnaissance. So for recolnnaissance,, you can have overlapping area but for exploration and production you cant. **IAP2- Liz McDaid (Green Connection)** So if everybody can apply, what is to stop everyone being given the right to do it? Why are you letting 100 people apply, if youre only in the end going to giver the permit to one person or can they all get permesion? **GP Kriel** They can theoretically get permission, but whether they would want to spend all that money if noone is going to buy that data from them. It would be a financial decision they would have to make. **IAP2- Liz McDaid (Green Connection)**

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EIMS Ref	1520	Project Name	TGS RECONNAISSANCE 6A

Item No	Item
	Yeah, they can dot it, well these guys are doing it even though Searcher has applied for the area. TGS thinks they have a going chance.I'm assuming youve got clients sitting in the wings who are saying go do the survey and come back to us with the results. **Micheal (TGS)** Yes, there's always whoever runs the exploration blocks. Most countries in the world now are coming into an area and loooking at having 5 companies applying for a permit to do the survey but one company is gonna end up with the permit, not all of them. Whoever gets that does the survey, you can then cooperate with the company that , whether thats impact or Searcher, less environmental impact. Once the permit and EA are issued, it becomes a point okay we got this and the timeframe the survey needs to be looked at and who owns the block, does it make sense economically for TGS to sell the data or buying. Alot of it is based on such, may not have anything to do with the geology or the profit of oil/gas here. Some of it may be across the atlantic region, or in South America, where they look at the geological basins are tied together and they look at those areas and say well theres lots of prospecting activity here based on or other areas in the world and say, is there interest? But we wont be shooting surveys on top of each othare, if anything it can come down to apoint of cooperation.
k.	**IAP 3- Kim Day (Birdlife)** I do totally understand that, its just that the meeting must be called under much clearer pretences and that I just feel, here youre sitting in front of an audience who is informed but you are taking this up the coast to talk to community leaders and to local fishermen where have to clearly explain this. I also feel that, we also need to point out that these application areas dooverlap with existing oil/gas concessions. As far as I can see, they overlap with Total, PetroSA, Sasigen, Wessacor, so those companies, there are concessions. So whose concession do those overlap? **GP Kriel** Basically all those license holders that you mentioned, so its actually the area. **IAP 3- Kim Day (Birdlife)** Do the concession owners know of it? **GP Kriel** Yes, we have included them as I&Aps in our database, I can give that information from the top of my head right now. **IAP 3- Kim Day (Birdlife)** Can we have that information on a map in your presentation/report, its fundemental information. We'd like to see where the prospecting/reconnaissance area overlap with the oil/gas company concession areas. **GP Kriel** Yes, we'll make sure that is included in the Basic Assessment Report and if possible we'll also include that in our presentations going forward. **IAP 3- Kim Day (Birdlife)**

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EIMS	MINUTES OF MEETING		
EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

Item No	Item
	I think transparency is the key word, we have to know whats going on here, this is exactly why things get interdicted. Without that transparency, we cannot begin to comment on what the possible impacts will be. **IAP2- Liz McDaid (Green Connection)** Yes, there's no meaningful consultation without transparency, its also important to explain how it works, the economics of it, as Micheal explained, that should all be in the BID document.
1.	**MP2- Liz McDaid (Green Connection)** Now I want to comment on the monitoring, obviously the marine ecologist will make comment, for example the Searcher and Shell cases, there were some very key issues around the failures of environmental monitoring, so do have answers in terms of exactly how will that be fixed? **GP Kriel** We could ask the question and get back to you. **IAP2- Liz McDaid (Green Connection)** So the good thing is that infrared camera, but you said could, not will. **Michelle (Seiche)** Yes, because we didn't provide environmental services for those projects for Shell and Searcher. The camera is part of Seiche equipment as well as acoustic monitoring equipment/ software and hydrophone are used worldwide to increase detection and support for the guys to monitor visually and acoustically on board. Thats all within our parameters, not necessarily other companies, it is hired out to other companies who would like to use it, I think its mandatory in the U.S, alot of the thermal imaging cameras are used there alot. **IAP2- Liz McDaid (Green Connection)** So can I just clarify, you guys are appointed to do the monitoring. So you will have or wont have thermal imaging? What is your job now? **Michelle (Seiche)** Yes, we will have thermal cameras if we are part of the survey. **GP Kriel** Her job is to provide context and explain some of the mitigation measures. **IAP2- Liz McDaid (Green Connection)** So you aren't contracted to be on the ship right now? **Michelle (Seiche)** No, we still have to submit proposals and pricing, along with other companies doing exactly the same thing. **IAP2- Liz McDaid (Green Connection)** Okay now the issue is that you present, like the really best case stuff but you didnt explain that you guys are not necessarily going to be on the boat and that stuff might not be on the boat, again there's a lack of transparency.

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EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

MINUTES OF MEETING

EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

Item No	Item
	GP Kriel I think the idea is just to provide context as to how the mitigation measures would be implemented on the boat. **IAP2- Liz McDaid (Green Connection)** Except that nobody else is probably going to have that thermal imaging camera. **Michelle (Seiche)** We do hire them out to the rest of the companies, so for us its pretty much there but we do hire them to other companies in the U.S. No matter who gets the contract at the end of the day, that additional tool can be used day and night. So at night time, the argument is that you can't hear the dolphins because they are not vocalizing. Then you have camera and actual monitoring operators that are watching those , so the team is a bit bigger, you might have two MMO's, two PAM's and two camer imaging monitors etc so that we see everything. So we see it as additional support. There' also human error, during the day we might have somebody in the forecourt and a dolphin or whale has just passed 300m behind the vessel, again by having the 360 degrees camera and increasing the teames, it increases the probability of detection **IAP2- Liz McDaid (Green Connection)** So for me, I want to make sure that all of those mitigations, including the full crew are included in the Basic Assessment. The other issue is that those binoculars only pick up the mammals, what about the turtles and fish, plankton and all the other things that were mentioned in the scientific submissions to the court cases. We want to see those issues addressed in the assessment otherwise its meaningless. **Michelle (Seiche)** Yes, well I used to work offshore around 2009, and in those days I was the only one. But looking at South Africa today, and how my teams on board, the PAM operators, they really do have authority and independence. We QC the data ourselves before it goes to the client and from therethe reports go to PASA and they do look at the reports on a daily basis.Over the years, they environmental monitoring has increased and the officers rotate shifts so that they are not fatigued, they get a 12 hour rest and 12 hour work period.
m.	**IAP2- Liz McDaid (Green Connection)** So then this is my other question, if you are independent and if you want to convince the public that this is real. Then why can those daily MMO reports not be published your company website. These guys are going to be onboard and they've got data which is extremely useful in that it would give everybody peace of mind that there isnt any damage happening and that they are stopping the boat as required. So why cant the public have access to that information,so that we know things are being done right. Thats not asking for the Sonar data but I'm assuming TGS wouldn't have a problem with the monitoring data being made public. **GP Kriel** We are just doing the EIA at the moment, would you want to see previous MMO reports? **Michael (TGS)** I think it would be better for us to submit the data PASA and for them to publish it. **IAP2- Liz McDaid (Green Connection)**

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EIMS

MINUTES OF MEETING

EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

Item No	Item
	No, you are not going to get away with that. I want to know why its not possible because that the agency thats promoting oil and gas, we are saying why cant it be made public at the same time. **GP Kriel** We'll just have to see the logistics around it and see if it would be possible. On face value , it probably doesnt make sense. But we will have a look. **IAP2- Liz McDaid (Green Connection)** So, I am a member of the public and you are supposed to be an indepent EIA practioner, why are you not taking this as a request that you want to push rather than something that youre going to just ask them. **GP Kriel** Like I said, I agree with you at face value and its probably a good idea, but I'm not 100% sure what the logistics would be post EIA and the reporting requirements, whether there would be something else preventing us from doing that so I'm just make sure about that. **IAP2- Liz McDaid (Green Connection)** So the other thing is , if you have the thermal imaging camera then its safe to run at night? **Michelle (Sekibo)** Yes, you can do the survey at night because the thermal imaging allows visually monitor at night. The software has the automatic 500m mitigation zone which the area of biggest concern but it does look beyond it as far as possible. **IAP2- Liz McDaid (Green Connection)** Thats my other question, this 500m zone is very arbitary, science does show that the sound carries much further, so how will that be addressed. **GP Kriel** We are looking at the acoustic assessment as well, so we can adjust that zone based on the results of that assessment. That will feed back into the ecology report on the noise anf mitigation measures proposed.
e.	**IAP1 -Chris Harmer (ADR Fishing)** From your background information here, the location points are different to the location points on the map. So its a bit difficult to understand what is correct. **GP Kriel** Apologies for that, we will check that and update appropriately. The actual information on the map is the correct one,apologies for the error. **IAP2- Liz McDaid (Green Connection)** You're pushing everything to the Basic Assessment, but the point of us being here is so that we can review and comment on things before that. You dont have terms of reference for the specialists, similarly the BID needs updating, that shouldnt have to wait for the BAR. **IAP 3- Kim Day (Birdlife)**

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EIMS	MINUTES OF MEETING		
EIMS Ref	1520	Project Name	TGS RECONNAISSANCE 8A

Item No	Item
	Infact, on this issue, its really important because we actually wrote and said could we please have the shapefile of the application area, we have not been responded to. Failing which we would need to plot the application area ourselves, if we could please just get that response. Obviously there's quite a few iterations that have to happen here, we've heard best practice environmental monitoring consultancy but as you said you still have to bid for the job. If Searcher gets the contract, are they appointing you or are they going to appoint somebody else, we dont really know. The monitoring equipment sounds like a really expensive product so they may go for somebody cheaper. So it becomes difficult to be able to say, unless we see the things you've included in a Best Practice document that everyone has to conform to for that particular contract. **GP Kriel** In terms of the equipment that was mentioned, we can have a look at writing that into the EMP as a spec which then becomes the terms of reference for whoever gets appointed. **Michelle (Seiche)** I have witnessed in Namibia a couple of years ago, where if a survey was taking place in December - January, that thethermal imaging cameras had to be an additional tool to cover the later migration of the humpback whales in that time of the year but if the survey was February to May, it wasnt necessarily required. **Andiswa Xuma** The email requesting a shapefile/kml of the application area was noted and responded to in the morning, apologies for the delayed response. Directions to the meeting venue were also sent to Ms McDaid.
a.	**IAP2- Liz McDaid (Green Connection)** What happens when there's bad whether during the survey? The thermal imaging might work but nothing else especially when there's fog which is common. **Michelle (Seiche)** The PAM operators and MMOs would be doing the monitoring, especially focussing on the PAM **IAP2- Liz McDaid (Green Connection)** Can you in your recommendations maybe make something for when its really high risk for marine fauna and the survey shouldnt happen at all? For particular whether conditions, the survey should be stopped. **Michelle (Seiche)** Yes, they watch the weather and stop the survey according to the conditions or move in a differentdirection away from the bad weather. **IAP3- Kim Day (Birdlife)** It would be quite good to see the marine cables on a map as well, just so we understand the extent or type of material it is made of. **GP Kriel** Yes we can include that in the BAR.
a.	**IAP4- Elaine Mills**

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EIMS | Environmental Impact Management Services

MINUTES OF MEETING

EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

Item No	Item
	Sorry, I arrived late and you may have answered this question already. The Searcher application area seems quite similar to the TGS area, I didnt realize that there is a bidding process still underway, I actually thought that youve already been contracted and I understand why there is an overlap. So can you please just explain it again, because that was my main question. **GP Kriel** So there's two companies trying to position themselves to be able to do that survey for the companies that want that information So TGS and Searcher are applying for reconnaissance permits so it is two separate EIA processes. The TGS area is slightly longer that the Searcher area so we are going to be looking at the EIA for both projects. **IAP2- Liz McDaid (Green Connection)** Why didnt you do one EIA for both projects, save time and cost instead of us having to come to the meetings twice. **GP Kriel** The clients wanted the assessments to be done separately. **IAP4- Elaine Mills** They would be doing the seismic survey on behalf of a kruger company, is that correct? **GP Kriel** Its a multiclient survey, so basically they would survey that they applied for then sell that information to whoever is interested. Theres various license holders in that application area, these will be indicated on a map. **IAP2- Liz McDaid (Green Connection)** Can we get a copy of the reconnaissance application from PASA? **GP Kriel** I'm not 100% sure, I'll have to get back to you on that one.
4	**IAP2- Liz McDaid (Green Connection)** There's basically no jobs here. **GP Kriel** Yes, we are not promising the public jobs at this stage, we understand the skills required are very technical. **IAP2- Liz McDaid (Green Connection)** How do they detect baby turtles? **Michelle (Seiche)** What I can say is that the guys on board ensure that theres no additional light and night time other than what is required for health and safety. All crew on board get training on the Environmental permit conditions and EMP. The small fish and baby turtles are really difficult to spot, but anything that is sighted gets recorded, even jellyfish.

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EIMS

MINUTES OF MEETING

EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

Item No	Item
	Michael (TGS) Its in our best interest to ensure that there are no non-conformances in a project, we shut down when we need to and communicating with the teams on board so that the response is inediate. In other places like Brazil, you get fined for every non-conformance so we try to ensure that international best practice is followed. **IAP2- Liz McDaid (Green Connection)** I just also want to say thank you for being in this meeting. **IAP3- Kim Day (Birdlife)** The application area seems small compared to all the other concession areas, how tempting is it for you to receive requests from other people to do more surveys? **Michael (TGS)** That block is approximately 52000 square kilometers, its massive. I think this is the only area we have interest in surveying. The chances that we will survey the entire area are pretty slim.
4.	**General** GP thanked everyone for attending and requested that IAPs must please advise if there's anyone who should be consulted or notified during this process.
5.	**Closure** The meeting was closed at 18:00.

APPENDICES

1.	**Attendance Register**
2.	**Presentation**

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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*	
EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

VERADERING BESONDERHEDE/ *MEETING DETAILS*

Vergadering/ *Meeting*	1810 Pre-application Consultation Public Meeting		
Vergadering Plek/ *Meeting Venue*	Hoedlies Bay Hotel: Conference Venue, Saldanha Bay	Date	2022/08/31
		Time	16h00-18h00

Teks in *italics* is uit die Afrikaanse teks vertaal. *Text in italics has been translated from the Afrikaans text.*

'n Openbare vergadering is geskeduleer tydens die vooraansoekfase met die Belanghebbende en Geaffekteerde Partye (I&APs). Die doel van die vergadering was om die aanvanklike bekommernisse van die lede van die publiek en belangrike I&APs vas te lê. Tydens die openbare vergadering wat tussen 16:00 en 18:00 plaasgevind het, is 'n aanbieding van die projekbeskrywing, voorlopige impakassessering, projekspan en projektydraamwerke aan alle deelnemers van die vergadering deur Environmental Impact Management Services (EIMS) Pty (Ltd) gelewer. 'n Aanbieding is deur mnr GP Kriel van EIMS in Afrikaans gelewer. SEICHE het 'n aanbieding gelewer oor die omgewingsversagting wat tydens seismiese opnames in terme van die Marine Soogdier Waarnemer (MMO) en Visvlakteamptes (FLO) in Afrikaans uitgevoer is. Die aanbieding is deur mnr Rudian Bally gelewer. Nadat die aanbiedings afgelewer is, is 'n vraag- en antwoord sessie geopen waar deelnemers vrae gevra het of hul kommentaar oor die projek uitgespreek het. Die bywoningsregister is aangeheg as 'n aanhangsel tot hierdie dokument.

A Public Meeting was scheduled during the pre-application phase with the Interested and Affected Parties (I&APs). The aim of the meeting was to capture the initial concerns from the members of the public and key I&APs. During the public meeting which took place between 16h00 and 18h00, a presentation of the project description, preliminary impact assessment, project team and project timeframes was delivered to all attendees of the meeting by Environmental Impact Management Services (EIMS) Pty (Ltd). A presentation was delivered by Mr GP Kriel from EIMS in Afrikaans. SEICHE delivered a presentation on the environmental mitigation carried out during seismic surveys in terms of the Marine Mammal Observer (MMO) and Fishing Liaison Officer (FLO) in Afrikaans. The presentation was delivered by Mr Rudian Bally. After the presentations were delivered, a question and answer session was opened where attendees asked questions or expressed their comments regarding the project. The attendance register has been attached as an appendix to this document.

AGENDA

Item
1. **EIMS Aanbieding/ *EIMS Presentation***
a. **Bekendstelling van die projekspan/ *Introducing the project team***
b. **Projekbeskrywing/ *Project Description***
c. **Regsaansoekproses/ *Legal Application Process***
d. **Publieke Deelname/ *Public Participation***
e. **Impakbepaling/ *Impact Assessment***
f. **Projek Kontak Besonderhede/ *Project Contact Details***
g. **Aanbieding van SEICHE/ *Presentation from SEICHE***
2. **Vraag en Antwoord/ *Questions and Answers***

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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*
EIMS Verw./ *EIMS Ref* 1520	Projek Naam/ TGS VERKENNING BA/ *TGS RECONNAISSANCE BA* *Project Name*

NOTULE/ *MINUTES*

Item No	Item
1.	Alle deelnemers is versoek om die bywoningsregister te onderteken soos hulle ingeskryf het. Aanbiedings van EIMS en SEICHE van die projekbeskrywing, aansoekproses en omgewingsversagtings tydens seismiese opname is gelewer volgens die agenda hierbo aan die vergaderinggangers. Daar is aangedui dat die vergadering opgeneem sou word vir die doeleindes van akkurate notule neem. Agtergrondinligtingsdokumente (in Engels, Afrikaans en isiXhosa), kommentaarvorms, registrasie, inligtingsuitdeelstukke en bywoningsregisters is by die vergadering beskikbaar gestel. Die deelnemers is aangemoedig om hul kommentaar en bekommernisse in te dien deur die kommentaarvorms in te vul wat verskaf word of deur kommentaar in te dien by die projek-e-posadres wat verskaf is. Daar is opgemerk dat alle deelnemers wat hul kontakbesonderhede verskaf het, by verstek geregistreer sal word op die I&AP-databasis wat deur EIMS gehandhaaf word. Na aanleiding van die aanbiedings is die vloer oopgemaak vir 'n bespreking en die deelnemers is aangemoedig om enige vrae of bekommernisse wat hulle oor die projek gehad het, op te stel. *All attendees were requested to sign the attendance register as they entered. Presentations from EIMS and SEICHE of the project description, application process and environmental mitigations during seismic survey were delivered as per the agenda above to the meeting attendees. It was indicated that the meeting would be recorded for the purposes of accurate minute taking. Background Information Documents (in English, Afrikaans and isiXhosa), comments forms, registration, information handouts and attendance registers, were made available at the meeting.* *The attendees were encouraged to submit their comments and concerns through filling in the comment forms provided or by submitting comments to the project email address provided. It was noted that all attendees who have provided their contact details would be registered by default on the I&AP database maintained by EIMS. Following the presentations, the floor was opened for a discussion and the attendees were encouraged to bring up any questions or concerns they had about the project.*
2.	Vrae en Antwoord/ *Questions and Answers*
a.	Selene Smith Ek het nou gewonder, moet ek vrae vra, moet ek praat, moet ek iets sê? Maar soos ek nou hier praat, ek is baie emosioneel, want dit lyk vir my al sê ons ook wat. In die eerste plek is ek teleurgestel dat vissers nie hulle teenwoordigheid toon nie, dat vissers nie kom en kom kyk waarin is ons gedompel nie. Ek doen navorsing op my eie en ek kyk waar die goed plaasgevind het, wat het daar al gebeur. En ek kyk na klomp goed. Ek kyk na klomp dinge. Die mooiste goed word vir ons hier gesê. In die eerste plek is ek bekommerd Ons het begin met Karpowerships. Hulle het meetings met gehou met die politicians Die politicians stel hulleself sommer voor. Hulle is die community-mense wat na die community luister. Ek gaan vir jou sê van Hervandaan af tot daar onder in Noord Kaap is vissers. Vissers is by die duisende wat afhanklik is van die see. Nou praat ek nie eens van die gemaakte vissers nie. Ek praat van die inheemse vissers hier, die tradisionele vissers, die vissers wat afhanklik is van die see, wat hulle bronne elke dag uit die see uit moet haal. Wat my baie bekommer, is dat Piet, Paul en Klaas kom nou en doen aansoek vir 'n permit. In die eerste plek was ons in die hof oor Searcher. Toe is die klag onwettig op die waters. Nou hoe gaan ons hierdie goed kan voorkom? Watter ooreenkoms ... Hoe weet ons tussen die twee maatskappye, Searcher en die ander maatskappy, hulle twee werk nie saam nie? Hoe gaan ons dit ooit weet? Baie mooi goed word vir ons afgespreel. Baie vissers ... Beloftes was al vir hulle gemaak oor baie goed. "Ons gaan dit vir julle gee, ons gaan daardie ..." Hier kan Government nie eens vir ons 'n reg gee nie. Ons mense moet dae en maande wag voor hulle 'n permit kan kry, en hulle kan nie see toe gaan nie, alhoewel hulle is vir

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EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	jare afhanklik, en kan die mense om see toe te gaan, kan hulle nie gaan nie, want hulle permit is nie reg nie. Hier kom ander maatskappye. Ek wil my hart eintlik nou uitpraat. Inons landgaan derduisende billion Rande gaan verlore en jy kry nooit die antwoord waarmee is dit op pad nie. Is hierdie 'n gretigheid in ons land waar ons leiers wil hê, maak nie saak wie kom nie, solank hulle geld in die land kan stort dat daar al daardie biljoene wat verdwyn het dat hulle dit nie weet kan in nie. Die vissers het gesê in Port Alfred. "Nee, nee, nee." Die vissers het besluit die top ses van Government moet waai en ek wil vanaand net sê ek wil niemand dreig nie. Ek respekteer almal se werk wat hulle doen en almal moet werk, maar wat nou gaan gebeur, al die goed kan julle vir ons wys. Ek het gesê toe die muur hier gebou geword het, toe sê ons vir die mense: "Mense, is dit reg dat die muur ...?" Die muur was nog nie 'n jaar of twee nie, toe het ons erosie in Langebaan. Ons het nou nog nie 'n strand waar ons kan swem nie. Nou nog nie. Klippe lê net so hoog; kinders moet oor daardie klippe val as hulle wil gaan swem. Kinders wat miskien sonder toesig gaan. Mense se huise het op daardie strandwalle verspoel. Mense moet net sulke hoë mure bou wat op die strand bly om daar nog te kan inwoon. Was daar gebruik? Die mense se inheemse kennis. Die mense het geweet dat vis gaan verdwyn. Mense, ek weet nie watse navorsing mense nou nog moet kom by tradisionele vissers nie, want hulle is gebore met dit. Hulle het hier gewoon. Hulle het hier gebly. Ek kan nie verstaan nie dat mense nou nog sê: "Die gaan nie seekry en daardie gaan nie seekry nie." 'n Vis het 'n kop en 'n stert. Hy bly lê nie in 'n walletjie of op 'n hopie nie. 'n Vis beweeg. Vis beweeg all over. Mense moet agter die vis aangaan. Ons het die swakste, soos julle verlede keer gehoor het, die swakste snoekseisoen gehad. In die hof het die judge gesê, die judge het dit gesê dat: "Mense julle moet in ag neem, snoek is 'n tradisie vir Weskus vissers." Snoek kan nie netso verlore gaan nie. Dis die mense se inkomste. Net 'n voorbeeld: 12,5 kg kreef was vir 'n visser gegee. Dit was R2 500 word gewees vir 'n seboom. Nou sê julle vir my waarvan moet ons lewe? Hoekom kom hier permitte landwyd en suid, all over? Ek het al 'n klomp videos gekyk wat in ander lande gebruik, waar die goed plaasgevind het. Wat het daar gebeur? Hoekom is almal doodstil daaroor? Maar die tegnologie van vandag is baie goed. Ons kan lees en ons kan surf en ons kan Google. As ek nie kan Google nie, dan vat ek my kinders om te Google. Maar ons doen die goed om te kyk watter impakte het hierdie goed in ons oseane. Hierdie oseane, mense, rêrigwaar, ek kan net nie ... of die mense dit wil wegwens, maar solank wat ek lewe, sal ek daaroor praat. Hierdie see ... Ons is afhanklik van dit. Ons mense ... Jy kan nie 'n visserman 'n dokter maak nie, maar hulle maak nou dokters vissermanne en predikante is ook vissermanne, en God weet wie is almal vissermanne, maar die regte vissers word benadeel nou al vir jare en vir jare en ons gaan weg tot die bitter einde toe. Ons gaan weg om behoue te bly dat ons kinders ook nog ... ek het nou die dag vir my kind gesê: "Regtigwaar, jou oupa was 'n visserman, jou opagrootjie was 'n visserman." Weet jy ek het een aand, op 'n Vrydagaand, vier familielede het ek verloor op die see. Hoeveel mense van ons lê nie in die water nie? Hulle lyke lê daar. Wil Searcher net kom en kom boor sommer dwarsoor ons voorvaders en mense wat in die water lê? Hoekom kan ons tradisie nie in ag geneem word nie? Hoekom kan ons inheemse kennis nie in ag geneem word nie? Ons tradisie is om te bewe uit die see uit om ons nageslag ... Ons het reëls self gehad voordat DFFE gekom het, voordat almal gekom het. Ek het bakkie in Langebaan en gesê: "Niemand gaan besluit neem namens ons nie." DFFE gaan sit, die Parkeraad gaan sit saam met die vissers en ons gaan besluit hoe wil ons, ons reëls hê, want ons het al die jare toe DFFE nie daar was nie, toe die park nie daar was nie, het ons vissers reëls gehad. Julle gaan nie Sondag see toe nie, of julle gaan nie die naweke nie. Ons moet die bronne kans gee om ook te kan groei. En elke dag, al wat ek nog begeer, is dat vissers by massas moet optree, dat die mense kan sien. Die mense het nou nog nie ... Julle doen nou nog aansoek vir die permit. As ons, ons oë uitvee, is die boot op die water. Dan is dit te laat vir ons om dat nog te praat. Ons wil deel wees van die laaste ding wat gaan plaasvind op hierdie waters. Ek sê vir julle, elke dag kry ons info dit het in hierdie land gebeur, dit het in daardie land gebeur, hoeveel skade was in daardie land aangebring, hoeveel skade ... En as ek sien wat julle wys, raak my siel ontstoke. My hart raak seer om te dink daar gaan niks vir ons kinders oorbly nie. Op die oomblik wil ek dit sê, mense moet dit kan hoor dat

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	ek dit sê, want ek wil nie skaam wees om dit te sê nie. Hier is te veel biljoene Rande verdwyn uit ons land uit, wat in amptenare se sakke sit en nou kan Piet, Paul en Klaas kan nou kom boor in die water. Kyk hoe stil is die water. Kyk hoe mooi is die water. Bitter mooi. Ek sê vir julle begin nou boor en gaan nou aan hier op die waters, julle sal sien hoe sterk ... Die see lewe mense. Die see lewe en die see gaan swaad wees as julle gaan boor in hom, as julle gaan whatever doen in dié seewater. As ek daardie bote sien dan raak ek bekommerd om te dink hier all of a sudden is en Langebaarn het so baie ... wat is die goed se naam? Seals. Orals skeur die mense nette, maar is gewoond in die water. Hulle vra so baie: "Kan julle nie 'n plan maak nie?" Hulle kan vir die mense permitte gee om al die seals uit die water uit te haal dat die mense 'n beter lewe kan hê en meer vis kan ... Die seals vreet al die voëls en die goed op. Daar is nou organisasies wat na die voëls kyk, daar is organisasies wat na die environmental kyk, daar is organisasies wat alles kyk. Daar is organisasies wat nou saam bymekaar gekom het want ons gaan hierdie stryd aansê. En réligwaar mense, enige een kan sê net wat hy wil. Vir visse kan jy sê net wat jy wil. Die vissers is gebore. Hulle het nie bloed in hulle are nie. Seewater is in hulle are. Jy kan hoor hoe sê die vissermanne daar is seewater in hulle hulle are. En 'n visserman is die laagste betaalde mens wat op God se aarde is. Hulle lewe van die hand tot die mond, maar het nog nooit gegaan vir ander werk nie. Hulle wil see wees, want dit is hulle tradisie. En vir tradisie, ons inheemse kinders, ons customary right. Mense, moet dit asseblief nie van ons weg afvat nie, want as ons customary right van ons weg afgeneem word, dan kan ons oorlog verklaar. En ek wil niemand dreig nie. Ek wil sê hoe my hart voel, want ons is vissers, jare. Hoekom moet politicians namens ons besluit? Ons het besluit in Port Alfred ... Hier sit die chief ook. Ons het besluit niemand wat wil kom praat, moet met 'n koning praat of met 'n chief praat nie, Ons praat almal saam, want ons is die visservolk. Die chief gaan nie besluit nie, die king gaan nie besluit nie, niemand gaan besluit nie. Ons gaan almal saam besluit. Dit is wat ons besluit het. En ons gaan volgende maand, gaan ons al die provinsies hier in Saldanha bymekaar hê dat ons weer ons strategy kan uitwerk, want soos mense nou ... die permit, maar daardie tyd moet die permit ingaan en die permit moet daardie tyd ingaan. Ek sê die Minister wat toelaat dat hierdie permitte gegee word vir ander mense, die Minister moet vir verantwoording geroep word. Die Minister kan nie na ons vissers toe kom nie, na ons vissersgemeenskappe wie die meeste geraak word nie. Hulle kan nie na ons toe kom nie. Hulle stuur mense na ons toe. Hier was nou hierdie week 'n hele week 'n konferensie in die Kaap. Wie was genooi? Nie vissers nie. Wie was genooi? Mense wat namens vissers wil gaan praat. Nooit, ook as wat ek lewe en wat ek vanaand hier staan nie ... hoeveelste is vandag? Die 31ste Augustus 2022, wil ek vanaand vir julle sê sdank as wat ek lewe en ek glo God gaan my laat lewe, want ek moet sorg vir my nageslag. My man het al die jare, het nie eens 'n reg gekry nie. Nou, ek het nou 'n reg. Ek kan dit nie eens gebruik nie. Ek het tinders, maar ek het foster kinders maar ek kyk na ander mense se kinders wat sorg vir my gemeenskap, met daardie bietjie geld wat ons uit die see uit kry. So, los ons visse, los ons waters, los ons alles. Gaan boor daar waar die mense wil hê moet geboor word. Maar hoekom wil alle oorsese lande wil nou hier kom boor? Jy kan mos self weet dit is 'n geldmaak storie, want mense wil geld maak om vir ons ... as hier nou die blokkie wat hulle hier uitgesit het ... Mense ek sê vir julle vanaand, die blokkie wat uitgesit is, dit het gebeur in Langebaan. Toe die mense begin werk met TFC, die plase en goed, toe word dit vir ons gesê: "Julle mag nie meer daar vis nie." En as hulle vir ons gesê het: "Jy mag nie meer daar vis nie", dan mag jy nie meer daar vis nie, want dan is dit nou 'n oortreding. Hoekom is dit so baie poaching hier in ons area? Dit het nooit plaasgevind nie, maar jy kan nie die mense kwalik neem nie, want die mense word van die een seewater af weggetoot na die ander seewater toe, want die ontwikkeling kom nou daar en as die ontwikkeling langs die water kom, dan sien daardie mense wat daar langs die water bly, hulle sien daardie stuk water sommer ook. Nou wat moet nou nog van ons afgeval word? Ek is vanaand baie, baie emosioneel. As ek dink ek is 'n vrou. Ek bakkel vir my vissers in Langebaan. Ek is 'n vrou. Ek moet vir hulle bakkei. Ek moet vir hulle sê: "Dit moet gedoen word, daardie moet gedoen word." Ek soek net die viesers se ondersteuning dat ek mense kan sien. Baiekaar dan gaan julle hier weg, dan sê

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	julle: "Ja, daar was net 'n paar mense. Die meeste wat hier gewees het, was ons wat dit aangebied het. Die vissers was nie daar nie." Dan moet die mense mos nou die indruk kry die vissers stel nie belang nie. Maar oral waar julle al gegaan het, wil ek vanaand vir julle die vraag vra: "Was daar al 'n visser wat gesê het, ja, kom met die ontwikkeling?" As 'n visser dit gesê het, dan is dit 'n politician, of gemaak het of hy 'n visser is, maar hy is nie 'n visser nie, baie dankie. *I was wondering now, should I ask questions, should I speak, should I say something? But as I'm talking about here now, I'm very emotional because it seems to me even though we're saying what, too. First of all, I am disappointed that fishermen do not show their presence, that fishermen do not come and see what we are immersed in. I do research on my own and I look where the stuff took place, what has already happened there. And I'm looking at bunch of stuff. I look at a lot of things. The most beautiful things are said to us here. First of all, I'm worried We started with Korporerships. They held meetings first with the politicians The politicians just introduce themselves. They are the community people who listen to the community. I'm going to tell you from here to down there in Northern Cape are fishermen. Fishermen are by the thousands who depend on the sea. Now I'm not even talking about the mode fishermen. I'm talking about the indigenous fishermen here, the traditional fishermen, the fisherman who depend on the sea, who have to take their resources out of the sea every day. What worries me a lot is that Piet, Paul and Klaas are coming now and applying for a permit. First of all, we were in court over Searcher. Then the charge went illegal on the waters. Now how are we going to be able to prevent this stuff? What deal ... How do we know between the two companies, Searcher and the other company, the two of them don't work together? How are we ever going to know that? A lot of nice things are being spun off for us. Many fishermen... Promises had already been made to them about a lot of good. "We're going to give it to you, we're going to give it..." Here, Government cannot even give us a right. Our people have to wait days and months before they can get a permit, and they can't go to sea, even though they've been dependent for years, and know the people to go to sea, they can't go because their permit isn't right. Here come other companies. I actually want to speak my heart out right now. In our country, thousands of billion Rands are lost and you never get the answer to which it is heading. Is this an eagerness in our country where we want leaders, no matter who comes, as long as they can pour money into the country that there are all these billions that have disappeared that they can't put it back in. The fishermen said in Port Alfred, "No, no, no." The fishermen have decided the top six of Government should blow and I just want to say tonight I don't want to threaten anyone. I respect everyone's work that they do and everyone has to work, but what's going to happen now, all that stuff you can show us. I said when the wall got built here, then we said to the people, "Folks, is it right that the wall...?" The wall hasn't been a year or two, then we have erosion in Longeboon. We don't have a beach where we can swim. Not yet. Stones lay just as high; kids have to fall over those pebbles if they want to go swimming. Children who may be going unsupervised. People's homes washed up on those beach walls. People just have to build walls like that that stay on the beach to still live there. Was there use? The people's indigenous knowledge. The people knew that fish were going to disappear. Folks, I don't know what kind of research people have yet to get at traditional fishermen because they were born with it. They lived here. They stayed here. I can't understand people still saying, "It's not going to hurt and that's not going to hurt." A fish has a head and a tail. He doesn't stay lying in a little room or on a pile. A fish moves. Fish move all over. People need to go after the fish. We had the weakest, as you heard last time, the worst pike season in court, the Judge said, the Judge said that: "People you have to consider, pike is a tradition for West Coast fishermen." Pike can't be lost just like that. It's the people's income. Just an example: 12.5 kg of crayfish were given to a fisherman. It was worth R2 500 for a season. Now you're telling me what should we live on? Why come here permits nationwide and south, all over? I've watched a bunch of videos that use in other countries, where the stuff took place. What happened there? Why is everyone dead silent about it? But today's technology is very good. We can read and we can surf and we can Google. If I can't Google, then I take my kids to Google. But we do the stuff to see

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	what impacts this stuff has in our oceans. These oceans, folks, really, I just can't... whether the people wish it away, but as long as I'm alive, I'll talk about it. This sea... We depend on it. Our people... You can't make a fisherman a doctor, but they now make doctors fishermen and ministers are also fishermen, and God knows who are all fishermen, but the real fishermen have been harmed for years and for years now and for years and we're going to fight to the bitter end. We're going to fight to keep our kids from being too... the other day I said to my child, "Really, your grandfather was a fisherman, your great grandfather was a fisherman." You know I last one night, on a Friday night, four family members I lost on the ocean. How many people of ours are not lying in the water? Their bodies lay there. *Does Searcher just want to come and drill all over our ancestors and people lying in the water? Why can't our tradition be taken into account? Why can't our indigenous knowledge be taken into account? Our tradition is to live from the sea out to our descendants... We had rules ourselves before DFFE came, before everyone came I got into a fight in Langebaan and said, "Nobody's going to make a decision on our behalf." DFFE sits down, the Parks Board sits down with the fishermen and we're going to decide how do we want, we want rules, because we have all these years when DFFE wasn't there, when the park wasn't there, we had fishing rules. You don't go to the sea on Sundays, or you don't go on the weekends. We need to give the sources a chance to grow as well. And every day, all I still desire is for fishermen to act at masses, for the people to see. The people haven't yet... You are still applying for the permit. If we wipe our eyes, the boat is on the water. Then it's too late for us to talk that yet. We want to be part of the last thing that's going to take place on these waters. I tell you, every day we get info it happened in this country, it happened in that country, how much damage was done in that country, how much damage... And when I see what you're showing, my soul becomes incensed. My heart aches to think there is nothing left for our children. Right now I want to say it, people need to be able to hear me say it because I don't want to be ashamed to say it. There are too many billions of Rands disappearing from our country, sitting in officials' pockets and now Pict, Pond and Kleos can now come and drill into the water. See how still the water is. See how beautiful the water is. Bitterly beautiful. I tell you guys start drilling now and move on here on the waters now, you'll see how strong... The sea lives people.* *The sea is alive and the sea is going to be angry if you're going to drill into him, if you're going to do whatever in this sea water. When I see those boats then I get worried about thinking here all of a sudden is and Langebaan has so many... What's the good's name? Seals. Everywhere the people tear nets, but are accustomed in the water. They ask so much, "Can't you make a plan?" They can give the people permits to take all the seals out of the water that the people can have a better life and more fish... The seals eat up all the birds and the stuff. There are organizations that look at the birds, there are organizations that look at the environment, there are organizations that watch everything. There are organizations that have come together now because we are going to take up this fight. And truly, folks, anyone can say whatever he wants. For fish, you can say whatever you want. The fishermen were born. They don't have blood in their veins. Sea water is in their veins. You can hear the fishermen saying there is seawater in their veins. And a fisherman is the lowest paid human being on God's earth. They live from hand to mouth, but have never gone for other work. They will be sea, because that is their tradition. And for tradition, our indigenous children, we have a right. Folks, please don't take it away from us, because if we're taken from our way, then we can declare war. And I don't want to threaten anyone. I want to say how my heart feels, because we're fishermen, years. Why should we decide on our behalf? We decided in Port Alfred... Here the Chief also sits. We decided no one who wanted to come and talk should talk to a king or talk to a chief. We all talk together because we are the fishing people. The Chief isn't going to decide, the King isn't going to decide, nobody's going to decide. We're all going to decide together. That's what we decided. And we're going next month, we're going to have all the provinces here in Saldanha together that we can work out our strategy again, because like people now... the permit, but that time the permit has to go in and the permit has to go in that time.*

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	I say the Minister who allows these permits to be given to other people, the Minister must be held to account. The Minister cannot come to our fishermen, to our fishing communities who are most affected. They can't come to us. They send people to us. There has been a conference in the Cape for a whole week this week. Who was invited? Not fishermen. Who was invited? People who want to speak on behalf of fishermen. Never, ever than I'm alive and what I'm standing here tonight... How many are today? The 31st of August 2022, I want to tell you tonight as long as I live and I believe God is going to let me live because I have to take care of my descendants. My husband has all these years, didn't even get a right. Well, I have a right now. I can't even use it. I have kids, but I have foster kids but I look at other people's kids taking care of my community, with that little bit of money we get out of the ocean. So, release our fish, loosen our waters, leave us everything. Go drill there where the people want it to be drilled. But why do all overseas countries want to come and drill here now? You can tell it's a money-making story because people want to make money to tell us... If here now the blocks they put out here... People I tell you tonight, the blocks that were evicted, it happened in Langebaan. When the people started working with TFC, the forms and stuff, then we were told, "You're not allowed to fish there anymore." And if they said to us, "Thou shalt not fish there anymore," then you are no longer allowed to fish there, because then now it is an offense. Why is it so much poaching here in our area? It never happened, but you can't blame the people because the people are pushed away from one seawater to the other seawater, because the development is getting there now and if the development comes next to the water, then those people who live next to the water own that piece of water as well. Now what else needs to be taken from us? I'm very, very emotional tonight. If I think I'm a woman. I fight for my fishermen in Langebaan. I'm a woman. I have to fight for them. I have to tell them, "This must be done, this must be done." I'm just looking for the fishermen's support that I can see people. A lot of times you leave here, you say, "yes, there were only a few people. The most that was here was us who offered it. The fishermen weren't there." Then the people must now get the impression that the fishermen are not interested. But everywhere you've gone, I want to ask you the question tonight: "Has there been a fisherman who said, yes, come with the development?" If a fisherman said that, then it's a good idea, or pretended to be a fisherman, but he's not a fisherman. Thank you very much. **CSP Kriel** Ek dink dit is alles belangrike dinge wat gesê moet word, en ek is baie bly jy het dit gesê, Mevrou, want ek dink die omgewing waarbinne hierdie storie gebeur, is nie net vir die olie en gas nie. Dit gebeur binne-in die viswaters. Dit gebeur binne-in die Suid-Afrikaanse waters. So, daar is 'n hele klomp dinge wat gebeur en 'n klomp goed wat in ag geneem moet word. So, dit is spesifiek hoekom ons wil kyk na die sosiale aspek van dit ook, want hierdie is 'n sosio-ekonomiese storie, is dit nie? En daar is kulturele goed. Dit is hoekom ons na dit ook wil kyk. So, dit is hoekom ons vir Wouter-hulle gekry het om te kom kyk wat julle te sê het en al daardie tipe goed. So, ek wil vir jou baie dankie sê vir daardie goed. Ons verstaan dat daar 'n geskiedenis is van mense wat nie reg behandel is nie. Ons verstaan al daardie goed, en ons verstaan dat ons praat van die omgewing, praat ons nie net van die visse en die goed nie. Ons praat van die mense ook. Ons praat van die kulturele omgewing en goed ook. So, dit is vir ons baie belangrik om daardie goed in ag te neem, en dit is belangrik dat julle hierdie goed sê ook, jy weet, want partykeer dink 'n mens, jy weet, wetenskaplik maar jy vergeet van die sosiale goed, of jy weet, wat ook al. So, dit is baie belangrik dat julle hierdie goed vir ons sê. So, ons gaan hierdie goed opneem. Die sosiale mense gaan ook daarna kyk. Hulle gaan daarna luister. Wouter-hulle gaan ook na julle luister en al daardie tipe goed. Ons verstaan dat daar permitte is wat ge-issue word vir die visse. Ons verstaan daardie tipe goed. Ongelukkig het ons nie rêrig vreeslik met dit te doen nie. Ons gaan dalk nie direk daarmee kan werk nie. Ons werk maar meer met die permitte in terme van die omgewingsgoed. So, daar is nie rêrig te veel wat ons kan sê oor die viserypermitte en goed nie, maar dat ons weet dat daar goed gebeur wat nie altyd reg is nie. Alright. Ons verstaan, jy weet, dat julle vissersgronde is baie belangrik vir julle, dat die tradisionele visvangs baie belangrik is. Dit is deel van julle kultuur. Dit is deel van julle manswees. So, dit

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	is spesifiek hoekom ons ook wil kyk na daardie visseryegedeeltes, waar julle visvang, hoe julle visvang, watse visse julle vang en of hierdie storie dan gaan inmeng met daardie, sodat as dit inmeng, dat 'n mens kan kyk van te veel inmeng, 'n mens moet dit liewers nie doen nie. Of dit gaan dalk gladnie inmeng met watse tipe vis en waar julle dit vang nie, of wat ook al. Dit is nou die twee uiterstes. Daar is heelwaarskynlik 'n middelgrond in die middelkant, maar soos ek sê, ons is nog besig om na daardie tipe goed te kyk, maar dit is belangrik dat julle vir ons gesê het dit daar daardie tipe goed is. So, in terme van die ander lande en waar die geld heen verhuyn. So, wat ek kan sê is dat hierdie is 'n redelike tegniese besigheid. Dit is 'n redelike duur besigheid om dit te doen. So, dit het redelik geld nodig, en dit het redelike kennis en goed nodig, en redelike duur bote en daardie goed. So, ek dink dit is maar meestal hoekom die ouens van oorsee af kom, is omdat hulle het daardie kundigheid en daardie geld, of watookal, en dan kom kyk hulle vir ons wat is daardie in ons eie waters. So, hierdie is basies net reconnaissance permit op hierdie stadium. Dit is nie noodwendig 'n eksplorasie en produksie en daardie tipe goed nie, maar ons weet dat dit wel tot dit kan lei en dit kan tot op daardie vlak kom. So, dit is baie belangrik om daardie tipe goed in ag te neem. Wanneer hulle by daardie produksie gedeelte kom, gaan hulle verseker moet kyk na dit. Hulle gaan verseker moet kyk na watter gedeelte van daardie geld gaan hier gebruik word, watter gedeelte van die geld gaan uit die land uit gaan, gaan dit uitgevoer word, gaan ons dit hier verwerk, wat gaan ons doen met daardie goed as dit op daardie stadium kom. So, en dan is dit belangrik om seker te maak dat Suid-Afrika bevoordeel word daardeur as dit op daardie stadium kom, maar daar is nog baie water wat onder die brug moet loop. Hulle moet nog eers goedkeuring kry vir hierdie storie, en dit is ook nie verseker nie. So, baie dankie vir jou insette. Ek waardeer dit rêrig baie. As daar enigiets anders is wat ek uitgemis het ... Ja, as daar spesifieke dinge is dan kan ons mekkien kom kyk. Ek dink dit is hoekom dit vir ons belangrik gaan wees om terug te kom en dan van ons spesialiste en goed saam te bring, sodat hulle kan ... Soos wat ek gesê het, hulle gaan dan vir julle sê wat hulle gekry het, en op daardie stadium gaan dit dan, as ons terugkom met ons verslag, is dit belangrik om te kom kyk wat weet julle. Julle, soos wat julle gesê het, julle is die manne op die see. Julle weet meer partykeer, baie keer, meeste van die kere eintlik, nè? So, julle ken die situasie, julle leef daarso, julle weet wat aangaan. So, dan ons daardie kennis ook in ag neem. So, ons wil dit rêrig kom doen. Ons wil nie kom wegkruip van dit af nie. *I think these are all important things that need to be said, and I'm really glad you said that, Madam, because I think the environment in which this story is happening is not just for the oil and gas. This happens inside the fishing waters. It happens inside the South African waters. So, there's a whole bunch of things that happen and a bunch of stuff that needs to be taken into account. So, that's specifically why we want to look at the social aspect of it as well, because this is a socioeconomic story, isn't it? And there's cultural stuff. That's why we want to look at that too. So, that's why we got Wouter-them to come and see what you guys have to say and all that type of stuff. So, I want to thank you so much for that stuff. We understand that there is a history of people who have not been treated right. We understand all that stuff, and we understand that we're talking about the environment, we're not just talking about the fish and the stuff. We're talking about the people too. We're talking about the cultural environment and stuff too. So, it's really important for us to take that stuff into account, and it's important that you say this stuff also, you know, because sometimes one thinks, you know, scientifically but you forget about the social stuff, or you know, whatever. So, it's very important that you guys tell us this stuff. So, we're going to take this stuff up. The social people are going to look at it too. They're going to listen to it. Wouter-they're going to listen to you guys and all that type of stuff too. We understand that there are permits that are being issued for the fish. We understand that type of stuff. Unfortunately, we don't really have anything to do with that. We may not be able to work directly with it. We're just working more with the permits in terms of the environmental stuff. So, there's not really too much we can say about the fisheries permits and stuff, but that we know that things happen that aren't always right. Alright. We understand, you know, that your fishing grounds are very important to you, that the traditional fishing is very important.*

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EIMS | Environmental Impact Management Services

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	it is part of your culture it is part of your humanity. So, that's specifically why we also want to look at those fisheries sections, where you fish, how you fish, what fish you catch and whether this story is going to interfere with that, so that if it interferes, that one can look at from interfering too much, one should rather not do it. Or it might not interfere at all with what type of fish and where you catch it, or whatever. Those are the two extremes now. There's probably a middle ground in the middle side, but as I say, we're still looking at that type of stuff, but it's important that you guys told us that there's that type of stuff. *So, in terms of the other countries and where the money goes away. So, what I can say is that this is a fairly technical business. It's a pretty expensive business to do this. So, it needs a fair amount of money, and it needs reasonable knowledge and stuff, and pretty expensive boats and that stuff. So, I think that's just mostly why the guys come from overseas is because they have that expertise and that money, or whatever, and then they come and see us what's that in our own waters. So, this is basically just reconnaissance permit at this point. It's not necessarily an exploration and production and that type of stuff, but we know that it can lead to it and it can get to that level. So, it's very important to consider that type of stuff. When they get to that production part, they're definitely going to have to look at it. They're going to have to look at what portion of that money is going to be used here, what portion of the money is going to go out of the country, is it going to be exported, are we going to process it here, what are we going to do with that stuff when it comes to that point. So, and then it is important to make sure that South Africa is benefited by it when it comes to that point, but there is still a lot of water that needs to go under the bridge. They have yet to get approval for this story, nor is it assured. So, thank you so much for your input. I really appreciate it. If there's anything else I've missed out... Yes, if there are specific things then maybe we can come and see. I think that's why it's going to be important for us to come back and then bring some of our specialists and stuff, so they can... Like what I said, they're going to tell you what they got, and at that point it's going to, when we come back with our report, it's important to come and see what do you know. You, as you said, you are the people on the sea. You know more sometimes, a lot of times, most of the times actually, huh? So, you know the situation, your live thereso, you know what's going on. So, then we take that knowledge into account as well. So, we really want to come and do that. We don't want to come and hide from it.*
b.	**Cornelita Mostert** Vag vir jare vir die vissers van Saldanha. Soos jy nou streeds gehoor het, dit is ons lewensbestaan en dit is ons geboorteregt. Ons is gebore langt die see en ons lewe tot vandag toe ... My pa (sy pa is al dood), ons lewe vir jare uit die see uit. Soos my kollega tereg gesê het, dit is ons begraafplaas en ek hoor wat jy sê, hoe jy antwoord en dit blyk my dat daar geen respek aan ons getoon word nie. In die eerste plek is, toe julle aansoek doen, of besig is met die aansoek, moes julle eers met die departement gepraat het, want ek dink ek kan nie net 'n ding begin nie. Daar is 'n vorm wat ek moet aansoek voor doen om vir hierdie projek aansoek te doen en soos dit vir my blyk en I dink, het julle klaar met Departement van Omgewingsake gesit en hulle het klaar vir julle die go-ahead gegee en nou is hulle te bang om na ons toe te kom om self met ons te kom praat, want hulle weet watse antwoorde en vrae hulle gaan kry. Nommer 2 is, dit blyk nie dat 'n vis 500 meter hier van af ... Wil julle stack om die soogdiere kans te gee. Ek dink jy kom 100 000 meter ver aan, dan hoor daardie whale en dan hoor daardie vis hier kom 'n gedruis. "Ek moet vlug vir my lewe, want ek gaan dood." Dit is exactly wat gaan gebeur, want enige gedruis maak daardie vis dat hy 'n veilige plek kry. Hier het ons 'n Witstompneus gebroei hier oorkant die palletjies. Waar is dit vandag? Toe Portnet gebou word, en toe Saldanha Staal gebou word, toe is daar slee wat afgaan as dit gelip word en as gevolg van Portnet se rooi dusi het onse Witstompneus getrek. Hier is nie een Witstompneus hier by die palletjies nie. Ons mense kon tot daar gevoel het om die Witstompneus te kry. Geensins vandag nie. Mense kom van oorsee af en hulle bronne is klaar die hel in gedra. Nou sien hulle daar is nie meer piek nie en hulle wil die Suid-Afrikaanse waters kom oorvat. Soos

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	ek voel, ek is 'n Suid-Afrikaanse vrou, vir my moet gerespek word. So, as Engeland of wie hier inkom, moet daar moets en moenies, want nou sit 'n Suid-Afrikaanse vrou in die gevangenis in Thailand en haar ma moet daar bly net om vir haar te kan sien. Sou die geld op word of minder word, moet sy maak dat sy in Suid-Afrika kom. Daar was geen versagting vir daardie vrou nie. Nou dink die buiteland hulle gaan ons vis kom destroy laat dit disappear en daar is geen respek vir ons nie. Ons eet hier uit van Omega 3 is baie belangrik vir ons liggame. Daarom gaan vang ons maar net die vis. Ons families gaan vang die vis en ons is vroue. Ek, myself is teen die drilling van die kus. Ek is a boat owner en ek gaan bemark my vis self wat my crew vir my inbring. So, ek sê straight nee. Die mense dink totally niks van ons nie. As DEF kan geld kry, of Omgewingsake kan geld kry, dan bly hulle sjuut, want ons moenie worry nie. En lank genoeg gaan die gemors aan. So, ek wil vir jou pleidooi vra vanmiddag: gaan sê vir daardie mense wat vir julle go-ahead gegee het om aan te gaan, te kom praat, vorms in te stuur, sê hulle moet na ons toe kom. Ons soek nie vir julle hier nie. Ek is een. Ek weet nie wat die vloer sê nie, maar ek 'n visservrou soek nie vir julle hier nie. Soos ons gesê het: "Voetsek Karpowership, voetsek", moes hy gegaan het, want die hof het beslis die gemeenskap se belange dra hy op die hand, want dit is die mense se tradisie. Dit is die mense se lewensbestaan en dit is die mense se kos. Dan het ek drie vrae om te vra. Wie gaan vir ons vissermanne werk gee? Die beleid van Suid-Afrika sê as jy 45 is, kan jy nie meer aansoek doen vir werk nie. Punt nommer 2: Wie gaan ons huishoudings in stand hou, terwyl die see vir ons 'n bron gee wat ons kan uit lewe, eet en ons dienste kan betaal. Nommer 3 is: Wie gaan ons kinders universiteite toe stuur? Ons sukkel already met daardie bietjie, maar as ons tafel gesit het en beplan 'n raam, dan kan ons na Sea Harvest toe gaan en sê: "Ek is 'n visservrou. Hier is my kind se rapport en sy wil verder gaan studeer. Is daar dan nie 'n helpende hand nie?" Ons kan nie na Omgewingsake toe gaan nie. Ons kan nie na die Departement toe gaan nie. Hy gaan vir ons straight sê hy kan nie vir ons help nie. En dit moet ons as die vissers in ag neem dat sy sulke vergaderings moet ons almal saamstaan, want dit is nie net vir my boot wat ek vaq nie. Dit is nie net vir my tafel nie, maar dit is vir die breë gemeenskap. So, my pleidooi is, ons soek regtig nie veel al daardie voorleggings. Ek weet nie of julle gukyk het nie maar in die voorleggings, Solene het ek gesien seismic. Maar ek het nou weer daar gesien sels. So, wat wil dit vir my sê? TGS is Shell, BP, Total Garage. Hulle change net. Dit gaan nou amper, Chief soos dit in die ... as u 'n werk het (hoe sê 'n mens?) 'n sub-kontrak, dan change die volgende maand die naam. Die sub-kontrak naam, want u was 'n slegte betaler, nou gee jy 'n ander naam. Só dit is hoe dié ding sirkuleer. Ons is nie dom nie. Hier is van ons wat kan lees en skryf. Hier is van ons wat Engels kan verstaan, sodat ons plat visserman kan verstaan waaroor dit hier gaan. So, go away, please. I thank you. *Fight for the fishermen of Saldanha for years. As you've heard by now, this is our livelihood and it's our customary law. We were born by the sea and we live to this day... My father (his father is already dead), we live out of the sea for years. As my colleague rightly said, this is our graveyard and I hear what you say, how you answer and it seems to me that no respect is shown to us. First of all, when you apply, or are busy with the application, you should have talked to the department first, because I guess I can't just start a thing. There is a form that I have to apply for to apply for this project and as it seems and sounds to me, you have finished sitting with Department of Environmental Affairs and they have already given you the go-ahead and now they are too scared to come to us to come and talk to us themselves, because they know what answers and questions they're going to get.* *Number 2 is, it doesn't appear that a fish 500 yards from here... Want to stack to give the mammals a chance. I think you arrive 200,000 yards away, then hear that whale and then that fish here hears a roar. "I have to flee for my life because I'm going to die." That's exactly what's going to happen, because any roar makes that fish find a safe place. Here we have a White Stump nose brewed here across from the pellets. Where is it today? When Portnet was being built, and when Saldanha Steel was being built, then there were beatings that went off when tipped and because of Portnet's red dust we pulled White Stump nose. There's not a single White Stump nose here at the pellets. Our people could have rowed up to there*

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EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	to get the White Stump nose. By no means today. People are coming from overseas and their resources are already hell-bent. Now they see that there is no more space and they want to come and take over the South African waters. As I feel, I am a South African woman, for me I must be respected. So, if England or whoever comes in here, there must be do's and don'ts, because now a South African woman is sitting in Thailand and her mother has to stay there just to be able to see her. Should the money run out or dwindle, she must make sure that she comes to South Africa. There was no mitigation for that woman. Now the outback thinks they're going to come and destroy our fish and there's no respect for us. We eat out here of Omega 3 is very important for our bodies. That's why we're just going to catch the fish. Our families go catch the fish and we are women. I, myself am against the drilling of the coast. I'm a boat owner and I'm going to market my fish myself bringing my crew in for me. So, I say straight no. The people totally don't think anything of us. If DEF can get money, or Environmental Affairs can get money, then they stay, because we shouldn't worry. And long enough the mess goes on. So, I want to ask for your plea this afternoon: go tell those people who gave you go-ahead to move on, come and talk, send in forms, tell them to come to us. We're not looking for you here. I am one. I don't know what the floor says, but I'm not looking for you here. As we said, "Voertsek Kanpowership, voertsek", he should have gone, because the court ruled the community's interests he had on hand, because that is the people's tradition. It's the people's livelihood and it's the people's food. *Then I have three questions to ask. Who is going to give us fishermen jobs? The policy of South Africa says if you are 45 you can no longer apply for jobs. Point number 2: Who is going to maintain our households, while the sea gives us a resource that we can get out of living, eating and paying for our services. Number 3 is: Who is going to send our children to universities? We're already struggling with that bit, but if we've set the table and plan a frame, then we can go to Sea Harvest and say, "I'm a fisherwoman. Here is my child's report and she wants to study further. Isn't there a helping hand then?" We can't go to Environmental Affairs. We can't go to the Department. He's going to tell us straight he can't help us. And this we as the fishermen must take into account that with such adjournments we must all stand together, for it is not only for my boat that I fight. It's not just table for me, but it's for the community at large. So, my plea is, we're really not looking for all those vaateggings. I don't know if you guys looked but in the submissions, Solene I saw seismic. But I've seen it again now. So what does that want to tell me? TGS is Shell, BP, Total Garage. They just change. It almost goes now, Chief as it does in the... if you have a job (how does one say?) a sub-contract, then change the name the following month. The sub-contract name, because you were a bad payer, now you give a different name. That's how this thing circulates. We're not stupid. Here are some of us who can read and write. Here are some of us who can understand English so our fint fisherman can understand what it's all about here. So, go away, please. I thank you.* **GP Kriel** Baie dankie vir jou kommentaar. Dit is belangrik dat jy dit gesê het. Ek gaan dit opneem. Ons gaan dit in ons notule sit en dit gaan dan by die Departement uitkom. Ek wil net 100% duidelik seker maak, Ons het nie vooraf gekoukus met 'n departement nie. Ons is 'n onafhanklike maatskappy. Ons belang is om seker te maak dat die omgewing beskerm word, en dit sluit die mense in die omgewing in, en die see ook. So, ons belang is om seker te maak dat dit gebeur.en ons wil nie kom koukus en agteraf wees nie. TGS is die ouens wat aansoek gedoen het. Ja, hulle doen aansoek want hulle wil kyk wat watse data is daar, watse inligting is daar en watse bronne daar is, en waar hulle is. Daardie inligting gaan dan gebruik word deur die lisensieblok houers. So, dit gaan dan deur die, wie-ever daardie area se goed besit, en 'n groter gedeelte daarvan is Total, of TotalEnergies soos wat 'n mens dit nou deesdae noem, Azinam. Shell van die gedeeltes, al daardie ouens. So, daardie inligting gaan op die ou einde deur daardie ouens gebruik word, en partykeer verkoop hulle die lisensieblokke onder mekaar, of hulle neem dit oor van een na die ander een toe. So, ek wil nie kom wegsteek en kom sê dat ons hierdie tipe goed nie van weet nie, maar

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	dit is daar. En ons dink nie julle is stupid nie. Ons weet julle kan hierdie goed doen. Julle het access tot die inligting ... Ons het nie agteraf gewerk nie en ons kom nie met 'n lang ding aan nie. Soos ek gesê het, ja, daar is mense wat wil goed doen. Daar is mense wat sekere inligting nodig het. Daar is 'n gat in die data en dit is hoekom hulle 'n voorstel gehad het om daardie spesifieke area te target. Ons is aangestel omdat hulle 'n voorstel het. Daardie voorstel het hulle gesê: "Okei, ons wil hierdie ding kom doen, maar ons mag nie net dit kom doen soos wat ons wil nie. Ons kan nie net kom en kom gemors maak soos wat ons wil en net oor die mense se visserbote ry soos wat ons wil en daardie tipe goed nie." Jy moet eers daar 'n wetlike proses gaan. As gevolg van die konstitusie, as gevolg van al daardie ander wette, is daar lyste en is daar ander wette wat bymekaar gestel is en die Omgewingsbestuurswet is een van daardie en daar is spesifieke maniere, daar is spesifieke wette waaraan ons moet voldoen. Ons kan nie ook net gaan en 'n proses gaan doen soos wat ons wil nie. Ons moet eers 'n sekere eerste stap doen in daardie proses en dit is om te gaan kyk watse goed is daar. Dan moet ons die aansoekvorm instuur om dit af te skop. Dan moet ons ons verslag bymekaar stel, ons moet dit aan die publiek bekendstel. So, dit is die wetlike proses en as ons nie aan dit voldoen nie, soos wat julle weet, dit het met Searcher gebeur en van daardie goed. Daar was sekere prosesgedeeltes wat nie reg was nie. So, ons wil probeer op 'n eerbare manier wil ons na julle toe kom en sê: "Luister hierdie is wat ons weet. Wat weet julle?" En ons wil nie goed kom wegsteek nie. Dit is nie die idee van die hele storie nie. Ons wil nie met allerhande tierlantyntjies en goed kom nie. *Thank you so much for your comments. It's important that you said that. I'm going to record it We're going to put it in our minutes and it's going to get to the Department then. I just want to make 100% clear. We didn't pre-caucus with a department. We are an independent company. Our interest is to make sure that the environment is protected, and that includes the people in the area, and the sea as well. So, our interest is to make sure that happens and we don't want to come caucus and be backward. TGS are the guys who applied. Yes, they apply because they want to see what data is there, what information is there and what sources there are, and where they are. That information is then going to be used by the license block holders. So, it then goes through the, who-ever owns that area's stuff, and a larger portion of it is Total, or TotalEnergies as one now calls it these days, Anlnam. Shell of the sections, all those guys. So, that information is going to end up being used by those guys, and sometimes they sell the license blocks among themselves, or they take it over from one to the other. So, I don't want to come and hide and say that we don't know this type of stuff about, but it's there. And we don't think you guys are stupid. We know you can do this stuff. You guys have access to the information...,* *Ons didn't work backwards and we don't come up with a long thing. Like I said, yes, there are people who want to do well. There are people who need certain information. There's a hole in the data and that's why they had a proposal to target that particular area. We were hired because they have a proposal. That suggestion they said, "Okay, we want to come and do this thing, but we're not allowed to just come and do it the way we want. We can't just come and make noise the way we want and just ride over the people's fishing boats like we want and that type of stuff." You have to go through a legal process first. Because of the constitution, because of all those other laws, there are lists and there are other laws that have been put together and the Environmental Management Act is one of those and there are specific ways, there are specific laws that we have to abide by. We can't just go and do a process the way we want. We have to take a certain first step in that process first and that is to go and see what's good there. Then we have to send in the application form to kick it off. Then we have to put our report together, we have to release it to the public. So, that's the legal process and if we don't comply with it, like you know, it happened with Searcher and some of that stuff. There were certain process passages that weren't right. So, we want to try in an honorable way we want to come to you and say, "Listen this is what we know. What do you*

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	know?" And we don't want to come and hide well. That's not the idea of the whole story. We don't want to come up with all kinds of trappings and stuff.
c.	**Chief Maart** Baie dankie programleier. Ek gaan hoofsaaklik kommentaar lewer en ek dink ek het vyf kommentaar areas wat ek wil aanspreek. Die een gaan natuurlik oor NEMA en die regering se rol. Die tweede area wat ek wil dek, gaan spesifiek oor die akoestiese impak. Die derde een gaan oor die ekonomiese impak en die vierde een is eintlik 'n boodskap wat ek wil stuur aan hierdie teenstrydige denkstrome wat in ons gemeenskap bestaan van mense wat sê maar die ding het vir ons 'n ekonomiese voordeel. Ek het 'n boodskap vir hulle en dan laastens wil ek graag praat oor ons kultuurerfenis en natuurlik ons sosiale impak wat ons sien op hierdie goed gaan gebeur. Kan ek op die eerste onderwerp-area gou fokus. Die regering en NEMA? My belangrike stelling wat ek wil maak is dat die regering ons faal in die oorsigrol wat hulle ingevolge NEMA het.en ook ingevolge ons demokratiese Grondwet en ek noem dit nie eintlik 'n demokratiese Grondwet nie. Ek noem dit eintlik a demokratiese Wet, want dit is 'n klomp duiwels wat daar bo sit en hulle soek net geld, want as u nou die Bybel reg lees, dan sê die Bybel dat die Here sê Hy staat net een God toenoor die grote Here. Hy sê jy kan nie God en mammon aanbid nie en mammon is die geldgod en dit is presies waar ons regering lê. Hulle is net agter die geld aan. Ons almal weet die tripple bottom line vir sustainable development het 'n tripple bottom line wat sê dit moet die drie P's wees: People, Planet en Profit. Vir die regering gaan dit net oor die laaste P, Profit. Hulle worry nie oor die mense nie. Hulle worry ook nie oor die omgewing nie. En dit is vir ons 'n sterk soort van aanval op ons gemeenskap se rol wat ons speel om, veronderstel om die land te regeer, want hulle sê mos demokrasie is eintlik 'n bottom up approach waar jy die mense moet regeer, maar die mense word nie raadgeslen nie. Ek meen hulle het die pragtige wet NEMA, maar NEMA word deliberlief nie geïmplementeer nie. Hulle kyk nie nie daarna nie. Ek wil dit amper stel, en ek gaan dit nou ook op 'n ander manier ook vir julle stel is dat ek agterkom is dat daar is 'n tipe van 'n collusion As julle kyk na hierdie werkswinkel wat hulle verlede week gehou het daar in die Kaapse Konfensiesentrum, is dit departemente: Omgewingsake, Departement Landbou en dan natuurlik ook Visserye, en dan natuurlik ook die Mynbou minister, Minister Mantashe. En eintlik kan 'n mens sien daar is 'n tipe van 'n collusion wat daar plaasvind, en ons is besig, ek meen ons verskillende omgewingsorganisasies en ons tradisionele owerhede, ons is besig om saam te werk om te kyk om riglyne te formuleer teen Minister Mantashe. Hy moet krimineel aangekla word. Net soos hulle nou met hierdie collusion wat nou plaasgevind het met die State Capture nè, is Transnet se CEO is krimineel aangekla. Minister Mantashe moet op dieselfde wyse aangekla word, want hoe kan hy die gemeenskap elke keer agterstoe skuif en net ter wille van 'n bietjie profyt wat hulle maak. Ek is seker daarvan. Hy het 'n bietjie bande daarbinne. Nou bring dit my by die volgende collusion. Ek is nog altyd by my eerste punt. Bloot die feit dat TGS en Searcher altwee vir EIMS aanstel as hulle omgewingskonsultant, sê dit vir my hulle is ook besig om te collude. As julle kyk na die areas ook, hoe naby aanmekaar lê hulle. Blikkemmer. Dink hulle nou ons is nou so dom nè. Daar is 'n ander tipe collusion wat plaasvind en dit is nie tot voordeel van die gemeenskap nie. Goed, dan net om antie Soelien se vraag te beantwoord netnou oor, of om te sê ek stem saam met haar stellings. Dit is nie konings en ministers en chiefs wat moet besluit oor die mense se grond en oor die mense se water nie. Dit is iets wat onaanvaarbaar is en dit is hoekom ons tans die Traditional Khoisan Leadership Act beveg, want die Traditional Khoisan Leadership Act laat baie mag oor aan jou chief om te kan besluit wat in sy area mag gebeur en ons stem nie daarmee saam nie, want die tyd van Jan van Riebeeck het ons mense sommer vir 'n knipmes groot stukke grond gaan verkoop, ensovoorts. Ons wil nie

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	weer 'n herhaling daarvan hé nie. Die mense, die tradisionele gemeenskap, en veral die visergemeenskap moet die ultimate sê hê oor wat gebeur in hulle waters. So, dan is ek klaar oor daardie regering en NEMA. Goed, my tweede onderwerp-area gaan spesifiek oor die akoestiese impak. U het dit ook daar uitgewys dat die soogdiere, selfs plankton, wat aan die onderpunt van die voedselketting is, gaan negatief beïnvloed word, en enige impak weet ons vir 'n feit as dit in die natuur plaasvind, dit kan nie weer omgekeer word nie. In Engels sê hulle it is irreversible. So, daar moet glad nie eers 'n impak gewees het nie. Die oomblik as julle besef daar gaan 'n impak wees, dan moet julle vir julleself sê: "Ons stop net hierso." Nè? Ja, daardie akoestiese impak, as ek dit reg gelees het, want ek doen 'n bietjie navorsing daaroor, dan sê hulle die menslike oor, nè, kan net vir vyf minute teen 120 desibels aanhoudend, net vir vyf minute, aanraan daarna luistar voordat hy heeltemal doof word, nè? Nou wil julle vir my sê dat diere wat soveel meer gehoorsensitiwiteit het as 'n mens, nou nie daardie impak sal kan voel nie. Wat die snaakste van alles is vir my, in julle dokumentasie praat julle van dat menslike aktiwiteit moet nie binne-in 'n 20 kilometer radius van hierdie knal wat julle afstuur met daardie boot, nè ... 'n Mens kan nie in 20 kilometer radius daarvan af kom nie, maar julle praat van 'n 500 meter radius vir diere. Hoe verstaan julle dit? As diere wat 'n baie groter gehoorsensitiwiteit het, hoekom kan hulle net 'n 500 meter ... dan wil julle mos eintlik ons diere, wil ek amper sê, vrek maak, nè? Julle wil hulle uit ons waters uitjaag, want ons weet die broei en die migrasiepatrone van onse seediere gaan definitief ... Daar is nie eers 'n vraag daaroor nie. Dit gaan definitief versteur word. En as ons kyk na watter knal die ou gunnetjie wat daar agter uitgeskiet word, hulle sê hy kan tot op 240 desibels kan hy geraas maak. Nou as jy dit vat, en ek vat byvoorbeeld net die mediaan een van 145 desibels (onthou die mens kan op 120 desibels vir vyf minute luister en dan word hy doof) ... Kom ek vat maar net die mediaan van 145 desibels. Onthou dit is 300 keer harder as 120 desibels. Driehonderd keer groter. So, ek meen hoe kan diere dit hou? So, julle wil ons diere uitroei. Ek praat derdens oor die ekonomiese impak. Ons kleinskaalse vissers is afhanklik van die kreef, snoek en ander vis wat in ons areas is om 'n bestaan te voer. Die ekonomiese impak is selfs groter as ons na die pelagiese vissersbedryf gaan, want as julle vat meer as 12 000 gesinne in hierdie area waar julle nou wil hierdie seismiese toetse doen, is afhanklik van die pelagiese vissersbedryf. Twaalfduisend gesinne nè? Twaalfduisend gesinne is baie. Nou kom mense, en ek wil nou eintlik gekom het by hierdie een waar die denkstrome verwerp wat sê daar is bepaalde ekonomiese voordele vir ons daarin as daar vir olie en gas geboor word. Ek sê nee, nè. Die een wat dit sê, ek meen vat sommer die boodskap huistoe en sê vir hulle hy moenie kom nonsens met ons praat nie, want ons weet almal daar is geen ekonomiese voordeel nie, want wat gebeur is, dat ons die een ... Ek was nog steeds by die ekonomiese impak. Die een ekonomie moet nou doodgaan ter wille van 'n ander ekonomie wat gebou word. En die wêreld beweeg weg van fossielbrandstof sê. Ek weet nie waarom Manasshe en hierdie mense so aangaan en nog steeds wil hê daar moet vir fossielbrandstowwe gedril word nie, want waarvoor is hierdie seismiese toetse? Om te kyk of hulle olie en gas kan kry. So, die wêreld beweeg daarvan weg omdat ons besef dat die impak op jou omgewing en op jou klimaatsverandering baie, baie groot en negatief is. En ek wil laastens by hierdie ekonomiese impak gou net hierdie studie aanhaal. In 2013 het Bloomberg 'n studie gedoen van die tuna-vangste (ek het dit vanoggend raakgelees) in Namibië se waters nadat die olie en die gasbedryf daar toegetree het. En op 'n jaar-tot-jaar grondslag, het die tuna-vangste eksponensieël afgeneem. Nie eers inkrementeel nie, dit is eksponensieël, want in 2011 het hulle 4 000 ton tuna gevang. In 2012, net 'n jaar later, 1 800 ton. Is dit 'n impak, of is dit nie 'n impak nie? Dit is 'n enorme impak. In 2013, net 650 ton. Vanaf 4 046 ton in 2011 tot 650 ton in 2013. Mense, asseblief, stop hierdie nonsens. Ons kan dit nie bekostig nie. Ek wil afsluit met die sosiale- en natuurlik ook die kulturele-erfenis impak. Ons het dit al herhaaldelik keer gesê, maar ek gaan dit weer sê ter wille van die rekord vir TGS ook dat die oseaan is vir ons 'n kosbare

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	en religieuse bron van lewe, en vanuit 'n kulturele oogpunt het ons nog al die tyd in harmonie saam met ons see en met ons natuur gelewe. Wat ons gegis het, wat jy uithaal, sit jy weer terug. Moenie uithaal en verwag die see gaan nie kom terugvat nie. Antie Soelaa het dit só mooi gedemonstreer toe hierdie Bacher-bote hier inkom en die see hier kom dieper maak om daardie muur te bou, toe kry ons daardie vloed in Langebaan. Ons het nie eers meer 'n kaslyn waar ons lekker mee kan loop nie, en dit was ons mooiste kuststrook. Ek meen daardie impak alleen, wys vir ons dat moenie met die natuur mors nie. Ek meen, ons het byvoorbeeld ook 'n kultuur gehad en ons spesifieke stam waaruit ek kom, die Kogahwa, het met skape en met beeste geboer, maar ons het jaggemaak op bokke, maar ons was baie versigtig om dragtige ooie te wil doodmaak, nè, want ons het gevoel daar moet 'n kultuur, daar moet 'n ketting voortgesit word, en jy kan nie die ketting daar versteur nie, want dan het ons nie môre, oormôre weer kos nie. Dié regering keer hierdie goed, goed, maar julle kom haal uit die see uit, julle versteur die hele seelewe met hierdie seismiese toetse en dit is 'n boodskap wat ek vir TGS gee. Asseblief, moenie weer kom doen wat die Kolonialiste gedoen het in 1652 nie. Hulle het in 1652 onse grond by ons kom afvat, onse vee afgevat, ons doodgemaak. Daar was selfs 'n wet uitgevaardig wat die Khoi- en die San-mense gesien het … Dit is nou ons voorvaders, wat hulle, hulle gedefinieer het as vermin. In Engels is dit vermin, nè, as wilde diere. En ons het 'n prys op ons kop gehad. Vir 'n Boesman, as jy hom skiet, het jy £8 gekry, en as jy 'n Khoi skiet, dan kry jy £6. Hulle het ons uitgeroei. Nou, ons het nie nou weer nodig om met guns terug te bakkel nie, want ons het nie guns gehad nie. Ons bakkel nou deur die sosiale media. Ons bakkie deur middel van die webwerwe en maak seker ons stem word gehoor. Julle gaan ons nie weer van die see ook weer kom beroof nie, nè. Genoeg is genoeg. Ek wil afsluit met UNDRIP, die United Nations Declaration on the Rights of Indigenous People, wat deur die United Nations aanvaar is as 'n deklarasie oor die regte van inheemse bevolkingsgroepe, stel dit baie duidelik dat daar moet vier prosesse plaasvind voordat enige ontwikkeling in tradisionele vissersgemeenskappe of watter tradisionele volke ook daar bly, se gemeenskap of in hulle water, of op hulle grond kan gebeur, naamlik wat hulle noem Free, Prior en Informed Consent, nè. Dit is vier verskillende beginsels. Free, Prior, Informed en dan die laaste een is natuurlik om Consent te gee, of om Consent te weier. In hierdie geval sê ons namens die vissergemeenskap, namens ons inheemse gemeenskap, sê ons nee. Anders verbeg u daardie beginsel ook van die United Nations. Baie dankie. *Thank you very much program leader. I'm mainly going to comment and I think I have five comments that I want to address. One, of course, is about NEMA and the government's role. The second area I want to cover is specifically about the acoustic impact. The third one is about the economic impact and the fourth one is actually a message that I want to send to these conflicting currents of thought that exist in our community of people who say but the thing has an economic benefit for us. I have a message for them and then lastly I'd like to talk about our cultural heritage and of course our social impact that we see is going to happen on this stuff. Can I focus on the first topic area soon. The government and NEMA? My important statement that I want to make is that the government is failing us in the oversight role they have under NEMA and also under our democratic Constitution and I don't actually call it a democratic Constitution. I actually call it a democratic Law because it's a bunch of devils sitting up there and they're just looking for money, because if you read the Bible correctly now, then the Bible says the Lord says He sets only one God against the great Lord. He says you can't worship God and mammon and mammon is the money god and that's exactly where our government lies. They're just after the money. We all know the triple bottom line for sustainable development has a triple bottom line that says it should be the three P's: People, Planet and Profit. For the government, it's just about the last P, Profit. They don't worry about the people. They don't worry about the environment either.* *And it's a strong kind of attack on our community's role that we play in governing the country, because they say democracy is actually a bottom up approach where you have to govern the people, but the people don't get noticed. I think they have the beautiful law NEMA, but NEMA is definitely not*

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	implemented. They don't look at it. I almost want to put it, and I'm going to put it to you guys in a different way now is that I'm noticing that there's a type of a collusion if you look at this workshop that they held last week there in the Cape Confluence Centre, three departments: Environmental Affairs, Department of Agriculture and then of course also Fisheries, and then of course the Mining Minister, Minister Mantashe. And actually one can see there's kind of a collusion taking place there, and we're busy, I think our various environmental organizations and our traditional authorities, we're working together to look to formulate complaints against Minister Mantashe. He should be criminally charged. Just as they do now with this collusion that has now taken place with the State Capture huh, Transnet's CEO has been criminally charged. Minister Mantashe should be charged in the same way, because how can he move the community backwards every time and just for the sake of a little profit they make. I'm sure of it. He's got some ties in there. *Now that brings me to the next collusion. I've always been at my first point. Simply the fact that TGS and Searcher both hire EIMS as their environmental consultant tells me they are also collude. If you look at the areas as well, how close together they are. Tin bucket. Now they think we're so stupid now huh. There is another type of collusion that takes place and it is not for the benefit of the community.* *Okay, then just to answer Aunt Soelten's question just now, or to say I agree with her statements. It is not kings and ministers and chiefs who must decide on the people's land and on the people's water. This is something that is unacceptable and that is why we are currently fighting the Traditional Khoisan Leadership Act, because the Traditional Khoisan Leadership Act leaves a lot of power to your chief to be able to decide what may happen in his area and we do not agree with that, because the time of Jan van Riebeeck our people just went to open up large pieces of land for a clipper, Etc. We don't want another repeat of it. The people, the traditional community, and especially the fishing community should have the ultimate say in what is happening in their waters. So, then I'm done with that government and NEMA.* *Okay, my second topic area is specifically about the acoustic impact. You also pointed it out there that the mammals, even plankton, which are at the lower end of the food chain, are going to be negatively affected, and any impact we know for a fact if it takes place in the wild, it can't be reversed again. In English, they say it's irreversible. So, there shouldn't have even been an impact at all. The moment you realize there's going to be an impact, you have to say to yourselves, "We're just stopping here." Huh? yes, that acoustic impact, if I read it right, because I do a little research on it, then they say the human ear, huh, can only listen to it for five minutes at 120 decibels continuously, just for five minutes, straight before he goes completely deaf, huh? Now you want to tell me that animals that have so much more hearing sensitivity than a human being will not be able to feel that impact now. Which is funniest of all to me, in your documentation you're talking about that human activity shouldn't be within a 20 kilometre radius of this bang you're sending off with that boat, huh... You can't get off it in a 20 kilometre radius, but you are talking about a 500 metre radius for animals. How do you guys understand that? As animals that have a much greater hearing sensitivity, why can they only have a 500 meter ... then you guys actually want to kill our animals, I'd almost say, huh? You want to chase them out of our waters, because we know the breeding and the migration patterns of our marine animals are definitely going to... There's not even a question about it. It's definitely going to be disturbed. And if we look at what bang the old gunnetjie shot out from behind, they say he can make up to 240 decibels he can make noise. Now if you take that, and I just take the median one of 145 decibels for example (remember man can listen for five minutes at 120 decibels and then he becomes deaf) ... Let me just take the median of 145 decibels. Remember this is 900 times harder than 120 decibels. Three hundred times bigger. So, I think how can animals keep it? So, you want to exterminate our animals.* *Thirdly, I'm talking about the economic impact. Our small-scale fishermen depend on the lobster, pike and other fish that are in our areas to make a living. The economic impact is even greater if we go to the pelagic fishing industry, because if you take more than 12 000 families in this area where you want to do*

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	these seismic tests now. It is dependent on the pelagic fishing industry. Twelve thousand families huh? Twelve thousand families are many. Now people come, and I actually want to get to this one where the currents of thought reject that say there are particular economic benefits for us in it if oil and gas are drilled. I say no, huh. The one who says that, I think just take the message home and tell them he shouldn't come and talk nonsense to us because we all know there's no economic benefit because what's happening is, that we're the one... I was still at the economic impact. One economy must now die for the sake of another economy being built. And the world is moving away from fossil fuel. I don't know why Mantoshe and these people are going on like this and still want fossil fuels to be dredged for, because what are these seismic tests for? To see if they can get oil and gas. So, the world is moving away from it because we realize that the impact on your environment and on your climate change is very, very big and negative. *And finally, to this economic impact, I just want to quote this study. In 2013, Bloomberg conducted a study of the tuna catches (I read it this morning) in Namibia's waters after the oil and gas industry stepped in there. And on a year-over-year basis, tuna catches have declined exponentially. Not even incrementally, it's exponential, because in 2011 they caught 4,000 tons of tuna. In 2012, just a year later, 2,800 tons. Is it an impact, or is it not an impact? It's an enormous impact. In 2013, just 650 tons. From 4 046 tons in 2011 to 650 tons in 2013. People, please, stop this nonsense. We can't afford that.* *want to conclude with the social and of course cultural-heritage impact. We have said this repeatedly, but I am going to say it again for the sake of the record for TGS also that the ocean is a precious and religious source of life for us, and from a cultural point of view we have lived all this time in harmony with our sea and with our nature. What we believed, what you take out, you put back again. Don't lash out and expect the sea isn't going to come back. Auntie Soekie demonstrated it so beautifully when these Bacher boats came in here and made the sea here deeper to build that wall, then we got that flood in Langebaan. We don't even have a coastline where we can have a good time walking with anymore, and it was our most beautiful coastal strip. I think that impact alone shows us that don't mess with nature. I mean, for example, we also had a culture and our particular tribe that I come from, the Kogelwa, farmed sheep and cattle, but we hunted goats, but we were very careful about wanting to kill pregnant ewes, huh, because we felt there had to be a culture, there had to be a chain continued, and you can't disturb the chain there, because then we don't have food again tomorrow, tomorrow. This government is stopping this stuff, all right, but you're coming out of the ocean, you're disturbing the whole marine life with these seismic tests and that's a message I'm giving TGS. Please, don't come back and do what the Colonialists did in 1652. They come to take our land from us in 1652, took our livestock, killed us. There was even a law enacted that the Khoi and the San people saw... it is now our ancestors, whom they, they defined as mutilated. In English, it was mutilated, huh, as wild animals. And we had a price on our head. For a Bushman, if you shoot him, you get £8, and if you shoot a Khoi, then you get £6. They exterminated us. Now, we don't need to fight back with favors anymore now because we didn't have favors. We are now fighting through the social media. We fight through the websites and make sure our voice is heard. You're not going to come and rob us of the sea again, huh. Enough is enough.* *I want to conclude with UNDRIP, the United Nations Declaration on the Rights of Indigenous People, which has been accepted by the United Nations as a declaration on the rights of indigenous peoples, makes it very clear that four processes must take place before any development in traditional fishing communities or whatever traditional peoples remain there, or in their waters, or can happen on their soil, namely what they call Free, Prior and Informed Consent, eh. These are four different principles. Free, Prior, Informed and then the last one is obviously to give Consent, or to refuse Consent. In this case, we are saying on behalf of the fishing community, on behalf of our indigenous community, we are saying no. Otherwise, you're taking that principle from the United Nations as well. Thanks a lot.*

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	Baie dankie Chief. Dit was 'n redelike gedetaileerde, mooi uiteengesitte gedeelte. Ja, in terme van NEMA, ja, dit is die Omgewingswet wat ons gebruik, dit is die Omgewingswet waarvolgens ons moet werk. Dit is wat Chief heel tereglik gesê het, dit is People, Planet and Profit. So, ons wil verseker, dit is verseker hoekom ons probeer kyk om die People, Planet en Profit-gedeelte daarvan na te kyk. Op hierdie stadium is dit die reconnaissance fase van die ding, weet, so, daar is nie vreeslik baie profit in hierdie projek vir die ouens wat dit kom doen nie. Die ouens wat dit hier kom doen op hierdie stadium, ja, hulle gaan data insamel maar dit gaan hulle baie geld kos om daardie data in te samel. Die idee is wel dat hulle dit dan kan verkoop maar dat daardie verkoop van die data dan wel een of ander tyd gaan gebruik moet word om die hulpbronne hierso te identifiseer en die hulpbronne hierso dan te kan gebruik. So, ons verstaan wat jy sê, ons stem saam met wat jy sê. Ek wil net sê dat ek kan ongelukkig nie praat van in terme van die collusion wat daar is tussen die departemente en goed nie, so graag as wat ek wil. In terme van die collusion tussen TGS en Searcher en EIMS, daar is geen collusion daar rerig nie. Ons is 'n diensverskaffer. Ons doen dienste vir daardie ouens maar ons doen nie dit sodat ons kan enige bevelfit daaruit kry, ons het nie shares in TGS of shares in Searcher nie, ons doen nie beter of ons wen nie daarvir as hulle beter doen nie, ons moet betaal word of hulle nou die goedkeuring kry of nie. So, ons is nie daarin om 'n grootskaalse uitbuiting van die omgewing te gaan doen en dan geld te maak daaruit nie. Ons is daar om te gaan kyk wat is die impak op die omgewing, is daardie impak bestuurbaar en kan ons seker maak dat die omgewing beskerm word daaruit. En onthou ons het 'n integriteit waarvolgens ons moet werk en ons moet seker maak dat ons volgens daardie kodes en goed werk. So, ons kan nie net willy nilly gaan doen nie. Ons weet daar is gevolge vir ons. Ons verstaan dat ons nie net kan gaan sê wat ons wil nie, ons moet kan, as ons 'n stelling maak, moet ons daardie stelling kan opvolg en ons moet dit kan staaf uit navorsing uit, interaksie met julle en verstaan hoe die omgewing werk en daardie tipe goed. So, daardie is vir ons baie belangrik en ons wil net seker maak dat daar geen dubbelsinnigheid is oor dit nie. In terme van die akoestiese impakte, ja 'n impak is ongelukkig soos wat ons in ons bedryf daarna kyk is 'n impak nie 'n swart en 'n wit ding nie. 'n Impak is 'n grys ding. So, as ek nou gaan hardloop en ek spring daar in die water, het ek 'n impak op die algae en ek spring op die water en goed maar ek roer nie al die algae uit nie. Verstaan? So, ek verstaan as ons elke dag as ons in ons lewens werk, het ons almal 'n impak op die omgewing en ek probeer nou nie TGS of Searcher of wat ookal se impak goedpraat nie, maar ek probeer sê dat 'n impak is nie noodwendig 'n doodskanaal vir die ding nie. So, dit is nie hoe ons na die impakte kyk nie, 'n impak is 'n grys storie en ons moet gaan kyk as hy swart is, as hy baie grys is, dan is dit 'n hoë impak en dan moet ons sê nee, ons kan nie dit doen nie. Maar as die impak neder aan wit is, dan kan 'n mens kyk, okay, luister is daardie impak ... Kan ons dit bestuur, kan ons seker maak dat ons hierdie ouens aanstel om te gaan kyk dat hulle nie as daar dalk 'n dolfyn of 'n haai of 'n vis of wat ookal in daardie omgewing aankom, dat 'n mens hulle kan beskerm nie, want die rede hoekom hulle dit afrit is sodat 'n mens daardie ding kan beskerm want mens weet as jy een walvis uithaal uit die voedselketting uit affekteer jy die hele voedselketting, verstaan? So, ons probeer daardie tipe goed inbou, jy weet, sodat ons dit probeer beskerm. So, ons verstaan dat 'n impak is hierdie vae begrip, maar ons probeer daardie impak kwantifiseer op 'n manier. Ons probeer 'n nommer in daardie impak sit sodat ons kan sê hierdie is hoog, hierdie is onaanvaarbaar of hierdie is laag, mens kan dit dalk bestuur, 'n mens kan daarna kyk. Ons hoef nie noodwendig oor dit saam te stem nie, maar ek probeer maar net vir julle verduidelik hoe ons daarna kyk. As julle saamstem daaroor is dit fine. Dit is presies hoe ons, jy weet, ek probeer vir julle ons proses gee daaroor. Dan ja, die klank is hard, die klank is duidelik hard en ons wil nie dit wegsteek nie. Ons moet verseker kom kyk na dit. So, dit is presies hoekom ons daardie modulering gedoen het, en of besig is om daardie modulering te doen vir hierdie ouens. Sodat ons kan kyk ookal as hierdie ouens hulle skip daar gaan vaar en hoe lank hulle daar gaan vaar en hoe gereeld hulle daar gaan vaar, watse,

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	hoe lank en hoe vér en hoe groot gaan daardie klankgolf wees, met ander woorde watse frekwensie gaan hy wees, watse dier kan hore dan hoor of nie, hoe vér gaan hy trek en hoe hard gaan hy wees verder van die skip af, nader aan die skip, al daardie tipe goed. En dan kan 'n mens begin kyk na die veiligheidsones en kyk na is daardie veiligheidsone genoeg? Is dit nie, moet ons dit verder net los of nie want partykeer word die klank harder so verder hy gaan afhangende van die see bodem, al daardie tipe goed. So, ons het gevra dat al daardie ouens na daardie goed kyk. So, ek stem saam dit is hard, mens moet daarna kyk. 'n Ander ding om te onthou is mens kan nie direk die klank wat in die water gebeur en die klank wat in lug soos hierdie is, kan 'n mens nie met mekaar vergelyk nie. Die klank is op ander frekwensies, is laer frekwensies so hy kan dalk verder gaan, maar hy gaan dalk nie altyd ... As 'n mens sê 240 desibels op land en op see is dit dalk 'n ander ding. So, ons moet daardie verskil ook gaan kyk en verskillende diere luister op verskillende maniere na daardie tipe goed. So, ons het gevra dat daardie ouens ook dan gaan kyk wat die impak van daardie verskillende goed is. Dan in terme van die menslike aktiwiteite binne-in die 20 kilometer sone en die 500 meter sone. Die rede vir daardie twee sones is verskillend van mekaar af, so gewoonlik in die industrie wat hulle doen is, die 20 kilometer sone is om seker te maak ... Onthou soos wat ons gesê het daardie bote het goed wat ten minste 10 kilometer partykeer agter hulle aanvrek en in hierdie geval het hulle gesê dit gaan 8 kilometer wees. Jy weet, so, partykeer is dit lang goed en vir daardie bote om om te draai, dit vat hom 'n goeie 20 of 30 kilometer om om te draai. Hy kan nie net besluit hy gaan nou 'n u-turn maak nie. So, daardie draaisone en goed is om seker te maak dat as daar ander bote in daardie omgewing is, dat hulle nie oor daardie bote ry nie en dat hulle nie die vissermanne seermaak nie. Dit is hoekom hierdie ouens met die infrarooi op die bote sit en kyk is daar ander skepe wat hy gaan seermaak? Miskien het die ou nie 'n AIS nie en al daardie tipe goed en dan moet hulle daardie tyn kan draai. So, dit gaan nie oor die hardheid van die geraas nie, dit gaan nie oor daardie tipe goed nie. Die 500 meter sone is gewoonlik die industrie se standaard op 'n bare minimum om te kyk as die klank so hard is, hoe ver gaan hy trek en gewoonlik op daardie gedeelte bo, begin die klank afneem na 'n punt toe wat die diere dit kan hanteer. Dit sê nog steeds dat dit nie hard is nie. So, ek wil dit net duidelik stel. Daardie klanke kan 'n mens vér hoor, maar ons 'n klank vér te hoor en aan in platvloerse Afrikaans, jou alie af te skrik vir die ding en dan weg te gaan, is twee verskillende goed en daar is sekere ... 'n mens noem dit threshold shifts wat hulle na kyk. So, hulle kyk watse afwyking gaan die dier hê en wat sê die ouens met die dik brille en wit jaasies oor hoe wyk daardie diere af van hulle grond, van waar hulle eet, van wat hulle doen so ons probeer kyk na daardie verskillende afwykings. Ja, so ons verstaan dat dit die visserye en vissermanne regtig afhanklik is van daardie areas, ons weet dat hierdie is bietjie dieper gronde, so, dit is agter daardie visserybedryf se ring fence area, maar ons verstaan dat daar nogsteeds mense is wat uitgaan soontoe en dat hulle afhanklik is van daardie area en daar is mense wat afhanklik is. So, ons wil rêrig nie op dit kom trap en kom sê dat dit nie belangrik is nie. Dit is regtig, dit is vir ons belangrik en ons wil daarna kyk. Die ekonomiese voordeel. Ja, so ons kan op hierdie stadium nie weesllik praat oor die ekonomiese voordele van hierdie projek self nie. Hierdie projek self gaan op hierdie stadium nie vir Suid-Afrika 'n ekonomiese voordeel hê nie, maar as ons net kyk na die identifisering en hierdie potensiële toekomstige gebruik van die goed is daar miskien 'n ekonomiese voordeel. Hoe daardie voordeel dan gaan versprei word in Suid-Afrika en hoe hy gaan gebruik word in Suid-Afrika, daardie is ook nog op in die lug en ons kan ook nie rêrig sê hoe dit gaan gebeur nie. Wat die ouens daarmee gaan doen en wat die situasie gaan wees, is op hierdie stadium moeilik om te sê. Dit gaan afhang van 'n klomp goed, van watse bron daar is, is dit gas, is dit olie, is daar niks, is daar iets anders wat hulle kry dalk? Jy weet daardie tipe goed. So, 'n mens kan nie op hierdie stadium enigiets sê oor die ekonomiese voordeel nie, maar wel die belangrike ding om in ag te neem as 'n mens na daardie tipe goed wil kyk en as 'n mens nou net na hulpbron identifisering kyk en 'n mens vergeet nou vir 'n klein gedeelte van die ander goed is dat 'n mens nie hierdie goed nou doen nie gaan jy nie later die hulpbron kan identifiseer en kyk of jy dit kan gebruik as deel van ons transition of as deel van ons energie mix of ons deel van daardie tipe goed nie. So, hierdie

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	is, as ons praat van die water wat onder die brug moet loop, hierdie is deel van die water wat onder die brug moet loop voordat hulle daardie hulpbron kan identifiseer. So, ek probeer maar net die proses verduidelik. Ons keur dit nie goed nie, maar ons sê dit is deel van die ekonomiese goed wat hulle moet doen voor die tyd. So, dit gebeur natuurlik nie in isolasie nie, dit gebeur binne-in omgewing en dit gebeur binne-in die visserybedryf en dit is hoekom 'n mens deur die EAI proses moet gaan om te kyk wat daardie impak is en of daar genoegsame voordele uit die projek gaan kom om dit dan te kan goedkeur. En dan ja, ons stem saam, rêrig ons is bewus daarvan dat dit julle kultuur is, dat dit belangrik is vir julle, dat dit julle lewenswyse is en ons is bewus van die free and prior informed consent. Ons werk soveel as moontlik volgens dit. Ons weet dat die wetgewing in die land nie altyd ooreenstem soos wat dit dalk moet nie. Ons neem dit in ag, maar ten spyte van dit probeer ons nogsteeds by julle uitkom, ons probeer by die gemeenskappe uitkom om te kom hoor wat hulle te sê het en ons wil dit as 'n sleuteldeel van ons proses insluit. Dit is vir ons baie belangrik om dit deel te maak. So, alhoewel daar nog baie goed gedoen moet word om dit in Suid-Afrika op 'n baie beter manier in te sluit en goed, is daar op hierdie stadium is die wetlike proses hierdie NEMA publieke deelnameproses waar daar in alle wetgewing publieke-deelname prosesse is. So, ons erken dit. Ons weet dat daar byvoorbeeld ander ouens is wat kyk na hierdie, na breër prentjies, byvoorbeeld ek weet nie of julle gesien het van Mnr Pedro Garcia en goed nie, maar hy het ook sy idees. So, ek dink daar is baie wat 'n mens kan gaan leer by hom en ek dink daar is baie goeie idees wat uit daardie goed uitkom. Ek dink daarna moet ook gekyk word. So, ons het met hom ook gaan gesels en gehoor wat hy te sê het en dink ons as 'n bedryf kan baie by dit leer en by julle leer oor die praat van daardie goed. *Thank you so much Chief. It was a fairly detailed, nicely laid out section. Yes, in terms of NEMA, yes, it's the Environmental Act that we use, it's the Environmental Act that we have to work under. That's what Chief quite rightly said, it's People, Planet and Profit. So, we want to assure, that's certainly why we're trying to look at the People, Planet and Profit portion of it. At this point, it's the reconnaissance phase of the thing, you know, so, there's not an awful lot of profit in this project for the guys who come to do it. The guys who come here are doing it at this point, yes, they're going to collect data but it's going to cost them a lot of money to collect that data. The idea is that they can then sell it but that that sale of the data will then have to be used at some point to identify the resources here and then use the resources here. So, we understand what you're saying, we agree with what you're saying. I just want to say that unfortunately I can't speak of in terms of the collusion that's there between the departments and stuff, as much as I want. In terms of the collusion between TGS and Searcher and EIMS, there is no collusion there. We are a service provider. We do services for those guys but we don't do it so we can get any benefit out of it, we don't have shares in TGS or shares in Searcher, we don't do better or we don't win from it if they do better, we have to get paid whether they get the approval or not.* *So, we're not in it to go do a large-scale exploitation of the environment and then make money from it. We're there to go and see what's the impact on the environment, is that impact manageable and we can make sure that the environment is protected from it. And remember we have an integrity that we have to work towards and we have to make sure that we work according to those codes and stuff. So, we can't just go do willy nilly. We know there are consequences for us. We understand that we can't just go and say whatever we want, we have to be able to, if we make a statement, we have to be able to follow up on that statement and we have to be able to substantiate that from research, interact with you guys and understand how the environment works and that type of stuff. So, that's really important to us and we just want to make sure that there's no ambiguity about it. In terms of the acoustic impacts, yes an impact is unfortunate as we look at it in our industry is an impact not a black and a white thing. An impact is a grey thing. So, if I'm going to run now and I jump into the water there, I have an impact on the algae and I jump on the water and stuff but I don't eradicate all the algae. Understand? So, I understand if we work in our lives every day, we all have an impact on the environment and I'm not trying to condone TGS or*

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	Searcher or whatever's impact right now, but I'm trying to say that an impact isn't necessarily a death channel for that thing. So, that's not how we look at the impacts, an impact is a grey story and we have to go and see if he's black, if he's very grey, then it's high impact and then we have to say no, we can't do that. But if the impact is closer to white, then one can look, okay, listening is that impact... Can we manage it, we can make sure that we hire these guys to go and see that if maybe there's a dolphin or a shark or a fish or whatever is arriving in that area, that one can protect them because the reason they put it off is so that one can protect that thing because you know if you take one whale out of the food chain you're affecting the whole food chain, understood? So, we're trying to build that type of stuff in, you know, so we're trying to protect it. So, we understand that impact is this vague understanding, but we're trying to quantify that impact in a way. We're trying to put a number in that impact so we can say this is high, this is inadmissible or this is low, one might be able to manage it, one could look at it. *We don't necessarily have to agree on that, but I'm just trying to explain to you guys how we look at it. If you guys agree on that, that's fine. That's exactly how we, you know, I'm trying to give you our process on that. Then yes, the sound is loud, the sound is clearly loud and we don't want to hide it. We certainly need to come and see it. So, that's exactly why we did that modulation, and whether we're doing that modulation for these guys. So we can watch okay if these guys are going to sail their ship there and how long they're going to sail there and how often they're going to sail there, whatse, how long and how far and how big is that sound wave going to be, in other words what frequency is he going to be, what animal can hear him then or not, how far he's going to pull and how hard he's going to be further from the ship, closer to the ship, all that type of stuff. And then one can start looking at the safety zones and look at is that safety zone enough? Isn't it, should we just leave it alone or not because sometimes the sound gets louder so further it goes depending on the ocean bottom, all that type of stuff. So, we asked that all those guys look at that stuff. So, I agree it's loud, one has to look at it. Another thing to remember is one cannot directly compare the sound that happens in the water and the sound that is in air like this, one cannot compare. The sound is at other frequencies, is lower frequencies so he might be able to go further, but he might not always go... If one says 240 decibels on land and at sea that might be another thing. So, we have to go and look at that difference as well and different animals listen to that type of stuff in different ways. So, we asked that those guys also then go and see what the impact of that different stuff is.* *Then in terms of the human activities inside the 20 kilometer zone and the 500 meter zone. The reason for those two zones is different from each other, so usually in the industry what they do is, the 20 kilometer zone is to make sure... Remember as we said those boats have stuff that pulls behind them at least 10 kilometres and in this case they said it was going to be 8 kilometres. You know, so, sometimes it's long stuff and for those boats to turn around, it takes him a good 20 or 30 miles to turn around. He can't just decide he's going to make a u-turn now. So, that turning zone and stuff is making sure that if there are other boats in that area, that they're not riding over those boats and they're not hurting the fishermen. That's why these guys are sitting on the boats with the infrared and watching are there other ships he's going to hurt? Maybe the guy doesn't have an AIS and all that type of stuff and then they should be able to twist that line. So, it's not about the loudness of the noise, it's not about that type of stuff. The 500-meter zone is usually the industry's standard at a bare minimum to watch if the sound is so loud, how far it's going to pull and usually on that section above, the sound starts to decrease to a point the animals can handle it, it still says it's not loud. So, I just want to make that clear. Those sounds one can hear far away, but to hear a sound far away and to scare off the thing in flat-floor Afrikaans, your ale, and then to leave, is two different things and there are certain... one calls them threshold shifts they look at. So, they look at what kind of anomaly the animal is going to have and what do the guys with the thick glasses and white coats say about how do those animals deviate from their land, from where they eat, from what they do so we try to look at those different disorders, yes, so we understand that it's the fisheries and fishermen are really dependent on those areas, we know that these are a little bit deeper grounds, so, it's behind that fishing industry's ring fence area, but we understand that there are still people who go out*

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	there and that they depend on that area and there are people who are dependent. So, we really don't want to come and step on it and come and say it's not important. It's really, it's important to us and we want to look at it. *The economic benefit. Yes, so we can't talk terribly about the economic benefits of this project itself at this point. This project itself will not have an economic benefit for South Africa at this stage, but if we only look at the identification and this potential future use of the goods there might be an economic benefit. So how that benefit is going to be distributed in South Africa and how it's going to be used in South Africa, that's still up in the air and we can't really say how it's going to happen either. What the guys are going to do with it and what the situation is going to be is hard to say at this point. It's going to depend on a bunch of stuff, from what source there is, is it gas, is it oil, is there nothing, is there anything else they get maybe? You know that type of stuff. So, one can't say anything about the economic benefit at this point, but the important thing to consider if one wants to look at that type of stuff and if one just looks at resource identification and one forgets now for a small portion of the other stuff is that one doesn't do this stuff now you're not going to be able to identify the resource later, and see if you can use it as part of our transition or as part of our energy mix or our part of that type of stuff. So, this is, if we're talking about the water that has to run under the bridge, this is part of the water that has to run under the bridge before they can identify that resource. So, I'm just trying to explain the process. We don't approve of it, but we say it's part of the economic good they have to do ahead of time. So, obviously it doesn't happen in isolation, it happens inside environment and it happens inside the fishing industry and that's why one has to go through the EAI process to see what that impact is and if there are going to be sufficient benefits to be able to approve it then.* *And then yes, we agree, we're aware that this is your culture, that it's important to you, that it's your way of life and we're aware of the free and prior informed consent. We work according to it as much as possible. We know that the legislation in the country does not always match up as it perhaps should. We take that into account, but despite that, we're still trying to get to you, we're trying to get to the communities to come and hear what they have to say and we want to include it as a key part of our process. It is very important for us to make this a part. So, although there is still a lot of good to be done to include it in South Africa in a much better way and well, at this stage the legal process is this NEMA public participation process where there are public participation processes in all legislation. So, we admit it. We know that there are other guys, for example, who look at this, at broader pictures, for example, I don't know if you've seen of Mr. Pedro Garcia and stuff, but he also has his ideas. So, I think there's a lot that one can go and learn from him and I think there's a lot of good ideas that come out of that stuff. I think that should be looked at as well. So, we also went to talk to him and heard what he had to say and think we as an industry can learn a lot from that and learn from you guys about talking about that stuff.*
d.	**Enrico Adams** My agtergrond is, ek ook maar marine mamal-ondervinding onder my. Ek is 'n kommersiële duiker. Ons doen kommersiële werk. So, ek is ook 'n bootelenaar, maar 'n ander tipe bootelenaar. Ek vang nie vis nie. Ek het gewerk met vis, enige vis, anchovy, Rudi weet. Ons het samplings gedoen enige ding. Ons het data ge-collect en ek praat daar vir myself so ek voel dat 'n transition en klein vissers saam kan bestaan. Dis net uit my oogpunt uit. En dat ons moet besluit op die ou einde van die dag, wil ons energy sufficient wees, of wil ons dependent wees. En ons moet frank wees daarop op die einde van die dag en clear kom met waar jy staan met energy sufficiency en of jy daarteen is. Die volgende is net 'n vraag aan EIMS is hoe word 'n mens deel van die Environmental Impact van die staanspoor af? Is dit 'n sekere, kyk julle gaan nou vir (wat is die ding se naam?) Searcher ook verteenwoordig en julle hoor daar die vrae wat gevra word, obviously. Is daar nie werkswinkels of deelname in julle proses hoe julle die gemeenskappe kan betrek wat meer wil weet oor hoe dit gedoen word nie, want ek voel altyd as ek nie 'n ding verstaan nie

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	dan gaan ek altyd negatief daaroor wees. Ek moet dit verstaan en ek moet dit uit die staanspoor uit verstaan en as ek bedoel uit die staanspoor uit jy kan vir my sê daardie ding is 20 meter lank nie. Ek het hom nie gesien nie, so ek gaan nie jou woord vat hy is 20 meter lank nie. Ek wil hom sien, nou gaan ek sien oukei wat maak hy en ek sê nie jy moet almal of van ons almal hier op die boot vat, ons gaan nou 'n jolly ride vat ons gaan nou hoor wat gaan die ding maak nie, een of twee mense. Word of mouth is 'n baie powerful ding en as een of twee mense kan op so ding gaan en hy kom terug na daardie ondervinding en hy verduidelik vir ons in meer detail wat gedoen was dan dink ek sal ons sal my denkwyse ... Ek vat dit vir my ook. Soos ek sê ek praat vir my, sal my denkwyse oopgaan op die einde van die dag. Dis hoe ek voel oor die hele storie. *My background is, I too but marine mamal experience under me. I'm a commercial diver. We do commercial work. So, I'm also a boat owner, but a different type of boat owner. I don't catch fish. I've worked with fish, any fish, anchovy, Rudi knows. We've done any thing. We've collected data and I'm speaking for myself there so I feel like a transition and little fishermen can coexist. It's just from my point of view. And that we have to decide at the end of the day, do we want to be energy sufficient, or do we want to be dependent. And we've got to be frank on that at the end of the day and come to terms with where you stand with energy sufficiency and whether you're against it. The following is just a question to EIMS is how does one become part of the Environmental Impact from the outset? Is that a certain, look you guys are going now for (what's the thing's name?) Searcher also represents and you guys already hear the questions asked, obviously. Aren't there workshops or participation in your process how you can engage the communities that want to know more about how it's done, because I always feel like if I don't understand a thing then I'm always going to be negative about it. I have to understand that and I have to understand it from the outset and if I mean from the outset you can tell me that thing is 20 metres long. I haven't seen him, so I'm not going to take your word he's 20 yards tall. I want to see him, now I'm going to see okay what does he do and I'm not saying you should take everyone or some of us all here on the boat, we're going to take a jolly ride now we're going to hear now what's going to make the thing, one or two people. Word of mouth is a very powerful thing and if one or two people can go on such a thing and he comes back to that experience and he explains to us in more detail what was done then I think we'll have my way of thinking... I take it for me too. As I say I speak for me, my way of thinking will open up at the end of the day. That's how I feel about the whole story.* **GP Kriel** Baie dankie vir dit. Ons sal ook jou kommentaar opneem en dit sê. Hoe 'n mens deel raak van die proses is deur op hierdie stadium deel te neem aan prosesse soos hierdie. Soos ek gesê het ons wil graag terugkom en kom meer vertikswinkel oor wat ons gekry het en goed maar ek verstaan dat daar ... Jy weet dit is hierdie vae begrip van 'n mens weet nie eintlik wat aangaan nie totdat jy dit gesien het nie so dit is 'n goeie punt. Ek dink dit is dalk iets om in ag te neem dat 'n mens dalk 'n kyk of daar kan geleenthede wees om dit te doen sou hulle goedkeuring kry dat daar miskien verteenwoordigers van die gemeenskap betrokke is by hierdie tipe goed dat hulle dalk ek weet nie geleenthede kry om op die boot te gaan as dit goedgekeur word. Ons is besig om na daardie tipe goed te kyk jy weet en dat daar half 'n oversight rol of iets soos dit kan wees op die bote. Miskien is so iets is dalk dit. 'n Ander ding waarna 'n mens ook moet kyk is watse geleenthede is daar vir opleiding, vir onderrig in hierdie tipe goed. Jy weet hulle is dalk net vir drie of vier maande hiërso of wat ookal wat hulle deel is met hulle goed of vir 70 dae maar dat hulle op 'n langer termyn jy weet 'n impak het in terme van die onderrig en in terme van jy weet, 'n bydrae tot die gemeenskap en daardie tipe goed. Jy weet as hulle kom deelneem in die gemeenskap moet hulle tog kom deelneem in die gemeenskap. As hulle die vissersgronde kom impak hê dan moet hulle tog kom deelneem en op 'n groter manier ook. So, ons is besig om te kyk na daardie tipe goed. Ons sal kyk hoe 'n mens dit dalk kan integreer as dit moontlik is.

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RD3

EIMS

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ EIMS Ref	1520	Projek Naam/ Project Name	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	Thank you so much for that. We will also record your comments and say so. How one becomes part of the process is by participating in processes like this at this point. Like I said we'd like to come back and get more workshop on what we got and stuff but I understand that there... You know it's this vague understanding of one doesn't actually know what's going on until you've seen it so that's a good point. I think it might be something to consider that one might have a look at if there might be opportunities to do that should they get approval that maybe there are representatives of the community involved in this type of stuff that they might I know don't get opportunities to go on the boat if it's approved. We're looking at that type of stuff you know and that there could be half an oversight roll or something like that on the boats. Maybe something like that might be it. Another thing that one should also look at is what opportunities there are for training, for teaching in this type of stuff. You know they might only be here for three or four months or whatever oh whatever they share with their stuff or for 70 days but that in a longer term you know they have an impact in terms of the teaching and in terms of, you know, a contribution to the community and that type of stuff. You know if they come to participate in the community they have to come and participate in the community. If they come to impact the fishing grounds then they have to come and participate and in a bigger way as well. So, we're looking at that type of stuff. We'll look at how one might be able to integrate it if it's possible.
a.	**David Harper** *I have some concerns with the EIMS doing a survey for multiple companies. Which are in effect where I see it competing. So, the question is, what are the risks of competing companies trying to influence the EIA's of their rivals and secondly will EIMS sell the data to interested parties or is EIMS doing the survey for someone specific?* **GP Kriel** *Like I said, we are doing it separately. We created two separate teams in this and I think you know some of the specialists will also know, I was involved in presenting some of the Searcher stuff but I am not involved in running the day-to-day stuff for the Searcher stuff, I am running the TGS project and carrying on with that on its own. We are still ... we are assessing both of it on its merits and we are fortunately in the position where everything that we do is going to get scrutinised by the public in anyway. So, if there are gaps, if there are holes if we are doing stuff in an incorrect way, you as the public will have full access to all of that stuff to be able to see whether we are doing anything illegally. And so our real purpose in this is not to do it in that way but the opportunity is there for us to have a common understanding of the area and to then to be able to implement that and make sure it is described accurately. So, we really do not want to hide anything, we were not colluding with anyone, we are not doing the survey ourselves at all. We are doing the assessments to determine if the survey itself should go ahead. So, we are not selling any data to anyone. We are just involved in assessing the impact of it and determining whether an environmental authorisation is something that should be pursued or not. So, from that point of view we are completely independent and we are open the public scrutiny in everything we do on this. So, should there be something that we are not doing correctly then that is open to you guys to point that out to us. And again like I said whatever we decide and whatever we promote at the end of the process, well promote is not the right word, but whatever our opinion is at the end of the process that will then go to the decision-makers. They will then have to scrutinize that and see whether that is correct or not and when they make their decision it is a whole process. So, although it goes to the DMR there is a whole lot of other stakeholders and key role players within those departments and other departments that come together to make that decision. And then even after that, I mean as you all know should the decision be positive for the guys or even negative and people want to appeal against that then that is that, they can appeal against that. So, it is an open process it is not something that has been done you know cloak and dagger. We really do not want to do any of that. So ja, that is the process. And fortunately we live in a*

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EIMS

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	country where even if you do not agree with what the minister says after the appeal period that you can then go and challenge that in court if you want to. So, we still live in a fairly free and open society where that avenue is still also available to you. So, we are not trying to hide anything we are just trying to do the assessment to the best of our abilities.
f.	**Pia Plougman** *I do not know how successful the previous surveys have been but has it been majorly successful and what are they hoping to find in this new zones that they will not find further towards the coast and how much is that? What is the cost? Because you can already hear that there have been impact from those surveys closer to the coast. I do not know if I am making sense in my question?* *If they have not found substantial amount of gas or oil closer how much more are they hoping to find further out at sea? And is it worth the damages already done?* **GP Kriel** *There have been a lot of surveys that have been done in the past and that started over decades ago. So, I think they started in the late seventies I mean the guys can probably correct me here, but it is in the late 70's, 80's, 90's. It was a fairly aggressive push to do all of that stuff so it was done quite a bit and then it continued through the 2000's as well. Back then it was bit more cowboy than it is right now so the standards have increased significantly. There is a lot more scrutiny on it. So, even the technology that they are using is significantly advanced from what it was in the past. So, it is not just a little let us throw a bomb at the back of the boat and let it explode and record that. It is a bit more calculated and bit better technology. In terms of the impact you know unfortunately along the coast there have been seismic surveys that have been done and they have found a significant amount of oil and gas and that is largely as a result of the Orange Basin and how it tops the oil. So, there is a significant amount of resource there. The problem is that we need to be able to quantify that I think as a country. So I think that is the reason why the guys are interested in that. Obviously, there are financial benefits. Obviously, there is a whole lot of other reasons to want to come into something like that, but I think that is probably the reason why they want to do it. So, like I said in that particular area, there are not so many of those survey lines. So, again, it is probably to just establish what is there, and if there is something to pursue further. Like I tried to explain earlier, is this is the first step in the process of this. So, first you do your reconnaissance, then you do further exploration which typically involves sticking a borehole, or drill into the ground and drilling a few kilometres down in to see what there is and how much there is and then you have to seal that up, plug it, abandon it properly and make sure that you do not mess that up, and then you come back if there is something viable, and you know that you have got sufficient quantities, depending on the price of the oil, social, economic conditions and the geopolitical conditions around the earth to then go and exploit that.* *Unfortunately, the Wes Coast is an area that has been impacted by a lot of things. Not just seismic surveys. So, if you go up and down the coast, I am sure we are all well aware of that, there is a lot of mining going on, there is a lot of fishing going on, industrial fishing itself, which also has a massive impact on stock levels and on just the habitat at the bottom of the ocean and in the ocean. And then there is a whole lot of other things. So, it is part of big shipping lands across the world and things like that. So, there is a whole host of other impacts associated with that happens on that national environment. So the 3D seismics, for sure have an impact. We need to go and quantify that and see if the impact is big enough or not and then we need to also take cognisance of the fact it happens in an already disturbed environment to a large degree as well. It is not to say that because that because it is already trashed, or disturbed, that you cannot go, or just can just go and you can just go and do what you want. You need to, exactly because of that, we need to go and make sure that we protect it in the right way. And that is why these types of*

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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*	
EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	assessments are important to quantify that risk and to see if you are going to tip something over the tipping point and make sure that you do not damage it forever. I do not know if that answered your question.

BYLAE/ APPENDICES

1. **Bywoning Register/ *Attendance Register***
2. **Aanbieding/ *Presentation***

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EIMS

Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Saldanha Bay - Hoedjies Bay Hotel	Date and Time	31 August 2022 - 16:00-19:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Johannes Swiegers	108 Road 1 Feb Hof Land, Saldanha	Tel: Cell: 074 953 2236 Email:		
Carien Cloete	VV Dam, Gouda.	Tel: Cell: Email: Callercloete@gmail.com		
Rubian Baily		Tel: Cell: Email: Rubian@GMAIL.com		
Michelle Rossa		Tel: Cell: Email: m.rossa@sanchi.com		

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EIMS

Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Saldanha Bay – Hoedjies Bay Hotel	Date and Time	31 August 2022 - 16:00–18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
K. SIAKMIE	86 WHIPPING	Tel: 0736739067 Cell: Email:		
N. Slamie	86 Whipping Str.	Tel: 063 223 9085 Cell: Email:		
X. Lawser	18 Langebaan	Tel: Cell: Email: South Salene Vaquel.co	x	
S. Smith	9 LANGEBAAN	Tel: 0717748838 Cell: Email:		

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Saldanha Bay - Hoedjies Bay Hotel	Date and Time	31 August 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Enrico Adams [redacted]	70 Mirabel Str. Sarasinia White City 7395	Tel: Cell: 076 869 6168 Email: adams.enricocom@telkom.		BBA
Charles Lakay	6 Frog Str Darlville Het Land	Tel: Cell: 0795661332 Email:		SSF
Ernie Africa	75 Van Riebeeck Str. Saldanha 7395	Tel: 061 684 5169 Cell: Email:		BBA
CHIEF IKHAESEN MARKET	9 OESTER STREET DIAZVILLE SALDANHA	Tel: 022-3205166 Cell: 083 955 8727 Email:		AKHONESE TRIBAL COUNCIL

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Saldanha Bay - Noordhes Bay Hotel	Date and Time	31 August 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Cornelius Mostert	141 Whipping	Tel: 084 756 2203 Cell: Email: cjmostertapp@gmail.com	C. Mostert	Coastal Links
ANDREW APRIL	5 ANGEL ST	Tel: Cell: - Email:		11
WATCH FOURIE	906 REZIA ALEIDA ST. PRETORIA	Tel: 082 851 3575 Cell: Email:		P&S HERITAGE
DAVID HARPER	LANGEBAAN	Tel: Cell: 076 808 8839 Email:	D	SLR AFRIFORUM EN V. AFFAIRS

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TOS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Saldanha Bay - Hoedjies Bay Hotel	Date and Time	31 August 2022 - 16:00–18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
MIE VANGOM	14 HOASBANKER STREET W/CITY SALDANHA	Tel: Cell: 066 180 6348 Email:		
JOHN VANGOM	14 HOASBANKER STREET W/CITY SALDANHA	Tel: Cell: 083 626 8744 Email:		
Sam-Mari Auret Ilse Auret		Tel: Cell: 082 923 9687 Email: samari@equispeches.co.za Tel: 0828280668 Cell: ilse@equispeches.co.za Email:		

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Saldanha Bay - Hoedjies Bay Hotel	Date and Time	31 August 2022 - 16:00–19:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Pia Plougmann	1 Van der Hoar, Kommetjie	Tel: Cell: 073 664 2228 Email: piaplougmann91@gmail.com		
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		Tel: Cell: Email:		
		Tel: Cell: Email:		

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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*	
EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

VERADERING BESONDERHEDE/ *MEETING DETAILS*

Vergadering/ *Meeting*	1520 Pre-application Consultation Public Meeting		
Vergadering Plek/ *Meeting Venue*	Lamberts Bay Community Hall	Date	2022/09/01
		Time	16h00-18h00

Teks in *italics* is uit die Afrikaanse teks vertaal. *Text in italics has been translated from the Afrikaans text.*

'n Openbare vergadering is geskeduleer tydens die vooraansoekfase met die Belanghebbende en Geaffekteerde Partye (I&APs). Die doel van die vergadering was om die aanvanklike bekommernisse van die lede van die publiek en belangrike I&APs vas te lê. Tydens die openbare vergadering wat tussen 16:00 en 18:00 plaasgevind het, is 'n aanbieding van die projekbeskrywing, voorlopige impakassessering, projekspan en projekttydraamwerke aan alle deelnemers van die vergadering deur Environmental Impact Management Services (EIMS) Pty (Ltd) gelewer. 'n Aanbieding is deur mnr GP Kriel van EIMS in Afrikaans gelewer. SEICHE het 'n aanbieding gelewer oor die omgewingsversagting wat tydens seismiese opnames in terme van die Marine Soogdier Waarnemer (MMO) en Vissakkelbeampte (FLO) in Afrikaans uitgevoer is. Die aanbieding is deur Mnr Rudian Baily gelewer. Nadat die aanbiedings afgelewer is, is 'n vraag- en antwoord sessie geopen waar deelnemers vrae gevra het of hul kommentaar oor die projek uitgespreek het. Die bywoningsregister is aangeheg as 'n aanhangsel tot hierdie dokument.

A Public Meeting was scheduled during the pre-application phase with the Interested and Affected Parties (I&APs). The aim of the meeting was to capture the initial concerns from the members of the public and key I&APs. During the public meeting which took place between 16h00 and 18h00, a presentation of the project description, preliminary impact assessment, project team and project timeframes was delivered to all attendees of the meeting by Environmental Impact Management Services (EIMS) Pty (Ltd). A presentation was delivered by Mr GP Kriel from EIMS in Afrikaans. SEICHE delivered a presentation on the environmental mitigation carried out during seismic surveys in terms of the Marine Mammal Observer (MMO) and Fishing Liaison Officer (FLO) in Afrikaans. The presentation was delivered by Mr Rudian Baily. After the presentations were delivered, a question and answer session was opened where attendees asked questions or expressed their comments regarding the project. The attendance register has been attached as an appendix to this document.

AGENDA

Item
1. EIMS Aanbieding/ *EIMS Presentation*
a. Bekendstelling van die projekspan/ *Introducing the project team*
b. Projekbeskrywing/ *Project Description*
c. Regsaansoekproses/ *Legal Application Process*
d. Publieke Deelname/ *Public Participation*
e. Impakbepaling/ *Impact Assessment*
f. Projek Kontak Besonderhede/ *Project Contact Details*
g. Aanbieding van SEICHE/ *Presentation from SEICHE*
2. Vraag en Antwoord/ *Questions and Answers*

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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*		
EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

NOTULE/ *MINUTES*

Item No	Item
1.	Alle deelnemers is versoek om die bywoningsregister te onderteken soos hulle ingeskryf het. Aanbiedings van EIMS en SEICHE van die projekbeskrywing, aansoekproses en omgewingsversagtings tydens seismiese opname is gelewer volgens die agenda hierbo aan die vergaderinggangers. Daar is aangedui dat die vergadering opgeneem sou word vir die doeleindes van akkurate notule neem. Agtergrondinligtingsdokumente (in Engels, Afrikaans en isiXhosa), kommentaarvorms, registrasie, inligtingsuitdeelstukke en bywoningsregisters is by die vergadering beskikbaar gestel. Die deelnemers is aangemoedig om hul kommentaar en bekommernisse in te dien deur die kommentaarvorms in te vul wat verskaf word of deur kommentaar in te dien by die projek-e-posadres wat verskaf is. Daar is opgemerk dat alle deelnemers wat hul kontakbesonderhede verskaf het, by verstek geregistreer sal word op die I&AP-databasis wat deur EIMS gehandhaaf word. As aanleiding van die aanbiedings is die vloer oopgemaak vir 'n bespreking en die deelnemers is aangemoedig om enige vrae of bekommernisse wat hulle oor die projek gehad het, op te stel. *All attendees were requested to sign the attendance register as they entered. Presentations from EIMS and SEICHE of the project description, application process and environmental mitigations during seismic survey were delivered as per the agenda above to the meeting attendees. It was indicated that the meeting would be recorded for the purposes of accurate minute taking. Background Information Documents (in English, Afrikaans and isiXhosa), comments forms, registration, information handouts and attendance registers, were made available at the meeting.* *The attendees were encouraged to submit their comments and concerns through filling in the comment forms provided or by submitting comments to the project email address provided. It was noted that all attendees who have provided their contact details would be registered by default on the I&AP database maintained by EIMS. Following the presentations, the floor was opened for a discussion and the attendees were encouraged to bring up any questions or concerns they had about the project.*
2.	**Vrae en Antwoord/ *Questions and Answers***
a.	**George Lenee** Goeie dag. Ek is George Lenee. Ek is 'n visserman. Ek sien nou hierdie koördinate, wat julle hier aanbied, hier op die blaai, is dit in-shore of op land of wat is dit? Want ek hoor julle gaan nou 120 kilos buite Saldanha wees né? Ons het 'n visbank, omtrent ses-en-vyftig of sewe-en-vyftig myl van Saldanha af. Waar jy van November af, né, vir drie maande tuna vang. As dit nie nog langer is nie. So, dit is op in die Wes, by Saldanha op. Hier by jou, sien julle gaan hulle 'n honderd-en-twintig hier af, kilo's uit, daarvan Saldanha, Hondeklipbaai toe. Hier lê buitekant Doringbaai, lê 'n vyftig myl bank wat ons ook elke jaar, ook seker so vir twee maande, tuna vang. So, en dan kyk die koördinate hierso die nommers. Dit is waar ons gewoonlik daardie ding van die stryd in die drie-en-dertig; dit is 'n Snoekmerk. Daardie is al. Dit is alles visvangmerke wat ons elke jaar ... En julle sê julle gaan iets ... Ons kan nie 'n Snoeksaksoen bepaal nie. Dit is alles te doen met klimaat "change". Vanjaar, ons moet nou al vlugtyding het, maar ons vang nie vis nie. So, hoe gaan julle die oes se Snoek bepaal? Wanneer is dit die Snoektyd? *Good day. I'm George Lenee. I'm a fisherman. I see now these coordinates, what you guys are presenting here, here on the page, is it in-shore or on land or what is it? Because I hear you're going to be 120 kilos outside Saldanha now, right? We have a fish bank, about fifty-six or fifty-seven miles from Saldanha. Where you catch tuna from November, say, for three months, if not even longer. So, it's up in the West,*

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	up at Saldanha. Here with you, you see them going down a hundred and twenty here, kilos out, from Saldanha, to Hondeklip Bay. Here lies outside Thorn Bay, lies a fifty-mile bank which we also catch tuna every year, also probably for two months. *So, and then the coalinoites check the numbers. That's where we usually do that thing about the fight in the thirty-three; it's a Snoek Mark. That's all. These are all fishing marks that we have every year... And you say you're going to do something... We can't determine a Snoek season. This is all to do with climate "change". This year, we should have fished by now, but we're not catching fish. So how are you going to determine the harvest's Snoek? When is it the Snoek Time?* **GP Kriel** So, ons het 'n redelike goeie idee van die navorsing en van die opnames en goed wat gedoen word. Deur word elke jaar, deur die Departement van Visserye, en Bosbou, en daardie ouens. So, hulle kyk na al die inligting wat vir die vissermanne afkom, en van die vissarbote afkom, en al daardie tipe goed. So, ons het 'n redelike idee van waar die ouens visvang, en waar die vissersgronde is. Ek sê nie daardie data is altyd perfek nie. So, ons gaan vir julle wys wat ons gekry het, en dan gaan ons terugkom en dan kan julle ook vir ons sê, "Okay, maar luister, daar het ons dit gevang. Daar het ons dit gevang op daardie tyd van die jaar. So, ons is nog steeds oop vir julle om ook vir ons te kom sê, okay. Wat ek wel wil sê is daardie hele aansoek area daarso, is van die ... En die industriële ouens doen. Ek praat nie nou van julle goed nie. Ek praat van die groot industriële boue en daardie ouers, wat hulle noem die Fisheries Ring Fence. So, dit is agter daardie hele storie. Dit is van die kontinentale bank, basies, af wat hy dieper ingaan. So, dit is daar waar die water, jy weet, 'n duisend meter diep is, en dieper raak. So, dit is min or meer die diepte daar, maar versekar es daar goed is wat in ons verslag nie staan nie, of ons vissery persoon se verslag nie is nie, en dan ... Ons gaan nou vir julle kom wys. So dan kan julle vir ons sê, "Okay, maar daar stem ons nie saam daarmee nie. Daardie is wat ons weet. Hierso, ons vang daar vis. Wat ons gaan doen is, ons het gaan kyk na die verskillende "spawning" areas. Ons gaan kyk na waar die verskillende ... Waar die groot hoeveelheid eiers lê. Waar al daardie tipe goed is. So, ons gaan kyk na al daardie verskillende goed en dan kyk ons waar die ... Want hulle noem dit die "recruitment" areas. Al daardie goed is in hoe die visse beweeg in en uit dit uit. Ons probeer al daardie goed na kyk en dan te probeer vasstel wat die rigting is waarheen hulle gaan beweeg. Wat die seisoen is vir al daardie goed. Soos ek gesê het, ons is ook afhanklik van julle, van julle kennis hierso. So, as daar iets is wat ons nie daarin ingesluit het, of iets is wat julle nie mee saamstem nie; moet julle dit asseblief vir ons sê. Ons kan nie net op daardie bronne kyk nie. Julle is die ouens wat op die waters is. So, soos ek gesê het; hierdie is die inisiële gedeeltes. Ons gaan weer ons moet uitkyk vir daardie goed. As ons terugkom dan gaan ons met julle kom gesels en dan kan ons hoor wat sê julle. *So, we have a pretty good idea of the research and of the surveys and stuff that's being done. There's every year, through the Department of Fisheries, and Forestry, and those guys. So, they're looking at all the information that's coming down for the fishermen, and coming down from the fishing boats, and all that type of stuff. So, we have a fair idea of where the guys are fishing, and where the fishing grounds are. I'm not saying that data is always perfect. So, we're going to show you what we got, and then we're going to come back and then you can also tell us, "Okay, but listen, there we caught it. There we caught it at that time of year. So, we're still open for you guys to come and tell us too, okay. What I do want to say is that whole application area, is from the... And the industrial guys do. I'm not talking about your stuff right now. I'm talking about the big industrial boats and those guys, what they call the Fisheries Ring Fence. So, it's behind that whole story. It's from the continental bank, basically, that he goes in deeper. So, it's there where the water, you know, is a thousand meters deep, and gets deeper. So, that's more or less the depth there, but certainly if there's stuff that's not stated in our report, or our fisheries*

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EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

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	person's report isn't, and then... We're going to come and show you now. So then you can tell us, "Okay, but there we don't agree with that. That's what we know. We catch fish there. *What we're going to do is, we want to look at the different "spawning" areas. We're going to take a look at where the different... Where to lay the large amount of eggs. Where all that type of stuff is. So, we're going to look at all that different stuff and then we'll see where the... Because they call it the "recruitment" areas. All that stuff is in how the fish move in and out of it. We try to look at all that stuff and then try to figure out the direction where they're going to move. What the season is for all that stuff. As I said, we are also dependent on you, on your knowledge. So, if there's something we haven't included in it, or something you guys don't agree with; please tell us that. We can't just look at those sources. You're the guys who are on the waters. So, like I said; these are the initial passages. We're going to know we have to look out for that stuff. When we come back then we're going to come and talk to you and then we can hear what you're saying.*
b.	**Rooey Shoshois** Ek lewe uit die see uit. Ek is 'n visser. Ek wil weer sê wat ek in alle vorige vergaderings gesê het, dat die eksperimente gaan nie werk vir ons nie. Dit gaan ons lewensbestaan afsny. Ek gaan nie weer verduidelik wat ek in alle vorige vergaderings verduidelik het nie, maar ek het twee vrae. Die eerste een is, "Voorlegging wat julle nou hier gedoen het; het julle alreeds hier in Lambertsbaai gekom doen?" Dieselfde voorlegging. Al verskil wat ek nou hier sien is, julle begin nou nader aan die kus beweeg. Wat ek wil sê rondom die twee honderd ses-en-vyftig kilometer gaan julle nou in die see "explore". Ceres is 'n dorp wat meer as vyf honderd weg is van Lambertsbaai af. En as Ceres se berge sneeu kry, dan voel ons die impak hier. Ek hoef nie verder vir julle te verduidelik wat ek vir julle eintlik wil sê nie. Al gaan julle op die drie honderd kilometer; gaan ons as kleinskaalse vissers, alle vissers, gaan die impak voel. Nou wil ek weet wat is die rede dat julle nou vandag weer dieselfde voorlegging kom doen, nadat julle in 'n vorige vergadering gehoor het wat is ons se gevoel. Die tweede een is, as ek kyk na die saal, wie is almal vandag hier in die saal, in vergelyking met wie was in die vorige vergadering in die saal. In die vorige vergadering het ons gehad, die heel eerste vergadering het ons gehad, die vissers, die boere kommersieel en kleinboere. Ons het toerisme hier gehad. Ons het die Environmental Departement hier gehad. Almal kon hulle sê gesê het. Alle sektors van die gemeenskap en die areas waar dit geraak is. Die tweede vergadering, toe sien ek 'n paar vissers wat baie sterk deurgekom het en gesê het, "Nee," vir Searcher. Vandag is dieselfde voorlegging, maar wat ek sien is; een visserman, twee vissermanne, drie vissermanne, en dan sien ek die jeug. Ek sien die jeug. My ore is op die grond en ek ... Kommunikeer respek vir my; laat ek klaar praat, asseblief. En ek het winde hoor waai die afgelope tyd wat betref die jeug van Lambertsbaai. Al die jong mense wat hier sit het vandag een doel hoekom hulle hier is. Ek wil graag hê u ... Ek soek nie geen lid van die gemeenskap moet opstaan en die vraag antwoord nie. U wat die voorlegging vandag hier kom doen moet vir hierdie jeug sê wat hier dit, as die goed gaan gebeur; gaan daar werk wees vir hulle, want julle gaan op die twee honderd ses-en-vyftig kilometer; gaan julle "explorations" doen. Is daar werk vir die jeug van die gemeenskap? Dit is al vir nou. Sal weer later terugkom. *I live out of the sea. I'm a fisherman. I want to say again what I have said in all previous meetings, that the experiments are not going to work for us. It's going to cut off our livelihoods. I'm not going to explain again what I've explained in all previous meetings, but I have two questions. The first one is, "What you've done here now; have you come here in Lamberts Bay already?" Same submission. All I see here now is, you're starting to move closer to the coast now. What I want to say around the two hundred and fifty-six kilometers you are now going to "explore" in the sea. Ceres is a town more than five hundred away from Lamberts Bay. And if Ceres' mountains get snow, then we feel the impact here. I don't need to explain to you further what I actually want to tell you. Even if you go on the three hundred miles; Are we*

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EIMS | NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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as small-scale fishermen, all fishermen, going to feel the impact. Now I want to know what is the reason that you are coming to make the same presentation again today, having heard in a previous meeting what we feel. The second one is, when I look at the hall, who are all here in the hall today, compared to who was in the previous meeting in the hall. In the previous meeting we had, the very first meeting we had, the fishermen, the farmers commercial and the peasants. We had tourism here. We had the Environmental Department here. Everyone could have said their say. All sectors of the community and the areas where it was affected. The second meeting, then I saw some fishermen who come through very strongly and said, "No," to Searcher. Today is the same submission, but what I see is; one fisherman, two fishermen, three fishermen, and then I see youth. I see youth. My ears are on the ground and I... Communicate respect for me; let me finish talking, please. And I've heard winds blowing lately in terms of the youth of Lamberts Bay. All the young people sitting here today have one purpose as to why they are here. I'd like you... I'm not looking for no member of the community to stand up and answer the question. You who come to do the presentation here today must tell these youth what sits here, if the stuff is going to happen; are there going to be work for them, for you go on the two hundred and fifty-six miles; are you going to do "explorations". Are there jobs for the youth of the community? That's all for now. Will come back later.

GP Kriel

Baie dankie vir dit, tannie Rosie. Ek waardeer dit. Ja, ons is bewus van die feit dat dit lyk soos duplikasie van goed. Ons verstaan dit. So, die rede hoekom dit dieselfde lyk is, is omdat dit dieselfde tipe aansoek is. Die proses, die wetlike vereistes, al daardie goed is dieselfde, en ons moet ongelukkig deur dieselfde proses gaan. So, ek is jammer as daar dalk 'n bietjie verwarring is met dit, maar dit is omdat dit 'n ander maatskappy wat ook aansoek doen, en hulle wil deur dieselfde proses gaan. Hulle wil ook dieselfde tipe goed kan doen. So, daar is ongelukkig 'n bietjie van 'n duplikasie in daardie stroom, maar dit is ongelukkig die wat wat dit vereis, en ons moet deur daardie proses gaan met dit. So, as julle wil kommentaar lewer; julle sal sien die aansoek areas is verskillend, en dit is omdat elke maatskappy; hulle werk nie saam nie. Die een sê, "Okay, ons dink daardie goed gaan ons wil hê." Die ander maatskappy sê, "Okay, ons wil dit dalk 'n bietjie op 'n ander manier doen. Ons wil kyk na 'n breër area, of 'n wyer area, of 'n kleiner area." So, dit is hoe hulle werk met daardie tipe goed. Ons beinvloed hulle nie of dit nie. Hulle sê vir ons dit is wat hulle wil doen, en dan moet ons gaan kyk of dit wat hulle wil doen okay is of nie. Of dit reg is vir die omgewing of nie, en vir die mense, en al die goed, wat dit wil kom doen. So, dit is basies hoekom daar twee verskillende prosesse is, en hoekom die baie dieselfde lyk. Maar dit beteken nogsteeds nie dat daardie prosesse nie belangrik is nie. Dit beteken nogsteeds nie dat 'n mens nie moet deelneem in daardie proses nie. So, dit is belangrik om julle sê te sê. As jy ongelukkig is daaroor. Dit is belangrik om te sê of julle vir of teen dit is, of wat ookal. Julle is geregtig om dit te sê, en julle is geregtig om dit te doen. So, ons wil nie dit kom wegsteek nie. Dan, ek verstaan daar is vissermanne wat nie hier is. Daar is dalk nie ander mense nie, maar ons het nog meer mense uitgenooi na hierdie vergadering toe as die vorige vergadering. Ons het regtig moeite gedoen om al die mense wat verlede keer hier was, het ons ook op ons lys gesit sommer net van die begin af. En as jy verlede keer by die vergadering was, het ons jou ook 'n e-pos gestuur of 'n SMS gestuur, of 'n passtuk gestuur, of wat ookal die goed daarop was, het ons uitgestuur. So, ongelukkig is daardie tipe goed . . Ons kan mense nie forseer om hier te wees nie.

Ons wil graag hê dat die mense hier moet wees om soveel as moontlik van die mense se kommentaar te hoor en daardie goed, maar, soos ek gesê het, hierdie is nie die eerste en enigste one nie. Daar is weer 'n geleentheid om en ons gaan weer terugkom, en die sal vir my "great" wees as ons dan nou 'n groot groep mense het wat ons dan hier die ding kan vasvat en hom deurwerk. So, baie dankie vir dit. Dan, in terme van die jong mense en die werkskepping en daardie tipe goed. Ja. So, ek weet nie wat se winde gewaai het, en wat se goed gesê is nie. Ek was nie deel van daardie goed gewees nie. So, ons hardloop hierdie proses, en ons gaan deur die wetlike vereistes. Ons probeer mense in kennis te stel om te sê,

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EIMS | Environmental Impact Management Services

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

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	"Kom, asseblief." In terme van die werkskepping vir hierdie fase van die projek: onthou hierdie proses is 'n langtermyn proses. So, die "reconnaissance", die verkenning, is 'n langtermyn ding. Dit is nie 'n ding wat nou gaan gebeur nie. En daardie langtermyn proses sluitend is nou verkenning vir die eerste jaar na hulle aansoek gedoen het. As hulle goedkeuring kry, dan daarna gaan hulle na eksplorasie toe, en daardie eksplorasie beteken, "Kom ons drill en kyk wat daar is." As hulle klaar is met die eksplorasie en hulle het iets gekry, en die bron is groot en sterk, en hulle kan baie geld maak daaruit, of hulle kan dit uittrek of wat ookal. Dan gaan hulle kyk die olie prys is sowaar. Hulle kan dit verkoop teen 'n wins. Daar is 'n bron vir Suid-Afrika om dit te gebruik. Al daardie goed. En dan daarna kan hulle dan eers gaan, en dan kan hulle aansoek doen om te produseer. En die produseer is wanneer jy dan die goed uittrek, en dan begin die goed gaan na die raffinadery toe waar hulle die petrol maak. Waar hulle die diesel maak. Al daardie goed. Dit is die lang proses, maar op elke stap moet ons eers 'n impakstudie doen om te kom kyk of dit wat gaan gebeur, of dit wat voorgestel is, of dit nie gaan skade maak vir die omgewing nie. So, dit is dan basies waar ons inkom. So, julle sal sien of dit nou ons is, of dit nou ander ouens is wat terug kom: dit hang af, jy weet, wie aangestel is om die "job" te doen. *Thank you so much for that, Aunt Rosie. I appreciate it. Yes, we are aware of the fact that it looks like duplication of stuff. We get it. So, the reason why it looks the same is because it's the same type of application. The process, the legal requirements, all that stuff is the same, and unfortunately we have to go through the same process. So, I'm sorry if there might be a little bit of confusion with it, but that's because it's a different company that's also applying, and they want to go through the same process. They also want to be able to do the same type of stuff. So, unfortunately, there's a bit of a duplication in that stream, but unfortunately it's the law that requires it, and we have to go through that process with it. So, if you guys want to comment; You'll see the application areas are different, and that's because every company; they don't work together. One says, "Okay, we think that stuff we're going to want." The other company says, "Okay, we might want to do it a little bit in a different way. We want to look at a broader area, or a wider area, or a smaller area." So, that's how they work with that type of stuff. We don't influence them or that. They tell us this is what they want to do, and then we have to go see if what they want to do is okay or not. Whether it's right for the environment or not, and for the people, and all the stuff, who want to come and do it. So, that's basically why there are two different processes, and why they look very similar. But that still doesn't mean those processes aren't important. This does not mean that one should not participate in that process. So, it's important to have your say. If you're unhappy about it. It's important to say whether you're for or against it, or whatever. You are entitled to say so, and you are entitled to do so. So, we don't want to come and hide it. Then, I understand there are fishermen who are not here. There may not be other people, but we invited even more people to this meeting than the previous meeting. We really made an effort to put all the people who were here last time, we also put on our list just from the beginning. And if you were at the meeting last time, we also sent you an email, or texted, or sent you a mail-in message, or whatever the stuff on it was, we sent out. So, unfortunately, that type of stuff... We can't force people to be here. We'd like the people here to be here to hear as many of the people's comments as possible and that stuff, but, like I said, this isn't the first and only one. There's another opportunity to and we're going to come back again, and it'll be "great" for me if we have a big group of people now that we can then take hold of the thing here and work him through. So, thank you so much for that. Then, in terms of the young people and the job creation and that type of stuff. Yes. So, I don't know what winds blew, and what stuff was said. I wasn't part of that stuff. So, we run this process, and we go through the legal requirements. We're trying to inform people to say, "Come on, please." In terms of the job creation for this phase of the project; Remember this process is a long-term process. So, the "reconnaissance," the exploration, is a long-term thing. It's not a thing that's going to happen now. And that long-term process is now scouting for the first year after they applied. If they get approval, then after that they go to exploration, and that exploration means, 'Let's drill down and see what's there." When they finish the exploration and they

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	got something, and the source is big and strong, and they can make a lot of money from it, or they can pull it out or whatever. Then they're going to check the oil price is so much. They can sell it at a profit. There is a source for South Africa to use it. All that stuff. And then after that, they can only then go, and then they can apply to produce. And the produce is when you then pull the stuff out, and then the stuff starts going to the refinery where they make the gasoline. Where they make the diesel. All that stuff. That's the long process, but at every step, we have to do an impact study first to come and see if what's going to happen, or what's been proposed, or if it's not going to harm the environment. So, that's basically where we come in. So, you'll see if it's us now, whether it's other guys coming back; it depends, you know, who is appointed to do the "job."
c.	**Rosey Shoshola** Met alle respek, meneer die voorsitter, ek sal graag wil hê u moet net vir die mense in "plain" Afrikaans sê; gaan daar werk wees vir hulle, al dan nie? Dit is al wat ek vra. *With all due respect, Mr. Chairman, I would like you to say only to the people in "plain" Afrikaans; is there going to be work for them, or not? That's all I ask.* **DP Kriel** Okay, in terme van hierdie aansoek vir die "reconnaissance permit"; nie op hierdie stadium nie. So, ek wil nie vir julle sê dat ons het niemand uitgenooi om te kom vir werk of enigeiets soos dit nie. Dit was nie die ding gewees nie. Ek is jammer as dit die indruk is wat daar buite was, maar dit was nie ons wat daardie boodskap uitgesit het nie. *Okay, in terms of this application for the "reconnaissance permit"; not on this stage. So, I don't want to tell you that we haven't invited anyone to come for work or anything like that. That wasn't the thing. I'm sorry if that's the impression that was out there, but it wasn't us who put that message out.*
d.	**Male Speaker 1** Ek het ook 2012 tot 2015, 2016 in die hawe gewerk. Ek het die eerste studie, of die persone wat eerste aansoek gedoen het; toe het ons 'n massiewe groot vergadering gehad met die verskillende identiteite wat daarmee betrokke is. Ek wil net aanvoeg of vir haar sê dat soos wat u dit nou uitwys. Die eerste paar stadiums is daar spesiale mense, in die sin dat jy professionele mense nodig om eers van die plak, totdat die bron daar is; as die olie bron daar is, so by so was dit gewees dat Lambertsbaai hawe sal ge-upgrade word. So, as dit is, as hulle sê daar is olie. Die geld is daar om ... Die prys en die goed is reg. Natuurlik, sal daar werk wees vir ons mense, maar die eerste paar fases het hulle spesialiste nodig om seker te maak. Want dit baat nie hulle gaan vir ons daarna toe te stuur. Ons sal nie weet nie. Maar wat ek wel weet, is die eerste ouens het hulle impakstudies gedoen. Die water, in die land; orals. En ek glo julle gaan dieselfde ook, maar weet dit is 'n fases. Dit is hoe hulle vir ons verduidelik het. Maar my vraag is ook, "Is daar werk vir ons mense?" Toe het hulle dit ... En ek weet nou ongelukkig het ek ... Weet ek nog van daardie tyd af dat daar vir die eerste paar fases, is dit mense wat gespesialiseer is in 'n sekere hoofyn, of in 'n sekere veld, om daardie werk eers te kan doen. Eers as die bron daar is, gaan dit definitief. Ek weet, want Lambertsbaai hawe gaan dan die ... Hoe kan ek nou maar sê? Die naaste hawe wees vir daardie ding. Ja, of nou die direk nou daar gaan wees; ek weet nou nie. Maar definitief. Dit gaan dan moet ... Maar obvious en dit sal ook vir ons mense moet 'n aanpassing wees om te gaan leer, so die dinge werklikheid gaan word. Dat ons mense ge"skill" kan wees. *I also worked in the part from 2012 to 2015, 2016. I have the first study, or the persons who applied first; Then we had a massively large meeting with the different identities involved with it. I just want to add or tell her that as you point it out now. The first few stages there are special ones, in the sense that you*

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	need professionals first from the place, until the source is there; if the oil source is there, so it was that Lamberts Bay harbour would be upgraded. So, if it is, if they say there is oil. The money is there to... The price and the stuff are right. Of course, there will be work for our people, but the first few stages they need specialists to make sure. Because it doesn't benefit them to send us to it. We won't know. But what I do know is the first guys did their impact studies. The water, to the land; everywhere. And I believe you guys are going the same way too, but know it's a phase. That's how they explained to us. But my question is also, "Are there jobs for our people?" Then they had it... And I know now unfortunately I have... Do I still know from that time that for the first few phases, it's people who are specialized in a certain mainline, or in a certain field, to be able to do that work first. Only when the source is there does it definitely go. I know, because Lamberts Bay Harbour is then going to be the... How can I just say? The nearest port is for that thing. Yes, whether or not it's going to be there right now; I don't know now. But definitely. It's going to have to then... But it's also going to have to be an incentive for us people to go and learn, so those things are going to become reality. That we humans can be "skinned." **GP Kriel** So in hierdie "reconnaissance permit" gaan dalk bitter min werk wees. Die werke wat nou uitgaan is eintlik vir die mense soos ons, vir ander wetenskaplikes wat op die boot werk, die "PAM Operators", die MMOs, al daardie ouens, verstaan. Maar die volgende werke; dan is daar dalk 'n geleentheid. Hoe daardie goed lyk op hierdie stadium; kan ons nie nou vir julle sê nie. En dit sal onverantwoordelik wees vir my om vir jou te sê, "Ja, daar gaan definitief, 100% verseker werk wees," want ons weet nie wat die bron is nie. Verstaan. En dit bepaal of daar dan volgende programme gaan wees. Wanneer dit kom by die produksie kant, wanneer hulle die olie uit die grond uittrek, dan kan hulle sê, "Okay, ons weet ons gaan soveel olie uittrek, en ons gaan dit vir so lank uittrek." En dan kan hulle sê, "Okay, "great," ons gaan dan soveel teruggee aan die gemeenskap. Ons gaan hierdie programme loods om die mense opgeleid te kry. Ons gaan al daardie tipe goed doen." Dit is dan wanneer jy, wat hulle noem 'n "Social and Labour plan" tipe ding moet doen. En dan moet jy in baie meer diepte gaan. Die "community profile". Jy moet gaan kyk watter behoeftes daar is. Al daardie tipe goed. En dan kom daardie impakte deur. En onthou dit is nie net daardie tipe goed wat gebeur nie. Daar is wat hulle noem die "secondary impacts" en daardie tipe goed. Dit is die goed wat so bietjie moeiliker is om te meet en met sekerheid te sê, maar byvoorbeeld as jy 'n olie rig het en daardie tipe goed; vir elke persoon wat op daardie olie rig is, is daar gewoonlik 'n ratio, daar is gewoonlik 'n verhouding. So, daardie een persoon het 'n ... Gaan instansie nodig hê om na sy mediese goed te kyk. Hy gaan nodig hê dat daar klinieke moet wees. Dat daar plekke moet wees om te bly as hulle van die boot afkom. Al daardie tipe goed. Dat daar restaurante is om te eet; plekke om te slaap. Dit is goed wat moeilik is om te meet en duidelike te sê. 'n Mens kan nie nou sê hoeveel dit gaan wees nie, maar daar is al daardie sekondêre impak. So, wanneer 'n mens produksie fase doen; dan kan 'n mens daardie goed meer akkuraat bepaal en dan begin, en dan kan kyk wat dit is. I think that's a very accurate description. So in this "reconnaissance permit" may be very little work. The jobs that are going out now are maybe for the people like us, for other scientists working on the boat, the "PAM Operators", the MMOs, all those guys, understand. But the following works; then there might be an opportunity. Now that stuff likes at this point; can't we tell you right now. And it would be irresponsible for me to tell you, "Yes, there's going to be definite, 100% assured work," because we don't know what the source is. Understand. And that determines whether there will be next programs then. When it comes to the production side, when they pull the oil out of the ground, then they can say, "Okay, we know we're going to pull out so much oil, and we're going to pull it out for so long." And then they can say, "Okay, great," we're going to give so much back to the community then. We're going to launch these programs to get the people trained. We're going to do all that type of stuff." That's when you have to do what they call a "Social and Labour plan" type of thing. And then you have to go into much more depth. The "community profile". You need to go and see what needs there are. All that type of

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	stuff. And then those impacts come through. And remember it's not just that type of stuff that happens. There's what they call the "secondary impacts" and that type of stuff. It's the stuff that's that little bit harder to measure and say for sure, but for example if you have an oil rig and that type of stuff; For every person who is directed at that oil, there is usually a ratio, there is usually a ratio. So, that one person has a... Going to need institution to look at his medical stuff. He's going to need there to be clinics. That there should be places to stay when they get off the boat. All that type of stuff. That there are restaurants to eat; places to sleep. These are things that are difficult to measure and say clearly. One cannot say now how much it will be, but there is already that secondary impact. So, when one does production phase; Then one can determine that stuff more accurately and then start, and then see what it is.
e.	**Chief Nicolaas Booysen** Ek is senior hoofman, Nicolaas Booysen. My vraag is eerste. U sê u en Searcher is beide op daardie blok in die aansoek proses. So, ek wil weet hoeveel jaar is u al besig om met die voorbereidings te doen om vandag hier met ons gemeenskap te kom die vooropgestelde idees te kom deel? En dan wil ek weet nadat .. Ek moet nou eers hier antwoord kry hoeveel jaar u al besig is, voordat ek nou verder kan gaan. *I am senior chief, Nicolaas Booysen. My question is first. You say you and Searcher are both on that block in the application process. So, I want to know how many years have you been doing the preparations to come here today with our community to come and share the preconceived notions? And then I want to know after... I just have to get an answer here now how many years you've been busy, before I go any further ka n now.* **GP Kriel** Ons is vroeër hierdie jaar aangestel deur Searcher, en toe later aangestel deur TGS. So, dit is nou 'n paar maande wat ons nou besig is met daardie twee projekte. Ja, ons het nie vooropgestelde idees nie. *We were hired earlier this year by Searcher, and then later hired by TGS. So, it's been a few months now that we're working on those two projects now. Yes, we don't have preconceived notions.* **Chief Nicolaas Booysen** So u werk direk vir Searcher? So, hulle betaal mos vir u? So, u werk vir hulle. Al het u u eie company, u word betaal deur hulle om die ding te kom doen. Met ander woorde, hulle is 'n maatskappy wat al jare bestaan. U doen al vir jare die goed. So, toe u en u maatskappy die gedagte gekry het van die idee van navorsing doen in die San se gebiedswaters en sy grondgebied; het u nie gedink dat u moet uitreik na die mense toe, en met die mense 'n gesprek aansit rakende dit waaraan u nou dink wat moontlik kan ontwikkeling wees of moontlike impakte het op die lewenswyse van die kusbewoners? Die vissersvolk. Nou vandag kom u met vooropgestelde idees sonder dat die San se free prior and informed consent daar betrokke is. U het nooit van die tydstip wat u en Searcher gekommunikeer het ... Searcher het al dieselfde goed gehoor. Hy stel nou net 'n ander agent aan. Hy het al klomp verskillende agente aangestel. Hy stel nou 'n ander agent aan. Hy het by velemale gehoor ... Hy het nooit die San gemeenskappe nie ... Hy nooi almal. Al die gemeenskappe behalwe die San gemeenskap, maar hy wil in die San se grondgebied en gebiedswaters, wil hy kom delf; inligting kom soek. Ons het nie julle se wetenskap in ons se argeologiese gebied nodig nie. As ons wil navorsing doen, doen ons dit op ons manier. Ons inheemse leefwyse sal vir ons bepaal hoe ons navorsing gedoen wil hê. U is nie 'n Suid-Afrikaanse maatskappy nie; u verteenwoordig nie 'n Suid-Afrikaanse maatskappy nie. Suid-Afrika het nie hierdie gas en olie nodig nie. Suid-Afrika is nie so 'n ontwikkelde land nie. Searcher het reeds vir ons gesê dat daar is nie 'n manier hoe hulle ons kinders kan vooraf laat opleì sodat hulle die kundiges op daardie bote kan bekom nie. Hulle

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	het gesê hulle kan dit nie doen nie. U het dieselfde van hulle af. Jy kan dit nie doen nie, want daardie mense word saam met al ingevoer. Die bote, alles. Die bystandbote, alles kom in. In Australia. In New Zealand. In Kanada. In Amerika. Amerika het reeds al sy bedrywighede, sy seismic bedrywighede gestaak in 2016 al, nadat die omgewings-aktiviste en die Khoikhoi groepe, en die San groepe gekant gewees het teen sy operasies, maar hy is ten gunste van klimaatsveranderings prosedures. Nou Suid-Afrika is ook 'n land wat ten gunste is van koolstofvermindering in die land, maar hier kom u met u buitelandse geld om vir Mantashe deurmekaar te maak. Mantashe het nie minerale nie. Hy het geen natuurlike hulpbronne nie. Dit behoort aan die inheemse bevolking wat die San gemeenskappe is. So, alvorens u nog nie met die San gemeenskappe gekonsulteer het, meaningfully, sodat ons saam tot by hierdie gevolttrekking kan kom nie; sal en gaan u nie toestemming kry om navorsing te doen in ons gebiedswaters nie. Because daai rif wat julle van praat; hy strek daar uit die Suid uit tot in die Noordsee. Daardie rif is 'n broeiplek van ons se visbronne; van ons se voedsel waar vanaf die wêreld afhanklik is. Julle het klaar die Pacific Ocean vergiftig. So, waar gaan die wêreld nou nog in 'n ander plek as Suid-Afrika hierdie belangrike bron van voedsel kry? Nêrens anders as hier nie. So, u kan nie kom met u klankgeluide nie. Daardie goed maak 'n massiewe klankgeluid, because dit moet dwarsdeur die aarde gaan van daardie klipbanke en dit is verskeie tipe rotslae. So, as daardie klank; hy gaan al harder, al harder hier af wanneer kan daardie ding daardie dier stop? Hy maak daardie dier al hoe deurmekaar. So gaan jy ons se voedselbronne deviate. So veroorsaak dit laat ons se visbronne tot niet gaan. Nie net ons se visbronne nie; julle wys niks daar van die skulpe en die koraal nuwe en die goed wat alles tot niet gaan gaan nie. So, eh, as 'n teenwoordiger van die bloedlyntamilies van die Weskus se San gemeenskappe sê. Nameas die Paddaman Chief dat seismic aktiwiteite gaan nêrens in die Weskus van die Weskaap plaasvind nie. Op tot in Hondeklipbaai, Port Nolloth; niks. Ons gee nie toestemming nie. *So you work directly for Searcher? So, they're paying for you? So, you work for them. Even if you have your own company, you get paid by them to come and do the trick. In other words, they are a company that has been around for years. You've been doing the stuff for years. So, when you and your company got the idea of doing research in the San's territorial waters and its territory; Didn't you think you should reach out to the people, and have a conversation with those people regarding what you're thinking about right now that could potentially be development or have potential impacts on the way of life of the coastal residents? The fishing people. Now today you come up with preconceived notions without the San's free prior and informed consent involved. You never knew of the time you and Searcher communicated... Searcher had already heard the same stuff. He's just hiring another agent now. He has hired many different agents. He now appoints another agent. He'd heard from many... He never has the San communities... He invites everyone. All the communities except the San community, but he wants to dig into the San's territory and territorial waters; information come searching. We don't need your science in our archaeological area. If we want to research, we do it our way. Our indigenous way of life will determine for us how we want research done. You are not a South African company; you do not represent a South African company. South Africa does not need this gas and oil. South Africa is not such a developed country. Searcher has already told us that there is no way they can have our children trained beforehand so that they can obtain the experts on those boats. They said they couldn't do it. You have the same from them. You can't do that because those people are imported along with all. The boats, everything. The standby boats, everything comes in.* *In Australia. In New Zealand. In Canada. In America. Amerika has already ceased all its operations, its seismic activities in 2016, after environmental activists and the Khoikhoi groups, and the San groups opposed his operations, but he is in favor of climate change procedures. Now South Africa is also a country that is in favour of carbon reduction in the country, but here you come with your foreign money to mess up for Mantashe Mantashe lacks minerals. He has no natural resources. It belongs to the indigenous people who are the San communities. So, before you haven't consulted with the San*

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	communities, so that we can get to this consummation together; will and will not get you permission to conduct research in our territorial waters. Because that ridge you're talking about; he extended there from the South into the North Sea. That reef is a breeding ground of our fish resources; of we food where from the world depends. You've finished poisoning the Pacific Ocean. So, where is the world going to find this important source of food other than South Africa? Nowhere but here. So, you can't come with your sound sounds. That stuff makes a massive sound sound, because it has to go all over the earth from those stone benches and it's several types of rock layers. So, as that sound; He's going down here harder, ever louder when can that thing stop that beast? He's messing up that beast more and more. So you're going to destroy our food sources. So it causes us to nullify our fish resources. Not just us fish sources; You don't show anything there about the shells and the coral reefs and the stuff that's going to go to waste. So, I, as a presenter of the bloodline families of the West Coast's San communities say, On behalf of the Frogmon Chief that seismic activities are not going to take place anywhere in the West Coast of the Western Cape. Up to Hondeklip Bay, Port Nolloth; Nothing. We don't give permission. **GP Kriel** Dankie Chief. Ek werk nie direk vir Searcher nie. Hoe dit werk is, hulle wil 'n impak studie gedoen hê, omdat hulle 'n lisensie wil hê. So, die wet sê dat hulle moet dan 'n persoon soos ons aanstel om dit te kom doen. En onthou hulle moet ons betaal of die goedkeuring gekry word of nie. So, ek wil net sê baie dankie vir dit. Dit is vir my baie belangrik dat u deelgeneem het. Dit is nie ons intensie om hierdie projek op julle te kom afdwing nie. Die idee is nie om dit te kom doen nie. Die tradisionele leierskap is vir ons baie belangrik. So, dit is hoekom ons probeer kom na die gemeenskappe toe. Dit is hoekom ons vir ons spesialiste gevra het om asseblief met julle te kom gesels. Om by julle te kom luister. Om by julle te kom hoor hoe voel julle daaroor? Wat sien julle en wat is julle persepsie oor die projek? En dit is nie om 'n ding net te kom afdwing, en te kom sê, "Ons wil vir julle kom "bulldoze" en dit is die einde van die storie nie. So, ek is jammer as dit die indruk is wat geskep is. *Thanks Chief, I don't work directly for Searcher. The way it works, they want an impact study, because they want a license. So, the law says that they must then appoint a person like us to come and do it. And remember they have to pay us whether the approval is gotten or not. So, I just want to say thank you so much for that. It is very important to me that you participated. It is not our intention to come and impose this project on you. The idea is not to come and do it. The traditional leadership is very important to us. So, that's why we're trying to get to the communities. That is why we have asked our specialists to please come and talk to you. To come visit you. To come and hear from you how do you feel about it? What do you see and what is your perception about the project? And it's not to just come and force a thing, and come and say, "We want to come and bulldoze for you and that's the end of the story. So, I'm sorry if that's the impression that was created.*
f.	**Chief Nicolaas Booysen** Ek wil net iets onder u aandag bring. U is bewus van die hofuitspraak vanoggend? So wat is die doel van hierdie proses dan? *I just want to bring something to your attention. You are aware of the court ruling this morning? So what is the purpose of this process then?* **GP Kriel** Ek is bewus daarvan, ja. Wat is die doel ...? Die hof se beslissing oor die Shell saak langs die wildeitus is 'n baie belangrike hofspraak. Ons is baie bewus van dit en dit kan redelike belangrike gevolge hê. Ons gaan ook, as EIMS, kyk na daardie hofuitspraak. Ons is tot 'n mate bewus van die tekortkominge in van die vorige prosesse , en ons het probeer om daardie goed op 'n ander manier te doen. So, ek weet in daardie

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	proses het hulle nie so breedvoerig met die gemeenskappe gekonsulteer nie, onder andere. Ons probeer 'n bietjie meer hier na die gemeenskap te kom. Ons probeer by julle, as die leiers, te kom hoor en te kom sê, "Ons erken julle as die leiers in die gemeenskap, en ons erken die vissermanne se moeilikheid. En ons verstaan dat ..." In Suid-Afrika, op hierdie stadium, moet ons aansoek doen by die Departement om die goed te doen. En dan met ons die publieke deelname doen volgens daardie wette. So, ons wil glad nie wegkruip agter die feit dat daar net daardie wetgewing is nie. Dit is hoekom ons spesifiek met julle kom gesels het en by hulle wil kom hoor het. Maar ons het opgeneem, en ons gaan dit duidelik maak uit hierdie vergadering uit, dat dit is hoe julle voel as 'n gemeenskap en as die San mense. So, dit is duidelike daarso. In terme van die ander lande; hulle is nog steeds besig met hulle eie goed. Hulle het hulle eie wetgewing. Hulle eie maniere hoe hulle dit wil doen. En dit moet ook gerespekteer wees, want die idee van hierdie studie is om te kyk of hulle nie die visse gaan wegjaag nie. En as dit nou op die einde van die dag uitkom dat dit 'n groot negatiewe impak gaan hê op die omgewing, die mense, die vissers; dan sal ons sê, "Nee, ons stel nie voor dat dit aangaan nie." En dan moet daardie ouens vir ons nogsteeds betaal. Hulle betaal vir die werk wat gedoen word en nie vir die goedkeuring nie. Hulle koop nie 'n lisensie. Hulle kan nie daardie lisensie koop nie. En soos ek al in die verlede ook gesê het; daar is ouens wat dit probeer doen het en dit nie reggekry het nie. Ons job is om seker te maak dat julle gehoor word, en dat die omgewing beskerm word. *I'm aware of that, yes. What is the purpose...? The court's decision on the Shell case along the wild coast is a very important court speech. We are very aware of this and it can have fairly important consequences. We're also going to, as EIMS, look at that court ruling. We are to some extent aware of the shortcomings in some of the previous processes, and we have tried to do that stuff in a different way. So, I know in that process they didn't consult with the communities as extensively, among other things. We're trying to get to the community a little bit more here. We try to hear from you, as the leaders, and to come and say, "We recognize you as the leaders in the community, and we acknowledge the fishermen's trouble. And we understand that..."* *In South Africa, at this stage, we have to apply to the Department to do the study. And then with us doing the public participation according to those laws. So, we don't want to hide behind the fact that there's just that legislation at all. That is why we specifically came to talk to you and want to hear from them. But we recorded, and we're going to make it clear from this meeting, that this is how you feel as a community and as the San people. In terms of the other countries; they're still doing their own stuff. They have their own legislation. Their own ways of doing it. And that should also be respected, because the idea of this study is to see if they're not going to chase the fish away. And if it comes out now at the end of the day that it's going to have a huge negative impact on the environment, the people, the fishermen; then we'll say, "No, we're not suggesting this go on." And then those guys still have to pay for us. They pay for the work done and not for the approval. They don't buy a license. They can't buy that license. And as I've said in the past, too; There are guys who tried to do it and didn't get it right. Our job is to make sure that you are heard, and that the environment is protected.*
2.	**John Van Der Heever** My naam is John van der Heever. Ek sluit aan by die raadsvoor van juffrou Shoshola wat gesê het sy het as dit vyf honderd kilometer Suidoos van ons af, op die Ceres berge sneeu, dan voel ons dit hier. En dit is dieselfde wat ek dink, wat sy bedoel met die seismiese navorsing wat u beplan. Nou, ons weet Europa het 'n tekort aan energie, en daar word nou sake gedoen met energie; is die plan. Nou, hoe gaan ons voorkom dat daar breek sal kom wat betref korrupsie binne in hierdie hele proses? Hoe beplan julle om korrupsie hok te slaan, because corruption is quite prevalant in our country, and it has a huge impact on

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EIMS | Environmental Impact & Management Services

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

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	us as individuals, although it seems not like it be. Verder, het ek ook opgelet dat u nie eintlik juis voorsiening maak vir die voël lewe daarso nie. Dit is meestal te doen met wat op die sedliment en onder die sedliment aangaan, wat ook vir my 'n groot kommerwekkend is, want ons wat hier langs die kuslyn lewe; daar word nou 'n impak studie gemaak in die see vir natuurlike hulpbronne, maar die mees belangrike faktor wat vir my blyk te wees is die mense wat langsaan die strande bly. Soos Lambertsbaai en al die ander kusdorpe, behalwe Saldanha. Saldanha is nou meestal geïndustrialiseer nadat hulle nou baie vis uitgewis het na 'n lang tyd, en dit lyk nou byna soos 'n spookdorp, want daar staan baie wit olifante daarso. Maar die industrialisasie van Saldanha, van die hele Weskus se skiereiland; dit gebeur en ons kan sien die impakte wat dit het op die lewende marine bronne, en die ekosisteem rondom Saldanhabaai hawe. En wat bedenf die ekonomiese impak; sal ons nou nie eindlik aan ons eie bas voel nie. Maar die mense wat beleggings doen, en wat die eksplorasie werk sal doen; hulle sal die voordeel te kry van al hulpbronne, maar die hulpbronne is deel van ons se gebiedswaters. Want as dit nie gewees het nie, sou u nie vir ons gekonsulteer het oor dit wat daar sal gebeur nie. Nou hoe sal die sosio-ekonomiese impak gedoen word teenoor die mense, soos ek wat nou hier praat, en alike ander om te kyk wat is die lewensstandaarde van die mense waar u nou die hulpbron vir die wes Europa sal kom ontgin waar u dit ten duurste sal betaal. Alhoewel dit baie valuta vir ons beteken, beteken dit nie ons sal daarvan kan lewe nie, want die korrupsie, soos ek genoem het in die begin, is groot. En die mense was die geld aanmekaar tot daar waar dit nie nodig is nie. Maar die sosio-ekonomiese impak en die uitvloeisel van die bevindinge; hoe sal ons weet wat die wetenskaplikes daar aanvang en wat vir hulle lowel en wat 'n negatiewe impak kan hê. Nie net vir ons nie, maar op die ekosisteem, soos dit nou daarut sien. Baie dankie. *My name is John van der Heever. I join the metaphor of Miss Shoshola who said she had if it snowed five hundred miles South-East from us, on the Ceres mountains, then we felt it here. And it's the same thing I think, what she means by the seismic research that you're planning. Now, we know Europe has an energy shortage, and business is now being done with energy; is the plan. Now, how are we going to prevent breaks from coming in terms of corruption within this whole process? How do you plan to curb corruption, because corruption is quite prevalent in our country, and it has a huge impact on us as individuals, although it seems not like it be. Furthermore, I also noticed that you don't actually exactly cater to the bird life thereso. It's mostly to do with what's going on on the sediment and under the sediment, which is also a big concern to me because we who live here along the coastline; There is now an impact being made in the sea for natural resources, but the most important factor that seems to me to be the people who live next door to the beaches. Like Loosberts Bay and all the other coastal towns except Saldanha. Saldanha is now mostly industrialized having now wiped out a lot of fish after a long time, and it looks almost like a ghost town now, because there are a lot of white elephants standing thereso. But the industrialization of Saldanha, of the entire West Coast peninsula; it's happening and we can see the impacts it has on the living marine resources, and the ecosystem around Saldanha Bay harbour. And what spoils the economic impact; we won't actually feel on our own bass now. But the people who make investments, and who will do the exploration work; They will get the benefit of all resources, but the resources are part of our territorial waters. Because if it hadn't been, you wouldn't have consulted us about what would happen there. Now how will the socio-economic impact be done towards the people, like me who are talking here now, and every other to look at what are the living standards of the people where you will now come and exploit the resource for the western Europe where you will pay it dearly. Although it means a lot of currency to us, it doesn't mean we'll be able to live off of it because the corruption, as I mentioned in the beginning, is huge. And the people were putting the money together until there where it's not needed. But the socio-economic impact and the outcome of the findings; how will we know what the scientists are doing there and what is troubling them and what could have a negative impact. Not just for us, but on the ecosystem, as it sees from it now. Thanks a lot.*

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EMS Verw./ *EMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

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	Mnr van der Heever, jy is doodreg. As die wind vyf honderd kilometer vêr waai van 'n berg af; ek weet ek bly daar aan die onderkant van Lesotho daar in die Oos Kaap. Ek voel 'n bergwind as hy afkom, en hy word warm. So, ek verstaan die vergelyking. En op dieselfde manier is die see nie net op een plek nie. Jy kan dalk daar iets gaan doen, en dan dink jy dit gaan net daar affekteer nie. Ons verstaan dit. Ons is heeltemal aanboord daarmee, en dit is hoekom ons 'n bietjie breër kyk. Ons kyk nie net na daardie spesifieke aansoek area nie. Ons kan nie net nie. Jy moet breër kyk as dit. In hierdie geval is die aansoek area redelik groot. So, as 'n mens breër kyk, kyk jy baie breed. En so ons kyk al die pad teen die Weskus op. Daar is selfs van die immigrasie goed wat buite die Suid-Afrikaanse waters gaan. Daar is van die skepe wat buite die Suid-Afrikaanse water gaan. So, daar is allerande impakte wat water is as dit. So, julle sal sien as ons kaarte insit van die areas, is dit baie keer kaarte vir die hele Suid-Afrika. Verstaan. So, daar is allerande goed wat 'n mens moet kyk na breë impakte waar daardie voël gaan van hieraf, en hy vlieg soentoe in die Winter. En hy gaan soentoe in die somer, en al daardie tipe goed. Dit is baie belangrik. Asluus as ek te vinnig deur die goed gegaan het, of as ek oor goed gegaan het, maar ons kyk definitief na al die voël lewe en goed ook. Dit is baie belangrik. Daar is pêdewyns. Daar is allerande voëls, seemeeue; al daardie tipe goed. So, daar is beskermde areas vir die voëls. Daar is belangrike voël areas. Al daardie goed word na gekyk as deel van die Marine ekologie. So, ons weet hulle voer op die visse in die see, en hulle vlieg oor die areas. Hulle kan ook deur die bote geslaan word; al daardie tipe goed. So, dit is belangrike goed om na te kyk, en dit is belangrik dat mense dit ook uitgewys het. So, baie dankie vir dit. Dan van die energie en goed, en waar die energie heen gaan. Op hierdie stadium kan ek nie sê nie, want die bron word nog nie uitgehaal nie. Maar wat ek weet is, ons werk binne in Suid-Afrika. Ons is binne in 'n wêreld omgewing. So, daar daar's bronne onder mekaar uitgevoer word, en hier ontgun word, en uitgevoer word vir geld en so aan, maar dan binne in Suid-Afrika ook, op hierdie stadium, het ons redelike probleme met energie. En ek dink soos hulle vantevore ook gesê het is, die tipe energie wat ons op hierdie stadium gebruik in Suid-Afrika is hoofsaaklik steenkool. En daardie steenkool, as jy hom ... En dit is die bad steenkool wat hulle brand op hierdie stadium. As jy daardie outjie brand ... Ek weet nie hoeveel van julle was al in Mpumalanga gewees nie, maar daardie areas lyk sleg. Dit lyk terrible. En dit is van die besoedelings hotspots in die wêreld, uhhhh, as 'n mens daarna gaan kyk. So, wanneer 'n mens dan gaan kyk, op 'n manier gaan ons as 'n land moet oorbeweeg na 'n ander bron van energie toe, op 'n stadium, ons daardie klimaatverandering impak ... Daardie impak is, jy weet; daardie goed te verminder. En wat die ouens nou sê, en wat die land se regering nou gesê het, is dat hulle wil transition. So, dit is die hele storie waar nou as ons sê transition, dan beteken dit ons moet eventueel by die solar panels, by die windturbines; ons moet by daardie goed uitkom. Want oos op hierdie stadium van die geveg, kan ons nie net die switch flick nie. Daar is nie genoeg sonpanele en windpanele, en hidro-elektrisiteit en allerhande ander bronne vir ons om net dit te doen nie. Dan gaan ons almal twenty-four-seven load shedding hê. So, wat ons moet doen, ons moet stadig afkiim van dit. So, wanneer 'n steenkool kragsentrale afgaan; moet ons dan oorskakel na iets soos 'n gas toe. As die gas brand, jy brand nogsteeds iets. Dit gaan nogsteeds koolstofdioksied in die lug insit, maar hy doen dit baie skoner, en hy doen dit baie minder. So, met ander woorde, dit gaan al klaar jou impak verminder. So, die uitgaste probleem is in Suid-Afrika, voer ons al ons olie en al ons gas, of die oorgroter meerderheid voer ons in. Volgens die Integrated Resource Plan moet ons daardie gas en olie hier probeer soek, sodat dit punt nommer een dalk nie so duur is om in te voer nie en dat ons dalk ons ale sekuriteit het hierso. In terme van die sekuriteit en daardie goed; al hierdie goed gebeur op hierdie stadium binne die Suid-Afrikaanse waters. Dit is wat ons noem daardie exclusive economic zone. Dit is onder die beheer van die Suid-Afrikaanse mense, en die Suid-Afrikaanse mense het die regering aangestel om sekere goed te doen.

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	In hierdie fase van hierdie projek; as 'n mens kyk na die sekuriteit en daardie tipe goed, dan gaan dit belangrik wees ons na daardie goed te kyk in die volgende fases. So, wanneer daardie bron daar is, en al daardie goed, moet 'n mens kyk dat dit op die regte manier bestee word. Dat daar die regte protokolle in plek is. Dat dit op die regte manier gedoen word, sodat die mense nie seer kry nie. Sodat daar nie onruste kom nie en al daardie tipe goed. So, in terme van daardie goed, is dit baie belangrik om die volgende fase te kyk na dit. Op hierdie stadium kan ons nie sê nie, want ons weet nie hoeveel olie daar is nie. Ons weet nie eers of daar enige olie daar is nie. So, hierdie is alles deel van 'n legkaart bymekaar sit, op die oueinde van die dag, om te kan kyk wat is daar. En dan kan daardie groter fase, wat meneer nou gesyn het, moet dit dan beantwoord word. Hulle moet dan later gaan kyk na daardie tipe goed, voordat hulle dan aangaan. In terme van die korrupsie. Ja, ek verstaan dat daar korrupsie in Suid-Afrika is. Daar is korrupsie regoor die wereld. Suid-Afrika het ons ongelukkig baie deurgeloop deur die korrupsie die laaste paar jare. Die laaste paar neute eintlik sekar maar. So, ons verstaan dat daar 'n hele omgewing is waarbinne in dit is, en daar is korrupsie wat plaasvind. As ons kyk na vandag se hofsaak wat uitgelewer is, dan behoort dit vir ons almal eintlik 'n belangrike ding te wees, en dit behoort vir ons eintlik 'n pluimpie te wees om te sê dat as daar iets gebeur het wat nie reg was nie, dan kan ons te minste nog iets daaraan doen. Ons het nog 'n hof wat onafhanklik is en ons kan onself na die hof toe wend en sê, "Ons stem nie saam met dit nie, ten spyte van die feit dat daar goedkeuring was en goed. So, as daar sulke ongeregtighede gebeur, dan is ek baie bly dat ons in Suid-Afrika bly waar dit te minste nog iets is wat ons kan doen daaraan, en dit kan doen. En dit is ons demokratiese reg in hierdie land om dit te kan doen, en ons moet dit gebruik. So, hierdie is nie die be all and end all nie. Daar is daardie "avenues" en ek is baie bly dat ons in Suid-Afrika bly vir dit. Onthou dan van die ekonomiese impakte. Daar gaan versekar ekonomiese impakte wees. Soos ek gesê het, jy weet, Suid-Afrika het energie nodig op hierdie stadium, so, dit is hoekom die ouens wil kyk watter energie is daar. Ons weet ons het baie son, maar ons het nog nie al die sonpanele nie. Ons weet ons het versekerlik baie wind, maar ons het nog nie al die windturbines nie. Ons weet ons het dalk baie olie, en ons het dalk baie gas. Kan ons dit vinnig genoeg uithaal? Weet ons hoeveel daar is? Al daardie vrae moet beantwoord word, maar dit is deel van die legkaart wat gebou moet word op hierdie stadium. En dit is hoekom die ouens agter dit is. So, as 'n mens gaan kyk na die needs and desirability van die hele storie; dit is hoekom hulle agter daardie hele storie aan is. Dit beteken nie net omdat daar 'n need is en dat hulle dit desire dat dit net gedoen kan word nie, en dit is hoekom daar 'n EIA proses is. Dit is hoekom daar dan 'n apel proses is. Dit is hoekom daar 'n hof is, as die dinge nie gedoen moet word so dit gedoen moet word nie. Maar die ekonomiese impak is baie belangrik. Die ekonomie ... En dit gaan tog oor, "Het ons genoeg energie, en waar gaan ons daardie energie vandaan kry." En dan moet ons dit gaan doen op die regte manier. *Mr van der Heever, you are dead right. If the wind blows five hundred miles far from a mountain; I know I live there at the bottom of Lesotho there in the Eastern Cape. I feel a mountain wind when he comes down, and he gets hot. So, I understand the comparison. And in the same way, the sea is not only in one place. You might go do something there, and then you think it's just going to affect there. We get it. We're totally on board with it, and that's why we're looking a little broader. We're not just looking at that specific application area. We can't just. You have to look broader than that. In this case, the application area is quite large. So, if one looks wider, one looks very broad. And so we look all the way up the West Coast. There is even some of the immigration stuff that goes outside the South African waters. There are some of the ships that go outside the South African water. So, there are all the impacts that have been rejected as that. So, you'll see if we put in maps of the areas, a lot of times it's maps for the whole of South Africa. Understand. So, there's all the stuff that one has to look at broad impacts where that bird goes from here, and he flies kissing in the Winter. And he goes kissing in the summer, and all that type of stuff. It is very important. Asksus if I went through the stuff too fast, or if I was about stuff, but we're definitely looking at all the bird life and stuff too. It is very important. There are penguins*

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EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	There are all-edged birds, sea gulls; all that type of stuff. Thus, there are protected areas for the birds. There are important bird areas. All that stuff is looked at as part of the Marine ecology. So, we know they feed on the fish in the ocean, and they fly over those areas. They can also be beaten by the boats; all that type of stuff. So, that's important stuff to look at, and it's important that sir pointed that out as well. So, thank you so much for that. Then of the energy and stuff, and where the energy goes. At this point, I can't say because the source isn't taken out yet. But what I know is, we are working inside South Africa. We are inside a world environment. *So, there's resources being exported amongst themselves, and here's to be disenfranchised, and exported for money and so on, but then inside South Africa as well, at this point, we have reasonable problems with energy. And I think as they said before, the type of energy that we're using at this point in South Africa is mainly coal. And that coal, if you let him... And it's the tab of coal they're burning at this point. If you burn that little guy... I don't know how many of you have been to Mpumalanga, but that area looks bad. It seems terrible. And these are some of the pollution hotspots in the world, actually, if one is going to look at them. So, when one is going to look then, in a way, we're going to have to move as a country over to another source of energy then, at some point, to that climate change impact... That impact is, you know; reducing that stuff. And what the guys are saying now, and what the country's government has said now, is that they want to transition. So, that's the whole story where now when we say transition, then that means we have to get to the solar panels, at the wind turbines; We need to get to that stuff. Because at this stage of the fight, we can't just watch the switch movie. There aren't enough solar panels and wind panels, and hydroelectricity and all sorts of other sources for us to do just that. Then we're all going to have twenty-four-seven load shedding. So what we have to do, we have to slowly get off it. So, when a coal-fired power plant goes down; should we then switch to something like a guest. If the gas is burning, you're still burning something. It's still going to put carbon dioxide into the air, but he's doing it a lot cleaner, and he's doing it a lot less. So, in other words, it's already going to reduce your impact. So, the only problem is in South Africa, do we import all our oil and all our gas, or the vast majority of us import. According to the Integrated Resource Plan, we should try to look for that gas and oil here, so that point number one may not be as expensive to import and we may have our own security hereso.* *In terms of the security and that stuff; all this stuff is happening within the South African waters at this point. That's what we call that exclusive economic zone. It is under the control of the South African people, and the South African people have appointed the government to do certain things.* *In this phase of this project; if one looks at the security and that type of stuff, then it's going to be important to look at that stuff in the next stages. So, when that source is there, and all that stuff, one has to see that it's spent the right way. That there are the right protocols in place. That it's done the right way, so the people don't get hurt. So that there aren't any unrests coming and all that type of stuff. So, in terms of that stuff, it's really important to watch the next phase after that. At this point, we can't say because we don't know how much oil there is. We don't even know if there's even oil there. So, this is all part of putting a puzzle together, at the end of the day, to be able to see what's there. And then that longer phase, which Sir has now asked, it must then be answered. They then have to go and look at that type of stuff later, before they then move on. In terms of the corruption. Yes, I understand that there is corruption in South Africa. There is corruption all over the world. South Africa, unfortunately, has seen us through a lot through the corruption over the last few years. The last few centuries actually sure but. So, we understand that there's a whole environment that's in there, and there's corruption that's taking place. If we look at today's court case that has been handed down, then it should actually be an important thing for all of us, and it should actually be a feather in our cap to say that if something happened that wasn't right, then at least we can still do something about it. We have another court that is independent and we can go to court and say, "We don't agree with that, despite the fact that there was approval and stuff. So, if such injustices happen, then I am very happy that we live in South Africa where it is at least*

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	another thing we can do about it, and do it. And it is our democratic right in this country to be able to do that, and we should use it. So, this is not the be all and end all. There are those "avenues" and I am very happy that we are staying in South Africa for it. *Then remember about the economic impacts. There are going to be economic impacts for sure. Like I said, you know, South Africa needs energy at this point, so, that's why the guys want to see what energy is there. We know we have a lot of sun, but we don't have all the solar panels yet. We know we have an awful lot of wind, but we don't have all the wind turbines yet. We know we may have a lot of oil, and we may have a lot of gas. Can we get it out fast enough? Do we know how many there are? All those questions need to be answered, but it's part of the puzzle that needs to be built at this point. And that's why the guys are behind it. So, if one is going to look at the needs and desirability of the whole story; That's why they're after that whole story. It doesn't just mean that there's a need and they want it to just be done, and that's why there's an EIA process. This is why there is then an appeal process. That's why there's a court, if the things shouldn't be done so they should be done. But the economic impact is very important.*
h.	**Nikkie Alfreds** Baie dankie. Ek wil net deel met die vorige sprekers wat hier gesê het, wat gepraat het, maar ek is Nikkie Alfreds van Lambertsbaai. Ek is 'n visserman en ek is 'n gemeenskapsleier. Die vorige sprekers het hier gepraat van, "hier is baie min vissermanne," maar hierdie Lambertsbaai is 'n bona fide vissergemeenskap. Ons is 'n vissergemeenskap. Ons boer nie met aartappels nie, en dit nie. Ons se ouers het vir ons groot gemaak uit die Marine bron uit. So, hierdie Lambertsbaai is 'n vissergemeenskap. Daar dit nou weer vir ons oortuig wat die minister nou uitgegee het by OEF, vyf-en-veertig by die kleinskaal se vissermanne, is daar vyf-en-veertig mense wat nou gekwalifiseer is vir 'n kleinskaalse vissermanne, wat 'n permit gekry het om die reg tot Marine bron. Ek wa af wat die visserman is, "Waar is my reg?" Want ek is 'n agter lewende vissergemeenskap; ek het 'n reg tot Marine bron. Ek het 'n reg om te lewe. Ek het 'n reg om te werk. Waar is my reg? Hoekom moet vem ons mense vir ons klaar kom identifiseer en te sê, "Jy is nie 'n visserman nie." Maar ons is 'n vissergemeenskap. Ek is baie bekommerd oor hier Lambertsbaai, want ons dorp het nie ekonomiese. Ons kinders is werkloos. Niemand van hierdie leiers, as hulle hier kom in 'n vergadering, praat hulle nie oor die nood van Lambertsbaai nie. Hulle praat oor hulleself. Julle gaan die bron beskadig. Julle sal dit doen. Elkeen het sy werk. Julle het navorsing gedoen om te kyk hoe kan julle die bronne beskerm. Maar dan hoort daar nogsteeds vir jou gevra, "Hoe lank is jy in die bedryf? Hoe lank doen jy hierdie werk?" Ons is nie daar om vir julle kom hakkel vir hoor te doen nie. Ons is daar, want ons soek hulp. Ons vra, "Hoe kan ons ons dorp se ekonomies ontwikkel? Hoe kan ons ons kinders werk gee? Ons kinders by honger. Ons kinders staan op die straat. Hulle het nie kos nie. Ek praat van, "Dit is wat die leiers moet doen." By elke vergadering ... Ek was nou in die Kaap gewees vir vier dae. Het hulle my uitgenooi na 'n konferensie toe. En ek het gegaan uit Lambertsbaai uit; nie vir my nie. Ek het nie geloop vra vir koelte nie. Ek het gegaan na die minister toe en ek het vier werkskepping projekte gehad wat ek vir hulle gewys het. Ek kom doen 'n pleidooi aan die minister vir Lambertsbaai se ekonomies en werkskepping vir ons jeug. Dit is die vier projekte wat ek van praat. Is die toilet fabriek, die stene projek, die dakplate fabriek, die galvaniese pot waar ons jong kinders kan sweis en as hulle klaar gesweis het en die veiligs dekte daarin sit sodat die ... Dit het ek gegaan na die minister toe. Ek het nie gegaan vir myself nie, want Lambertsbaai het 'n nood. En Lambertsbaai se nood is werkskepping projek. En as ek kyk na die langtermyn projek wat die gas, gaan dit tog vir ons help in die langtermyn. Nou, ons sal baat vind daaruit, want die opbrengs van daardie olie en gas kan ingeploeg word vir ons gemeenskap vir ander projekte wat kan gedoods word vir ons jong kinders wat hier buite loop. Matrikulante wat nie meer kan studeer nie. Wat nie kan meer loop leer nie. Daar kan ons ons se hulp

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	van kry van daardie bronne af, want die Here gee die bronne. Nie 'n mens nie. Die Here gee vis uit die see. Hy gee hulpbronne ook. Nou maar laat ons die hulpbronne geniet. Hoekom mag ons nie die hulpbronne geniet as 'n gemeenskap nie? As die vis oor drie jaar weg is, en hier is nie vis in Lambertsbaai nie. Dan kom wat? Armoede. Verdrukking kom onder ons mense. Hier is nie werk nie. Maar daar was 'n hulpbron gewees in die see wat die Here gegee het. Olie waarvandaan ons kon gelewe het. Wat kan ingeploeg gewees het, wie as 'n gemeenskap het. Ons moet nie net kyk van die toilet fabriek nie. Ons moet kyk na landbou om nywerheid. Hoe kan ons ons se dorp se ekonomies ontwikkel? Wat kan ons doen met die grondie wat hier lê? Dan wil ek net terugkom na die vorige leier wat gepraat het ook, van die inheemse volk. Ons is verdeeld, want hulle kan nie vir ons nie, want toe ek hier staan, soos ek hierso staan, is ek 'n Khoisan. Ek is 'n Khoisan. My ma kom uit Namakwaland uit. My ma is 'n Khoisan. Maar raai hoekom is ek nie deel van die Khoisan nie? Omdat die leiers nie vir ons erken as 'n Khoisan nie. Hulle dink net aan hulleself. Dan verstaan ek nie. Ek vat niemand aan nie. Ek vertel vir niemand 'n ding nie. Die punt is net hier. Ons mense kry te swaar. Ons kinders kry swaar. Vyf-en-veertig vissersmanne kan nie Lambertsbaai se ekonomies ... Hulle kan nie Lambertsbaai se gemeenskap wees nie. Lambertsbaai het 'n vissersgemeenskap. Almal moet die reg hê tot .. Ek gee nie om vir daardie vyf-en-veertig mense nie. Hulle het hul se reg gekry, maar wat van my? Daardie vyf-en-veertig kan verremôre see toe gaan. Hulle kan vis loop vang. Hulle kan vir hulle kreef vervang. Wat kan ek op die tafel sit? Wat van jou broer, wat ook 'n visserman is, wat ook 'n vissersgemeenskap is? Waarvan moet hy lewe? Maar jy het die reg. Jy kan verremôre see toe gaan. Jy kan loop kreef vang. Jy het kos op jou tafel, maar jou broer en jou sister sterf hier langs jou van honger te, want hulle het nie reg tot marine bron nie. Dit is nie reg nie. Ek is nie hier om niemand aan te vat nie, maar die punt is net die fokus op Lambertsbaai se ekonomies en gee werksskepping vir jou kinders, dat jou kinders kan lewe. Dit is dan nie 'n probleem nie. Almal lewe lekker. Dit is waarvan ek ... Wil net sê, " Ek het niks teen 'n leier nie. Ek het niks teen kom aan nie. Maar die punt is net die, "fokus op jou dorp se ekonomies." *Thanks a lot. I just want to share with the previous speakers who said here, who spoke, but I'm Nikkie Alfreds from Lamberts Bay. I'm a fisherman and I'm a community leader. The previous speakers here spoke of, "there are very few fishermen here," but this Lamberts Bay is a bona fide fishing community. We are a fishing community. We don't farm potatoes, and we don't. We're parents raised for us from the Marine source. So, this Lamberts Bay is a fishing community. There it now convinces to us again what the Minister has now given out at DEF, forty-five by the small scale's fishermen, there are forty-five people who are now qualified for a small-scale fisherman, who have been granted a permit to establish the right to Marine source. I ask myself what the fisherman is, "Where is my right?" Because I'm a bekkod living fishing community; I have a right to Marine source. I have a right to live. I have a right to work. Where is my right? Why do some of our people have to come and identify and say, "You're not a fisherman." But we are a fishing community. I am very concerned about here Lamberts Bay, because our town is not economic. Our children are unemployed. None of these leaders, when they come here to a meeting, they don't talk about the plight of Lamberts Bay. They talk about themselves. You're going to damage the source. You'll do it. Everyone has his job. You guys have done some research to see how can you protect the sources. But then you should still be asked, "How long have you been in the industry? How long have you been doing this job?" We're not there to come and fight for you to hear. We are there because we seek help. We ask, "How can we develop our town's economically? How can we give our children jobs? Our children are starving. Our children are standing on the street. They don't have food. I'm talking about, "This is what the leaders need to do." At every meeting... I have now been to the Cape for four days. Did they invite me to a conference. And I went out of Lamberts Bay; Not for me.* *I didn't walk asking for coolness. I went to the minister and I had four job creation projects that I showed them. I come and make a plea to the Minister for Lamberts Bay's economic and job creation for our*

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	youth. These are the four projects I'm talking about. Is the toilet factory, the bricks project, the roof slabs factory, the galvanic pot where we can weld young children and when they have finished welding and put the safe covers in it so that the ... This I went to the Minister. I didn't go for myself because Lamberts Bay has an emergency. And Lamberts Bay's emergency is job creation project. And when I look at the long-term project that the gas, it's still going to help us in the long run. Now, we will benefit from that, because the proceeds of that oil and gas can be ploughed in for our community for other projects that can be launched for our young children who are walking out here. Matriculants who can no longer study. What can't learn more walking. There we can get our help from those sources, because the Lord gives the resources. Not a human being. The Lord gives fish from the sea. He gives resources as well. Well, let's enjoy the resources. Why aren't we allowed to enjoy the resources as a community? If the fish are gone in three years, and there is no fish here in Lamberts Bay. Then comes what? Poverty. Tribulation comes among our people. There's no work here. But there was a resource in the sea that the Lord gave. Oil from which we could have lived. What could have been plowed in, who has as a community. We shouldn't just be watching from the toilet factory. We need to look at agriculture for industry. *How can we develop our town's economic development? What can we do with the soils that lie here? Then I just want to come back to the previous leader who spoke as well, of the indigenous people. We are divided because they do not know us, because when I stood here, as I stood here, I am a Khoisan. I am a Khoisan. My mother is from Namaqualand. My mother is a Khoisan. But guess why I'm not part of the Khoisan? Because the leaders do not recognize us as a Khoisan. They think only of themselves. Then I don't understand. I don't take on anyone. I don't tell anyone a thing. The point is right here. Our people are suffering. Our children are suffering. Forty-five fishermen cannot access Lamberts Bay's economically... They cannot be Lamberts Bay's community. Lamberts Bay has a fishing community. Everyone should have the right to... I don't care about those forty-five people. They got their due, but what about me? Those forty-five can go to sea this morning. They can catch fish walking. They can substitute crayfish for them. What can I put on the table? What about your brother, who is also a fisherman, who is also a fishing community? What should he live on? But you are right. You can go to the sea tomorrow. You can catch walking crayfish. You have food on your table, but your brother and your sister are dying of hunger here beside you, because they don't have a right to marine source. That's not right. I'm not here to take on anyone, but the point is just the focus on Lamberts Bay's economic and giving job creation to your children, that your children can live. That's not a problem then. Everyone is having a good time. That's what I... just want to say, "I have nothing against a leader. I have nothing against him. But the point is just the, "Focus on your town's economic."* **Nikoleas Booysen** **Baie dankie daarvoor. Ja. Ek gaan daardie kommentaar so opvat en dit neerskryf. Ek kan ongelukkig nie kommentaar lewer oor die vissersregte en daardie goed nie. So, ek verstaan dat dit 'n redelike storie is, maar, ja, baie dankie vir daardie kommentaar. Ek waardeer dit. Baie dankie.** *Thank you so much for that. Yes. I'm going to take those comments up like this and write them down. I can't comment on the fishing rights and that stuff, unfortunately. So, I understand that this is a reasonable story, but, yes, thank you very much for those comments. I appreciate it. Thanks a lot.*
3	**Male Speaker** **Ja, meneer. Ek voel nou so gaskok, want ek is 'n visser; ek is deel van vyf-en-veertig, maar ek is dertig jaar 'n visser. So, al wat ek wil weet by u. U het mos nou o navorsing gedoen u se wel aan, en alles die. Sê maar u kry daardie permit en o loop prospek. Julle prospek nou eers. Hoe lank wat dit, want because why, ky gaan die natuur seer maak. Definitief. Gaan so 'n ding die koraalrif seermaak, en hoe lank vat dit, vir daardie ding om daardie rif te herstel of wat gaan julle doen om iets aan daardie rif te doen, waar**

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	julle mikkien skade gedoen het. En hoe lank vat dit vir so 'n koraalrif herstel? Het julle al nawersing gedoen of wat? Want because why soos ek hoor. Julle gaan nie net op een plek prospek nie. So, julle gaan van daar waar julle skade doen, hoe lank vat dit om daardie ding se ... Laat daardie gebied kan herstaal, en so. *Yes sir. I feel so shocked now, because I'm a fisherman; I'm part of forty-five, but I've been a fisherman for thirty years. So, all I want to know from you. You've now done your research you're grazing on, and all the. Just say you get that permit and you walk prospect. You're only now prospecting. How long what it, because because why, he's going to hurt nature. Sure thing. Is such a thing going to hurt the coral reef, and how long does it take, for that thing to repair that reef or what are you going to do to do something about that reef, where maybe you did some damage. And how long does it take for such a coral reef to recover? Have you guys done any research or what? Because because why as I hear. You're not just going to prospect in one place. So, you go from there where you do harm, how long does it take to get that thing's... Let that area be able to re-language, and such.* **GP Kriel** Ekskuus, op hierdie stadium is ons studie nog nie heeltemal klaar nie. So, ek kan nog nie vir jou honderd persent duidelikheid gee daaroor nie, maar dit is een van die dinge waarna die spesialiste moet kyk. So, hulle moet kyk .. Okay, so, as hierdie impak is groot of klein, of wat ookal is en waar hy gaan oral plaasvind, en dan gaan kyk julle na wat se spesifieke impak gaan hy hê op watter organisme. En hoeveel organismes dink hulle gaan hy ... Gaan dit grootskaalse skade wees. Gaan hy kleiner skade wees. En dan gaan ... Wat ons probeer doen is, ons probeer daardie skade so min as moontlik maak. En ons doen daardie versagtingsmaatreël of 'n mitigation measure. Maar die herstel van daardie ding word ook bepaal oor die grootte van die impak, en waar jy dit gedoen het en daardie goed. So, die spesialiste is daar veronderstel om daardie goed in te sit, en dan moet hulle sê, "Okay, die herstelling gaan so lank vat, en as daar dan 'n grootskaalse versteuring gewees, gaan ek lieber sê, "Liewerste, moet nie dit doen nie, of wat ookal. Die herstel kan 'n dag wees. Dit kan twee dae wees. Dit kan 'n paar maande wees. Of dit kan 'n permanente impak wees. Ons is besig om al daardie nommers bymekaar te sit, en te kyk. En dan sal ons vir julle kom terugvoering gee in EIA oor daardie goed. *At this point, our study is not quite finished yet. So, I can't give you one hundred percent clarity on that yet, but it's one of the things that the specialists need to look at. So, they have to look... Okay, so, if this impact is big or small, or whatever is and where he's going to take place everywhere, and then you guys are going to look at what specific impact is he going to have on which organism. And how many organisms do they think he's going to... is it going to be massive damage. Is he going to be smaller damage. And then go... What we're trying to do is, we're trying to make that damage as little as possible. And we do that mitigation measure or a mitigation measure. But restoring that thing is also determined by the size of the impact, and where you did it and that stuff. So, the specialists are supposed to put that stuff in, and then they have to say, "Okay, the restorement is going to take so long, and if there's been a large-scale disturbance, I'm going to say, "Rather, don't do this, or whatever. The recovery can be a day. It can be two days. It may be several months. Or it could be a permanent impact. We're in the process of putting all those numbers together, and watching. And then we'll come and give you feedback in EIA on that stuff.*
J.	**Rosey Shoshola** Ja, ek wil net vir Mnr Bezuidenhout sê, baie dankie vir daardie baie mooi verduideliking rondom die werkskepping. En nou weet die jeug ook hoe prosesse gaan werk en dat daar nie, soos in onmiddellik, vir hulle gaan werk wees nie, maar wel in die langtermyn, sou die goed suksesvol is. So, baie dankie Mnr Bezuidenhout. Dit was baie mooi verduidelik in ons taal. En dan as ons praat oor werkskepping, nê, dan

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	kyk ek na 'n snoek-run in Lambertsbaai. Dan sien ek vissers van regoor die Suid-Afrika kan kom werk in Lambertsbaai. Uit die snoek uit kan hulle vir hulle gesinne sorg. Ek praat van meer as twee honderd kommersiële bote wat vir snoek-run, in Lambertsbaai kom, en een boot wat rondom tien crew manne. Dan praat ek nie eers van die hawe werkers nie. Ek praat nou nie eers van die vroue wat op die hawe, 'n inkomste maak deur kos te verkoop nie. As ons al daardie klomp mense bymekaar tel, dan vra ek vir myself, die werkskepping waarna Mnr Bezuidenhoot verwys het wat oor 'n paar jaar kan gebeur; die moontlikheid daarvan. Dan vra ek, "Kan dit opmaak vir die verlies aan inkomste vir die vissers wat hulle lewe uit die see uitmaak. Baie van die vissers is vyftig jaar en ouer. Waar het hulle nou lus om 'n nuwe skill te gaan leer op daardie ouderdom? Hulle kan net visvang al die jare. Dit is nou wat die Searcher vir ons kan gee. Die werk wat die visserye vir ons gee. Wat is die werk wat uit hierdie projekte uit kan kom? En dan wil e knok baie graag weet, wat vir my 'n groot bekommernis is, is die rehabilitasie van die bron. Sou julle julle surveys doen en gestel julle kry niks; dan is daar reeds skade aan die bron gedoen. Hoe gemaak om daardie skade te herstel, sodat ons kan voortgaan met ons aktiwiteite? Sou julle olie of gas kry daar waar julle drill, dan gaan dit weer 'n ander effek hê. Julle gaan definitief wil kom delf. En die boodskap gaan uit, internasionaal, né. Wat huidiglik gebeur met ons se visvaters is; in die diep merk ons Sjinese bote op; Japanese bote op, wat kom poech in ons se waters. En die regering het nie beheer oor daardie mense nie. Sou die boodskap uitgaan dat die olie en gas in ons se waters gevind word; wat dink julle gaan gebeur met die ander maatskappye wat ook opsoek is na olie en gas. Julle gaan lets soos wat jare terug gebeur het met Kimberley-hulle en Upington-hulle, toe die mense daar eeue terug diamant ontdek. Mense het eeue gelede diamante ontdek en dit het 'n toestroming van alle karakters veroorsaak. En dan wil ek terugkom na vissers en wie is die vissers. As ek praat van die vissers, dan praat ek van die visters wat hulle lewe maak uit die see uit. Wat opstaan in die oggend en daardie koue water gaan trotseer om 'n Hotnotvissie of 'n Jakoppie te vang om vannaand vir sy gesin te kom voorsit. Dit is 'n visser. Ek praat van 'n vrou wat in die oggend opstaan. Dan sien sy hier is niks kos in haar huis nie. Dan stap sy oor strand toe en sy gaan vergader skulpe, mossels, om vir haar gesin te kom kos op die tafel sit. Ek praat nie van mense wat, met 'n skipper sertifikaat sit, maar hy is daar in 'n vertoonkas by die huis nie. En dan wil ek ook sê dat die vissers van Lambertsbaai is nie mense wat geidentifiseer word deur Departement nie, want Departement identifiseer enige een as 'n visser. Ons as vissers, wat werk op die oseaan. Wat betrokke is by die naprosessering van die oseaan; ons is die mense wat hongersnood in die oë staar. En as dit kom by uitreiking van permitte; ons kan nie daarvoor help nie. Ek hoor die vorige spreker praat van vyf-en-veertig permitte. Dit is vêr van die waarheid af. Huidiglik in Lambertsbaai, is daar amper twee honderd permitte. As ons kyk na interim small-scale; dan sit ons met 'n getal van honderd-en-twaalf mense op daardie permit. As ons kyk na die near-shore, dan sit ons met amper vyftig mense. As ons kyk na hywis permitte; dan sit ons ook met heelwat vissers. Vissers wat deur Departement geidentifiseer is. As my buurman 'n permit kry en ek kry nie 'n permit nie; kan ek nie vir my buurman kwaad wees nie. Dit is nie sy skuld nie. Dit is Departement. En dan wil ek ook vir die vorige spreker, Mnr Alfred, sê baie dankie dat jy kyk na werkskepping, maar dan wil ek ook in dieselfde asem vir jou vra dat jou projekte waarmee jy besig is, moet nie 'n inruil proses wees vir ons se oseaan nie. Gaan aan met jou goed. Gaan jou support Oom Nikkie. Gaan aan met jou werkskeppingsprojekte vir die jeug, maar dit kan nie wees inruil vir, sê ja vir Searcher nie. Daardie projekte moet verwyder word van seismic se surveys, want as ek hoor die beplanning wat u het is goed, maar dit het niks te doen met die oseaan en die voorlegging wat vandag hier gedoen is nie. En dan wil ek ook sê, met alle respek, en mense kan vir my kwaad wees vandag tot in hulle grafte; Mnr Alfred sal vir Searcher wees vir surveys en gekant wees teen die voortbestaan van tradisionele visserye, want hy persoonlik maak nie sy lewe uit die see uit nie. Hy was plus minus dertig jaar gelede nog op 'n pelagiese boot. Dertig jaar gelede omtrent was hy op 'n pelagiese boot, maar 'n Nieniskaalse visser is hy nie, want ek nog nooit gesien hy vang Hotnot visse or snoek nie. Hy face nie die bekommernisse wat ons "face" nie. Hy lê nie nagte wakker soos ons wakker lê, wat se brood en botter, daagliks op hierdie

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	oombêk, uit die oseaan uit kom nie. Mnr Alfred het hierdie vissers ge-fail jare gelede met SACFH. Hy het die hele see beslt. Die hele see het hy besit, onder sy leiding. Die vissers van Lambertsbaai het 'n permit gehad wat alles ingesluit het. Tonne, tonne. Dan kry die vissers, die einde van die jaar, 'n R300.00 uit al daardie spesies uit, wat aan hulle toegeken is, onder leiding van Mnr Alfred. Ek wil hom nie te nakom nie. Ek praat net die waarheid. Ons vissers is gefail. Hy het ons gefail. Vandag wil hy kom en sê ons moet saamstem dat ons ons se waters moet weggee vir eksplorasie projekte. Ons kan nie meneer. Dit is ons se livelihood. Ons het nie 'n ander livelihood nie. Ons kan nie ander werk nie. Ons ken visvang. Ons kan vis skoonmaak. Ons ken mossels vergader. Ons kan skulpe vergader. Ons ken lewe uit die see uit. Baie dankie. *Yes, I just want to say to Mr Bezuidenhout, thank you so much for that very nice explanation around the job creation. And now the youth also know how processes are going to work and that there is not going to be work, as in the long term, if there is going to be work for them, but in the long run, the stuff would be successful. So, thank you very much Mr Bezuidenhout. It was very nicely explained in our language. And then when we talk about job creation, eh, I'm watching a pike run in Lamberts Bay. Then I see fishermen from all over South Africa can come and work in Lamberts Bay. Out of the pike, they can take care of their families. I'm talking about over two hundred commercial boats coming for pike-run, in Lamberts Bay, and one boat coming around ten crew men. Then I'm not even talking about the port workers. I'm not even talking about the women who, on the port, make an income by selling food. If we take all that bunch of people together, then I ask myself, the job creation that Mr. Bezuidenhout referred to that could happen in a few years; its possibility. Then I ask, "Can this make up for the loss of income for the fishermen who make up their lives from the sea. Many of the fishermen are fifty years and older. Where do they feel like going to learn a new skill at that age? They've only known fishing all these years. Now that's what the Searcher can give us. The work the fisheries give us. What is the work that can come out of these projects? And then a kook would really like to know, what is a big concern for me is the rehabilitation of the source. Would you do your surveys and suppose you get nothing; then damage has already been done to the source. How made to repair that damage so we can continue our activities? If you get oil or gas where you drill, it's going to have a different effect again. You're definitely going to want to come and dig. And the message goes out, internationally. What's happening to us right now is fishing waters; in the deep we notice Chinese boats; Japanese boats op, which come poach in our waters. And the government doesn't have control over those people. Should the message go out that the oil and gas are found in our waters; What do you guys think is going to happen to the other companies that are also looking for oil and gas. You go something like what happened years back to Kimberley-them and Upington-them, when the people there discovered diamond centuries back. People discovered diamonds centuries ago and this caused an influx of all characters. And then I want to get back to fishermen and who are the fishermen. When I speak of the fishermen, I am talking about the fishermen who make their living out of the sea. Who gets up in the morning and is going to brave that cold water to catch a Hotnot fish or a sakeppie to come and serve his family tonight. It's a fisherman. I'm talking about a woman who gets up in the morning. Then she sees there's nothing food in her house here. Then she walks across to the beach and she goes to meet shells, clams, to come and put food on the table for her family. I'm not talking about people who, sitting with a skipper't certificate, but he's there in a display case at home. And then I also want to say that the fishermen of Lamberts Bay are not people identified by Department, because Department identifies any one as a fisherman. We as fishermen, who work on the ocean. What is involved in the postprocessing of the ocean; We are the people facing famine. And when it comes to issuing permits; we can't help it. I hear the previous speaker speak of forty-five permits. This is far from the truth. Currently in Lamberts Bay, there are almost two hundred permits. If we look at interim small-scale; Then we put a number of one hundred and twelve people on that permit. If we look at the near-shore, then we are left with almost fifty people. If we look at line fishing permits; Then we also sit with quite a few fishermen. Fishermen identified by Department. If my neighbor gets a permit and I don't get*

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	a permit; can't I be mad at my neighbor. It's not his fault. This is Department. And then I also want to say to the previous speaker, Mr. Alfred, thank you so much for looking at job creation, but then in the same breath I also want to ask you that your projects that you're doing shouldn't be a trade-in process for us ocean. Get on with your stuff. Go support you Uncle Nikkie. Get on with your job creation projects for youth, but they can't be trade-ins for, say yes to Searcher . *Those projects should be removed from seismic's surveys, because when I hear the planning you have is fine, but it has nothing to do with the ocean and the submission that was done here today. And then I also want to say, with all due respect, and people can be angry with me today all the way to their graves; Mr Alfred will be to Searcher for the survival of traditional fisheries, because he personally does not make his life out of the sea. He was plus minus thirty years ago still on a pelagic boat. Thirty years ago he was on a pelagic boat, but a small-scale fisherman he is not, for I have never seen him catch Hotnot fish or pike. He doesn't face the worries we face. He doesn't lie awake at night as we lie awake, whose bread and butter, daily at this moment, come out of the ocean. Mr Alfred failed these fishermen years ago with SACFN. He owned the whole sea. The whole sea he owned, under his direction. The fishermen of Lamberts Bay had a permit that included everything. Tons, tons. Then, at the end of the year, the fishermen get a R300.00 out of all those species, which was awarded to them, under the leadership of Mr Alfred. I don't want to honor him. I'm just telling the truth. Our fishermen have been failed. He failed us. Today he wants to come and say we have to agree that we should give away our waters for exploration projects. We can't sir. It's ours. We don't have another. We don't know other jobs. We know fishing. We know fish cleaning. We know clams gather. We know shells assemble. We know life out of the sea. Thanks a lot.* **GP Kriel** Dit is belangrik om te onthou dat hierdie is nie 'n eksklusiewe area nie. Daar is baie dinge wat in die see kan gebeur, né. So, mens kan nie net sê, "Net visserye in die see, en net olie in die see, of net gas in die see. Mens gaan moet kyk, eventueel, is daar 'n manier dat altwee op dieselfde tyd kan gebeur of nie. En dit is 'n besluit wat ons moet maak, deur te kyk na die impakte. Deur te kyk na hierdie prosesse, en te sê. As hierdie aangaan, gaan die vissermanne bedreig word? Gaan hulle broone vermiesig word? Gaan al daardie goed gebeur?" Want die ouens daar buite; daar is industriële vissers, daar is ouens wat anywese doen. Daar is ouens wat vir olie en gas kyk. Daar is ouens wat met ons waters gebruik om deur te vaar. Daar is Marine kabels wat daardeur gaan. Daar is beskermde areas. Daar is 'n groot klomp dinge wat in die see gebeur, en op die land gebeur in ons land, en ons kan nie net sê, net vissers nie. So, dit is hoekom ons kom kyk na al daardie goed op dieselfde tyd, op dieselfde manier. So, ons kan nie. Ons moet gaan kyk, "Gaan dit daardie verskillende goed affekteer of nie? En dit is baie belangrik dat ons nie net met oogklappe so aan kyk na die storie nie. Die werkskepping; dit is baie belangrik om te kyk of daar gaan 'n verlies wees en goed, maar op hierdie stadium gaan ons kyk wat die impak is, en as daar grootskaalse impak is op die omgewing, en daardie tipe goed, dan sal daar dan ander impakte wees en goed. En dan sal 'n mens dan moet twee keer dink of dit gaan aangaan. So, ons sal nou gaan kyk. Ons sal dit gaan kwantifiseer en dan gaan kyk of dit eintlik 'n groot ding gaan wees. So, in daardie geval, gaan ons dan in 'n groter detail in die stappe wat hierna kom, sal 'n mens dan die groter impak en die ekonomiese goed kan doen. Ek wil nie betrokke raak by die debat hier op die dorp nie, maar ek verstaan dit is deel van die sosiale omgewing. Ek verstaan daar is geskiedenis op die dorp. Daar is geskiedenis in ons land. En dit is belangrik dat ons dit ook verstaan. So, baie dankie vir almal se insette daar.
8.	**Nikolaas Booysen** Dankie. Die saal is nou eintlik leeg. Mense se uitgangspunt oor werkskepping in hulle dorp. Hulle is vissergemeenskap. Hier is opportunities vir werkskep. Dit is maar net, ons moet uitreik na ons leierskap

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

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	met ons se idees en die gebous in ons se hawens kan ons uitwys vir die seker projekte wat ons wil hê. Dan kan die prosesse aangaan, maar dit is maar net verdeeldheid in die gemeenskap bring laat niemand wil met sekere leierskappe saamwerk om sekere goal te achieve. So, daardie gesels random werkskepping. Dit is vir die gemeenskap om alleen byeekaar te kom en hulle werkskepping inisiatiewe uiteen te sit, maar weereens as die Goeriqua stam van die Weskus, versoek ek u om met die stamleiers in konsultasie te tree rondom hierdie projek. Want soos ek sê, en ek benadruk dit, dat ons was ooit geken in u konsultasie prosesse nie. Tot vandag toe was ons nog nie geken nie. Although is ek hier. Ek het opgedaag hier as gevolg van die advertensies. Die manner weet hoe werk die prosesse van free prior and informed consent und in terms of daardie prosesse. En die UNDRIP, en die NEMA Act, die NAGOIA protocol. judgement en almal daardie dokumentasie gaan kyk, dan sal jy sien hoe u met die inheemse gemeenskap, net soos u met die tradisionele gemeenskappe ge-engage het, moet u met die inheemse gemeenskappe engage om die issues klear aan te kry. *Thank you. The hall is now actually empty. People's premise about job creation in their town. They are fishing community. Here are opportunities for job creation. It's just, we need to reach out to our leadership with our ideas and the buildings in our ports can point us out for the sure projects we want. Then the processes can go on, but it's just bringing division into the community let no one want to work with certain leaderships to achieve certain goal. So, that chatter around job creation. It is for the community to come together alone and outline their job creation initiatives, but again as the Goeriqua tribe of the West Coast, I urge you to consult with the tribal leaders around this project. Because as I say, and I stress this, that we were never known to your consulting processes. To this day, we were not yet known. Although I'm here. I showed up here because of the ads. The gentleman knows how do the processes of free prior and informed consent and in terms of those processes work. And the UNDRIP, and the NEMA Act, the NAGOIA protocol. judgement and everybody's going to look at that documentation, then you'll see how your engage with the indigenous community, just like you've engaged with the traditional communities, you have to engage with the indigenous communities to get the issues done.* **GP Kriel** Ek sê baie dankie. Julle is nog steeds welkom om ons te bel, of ons e-pos te stuur of wat ookal. Ons sal julle dan op hoogte hou van hierdie proses verder loop. Dankie dat julle gekom het. Ek waardeer dit en ons sien julle weer. Dankie. *I say thank you very much. You're still welcome to call us, or email us, or whatever. We will then keep you updated on this process going on. Thank you for coming. I appreciate it and we'll see you again. Thank you.*

BYLAE/ APPENDICES

1.	**Bywoning Register/ *Attendance Register***
2.	**Aanbieding/ *Presentation***

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00–18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Michelle Rafe		Tel: Cell: Email: m.rafe@seiche.com		/ Seiche
Colleen Clokie		Tel: Cell: Email: Colleenclokie@gmail'		—
Kubian Smit		Tel: Cell: Email: kubian@tgsmail.com		—
Mrawja Swartz		Tel: Cell: Email: mrawja@gmail.com		—

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Jay-Leigh Abrahams Koopman	76 Cohen	Tel: Cell: Email: jayleighabrahams@gmail.com		Koopman
Mosuli Bomane	N.05 VAN ZYL STRT	Tel: Cell: Email: mosulibomane@gmail.com		
Siphiwe Ntshinka	Bis Compound VAN ZYL Street	Tel: Cell: 082 671 8460		
Anthony Petersen	177 Lizzie Smit Str.	Email: 0717142658		
Sufferance Vibulele Lwazi Mkile	A 9 VAN ZYL Street	Tel: Cell: 060 875 0405 Email: lwazi@mail.com		

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Attendance Register

EIMS Ref	1540	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00–18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Danzil van Wyk	Seester Slingel	Tel: 0606656274 Cell: — Email: danzil.vanwyk@gmail.com		
[illegible]	[illegible]	Tel: Cell: Email:		
Noel [illegible]	52 [illegible]	Tel: 0743348877 Cell: Email:		
David Dia[illegible]		Tel: 0606924925 Cell: Email:		

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PO Box 2865, Paragonia, 2121, South Africa
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Ground Floor, Building 1, Suite 1, Tyger Valley Office Park, Corner Willie van Schoor Avenue and Jan Smuts Drive, Bellville, 7530, South Africa
PO Box 19751, Tygerberg, 7537, South Africa

Attendance Register

BMS Ref	1520	Project Name	Proposed T65 Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lambert's Bay - Community Hall	Date and Time	1 September 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Kim Coetzee	22 Farmer St. Lambertsbay	Tel: 082 612 7727 Cell: Email: kimcoetzee13@gmail.com	KCoetzee	
Marsha Poalje	44 ST Polerstr	Tel: Cell: Email: mneil1233@gmail.com		
Riefka Blom	174 Lizzie Forestr	Tel: Cell: Email: 0653946683	R.Blom	
J N Koopman	76 Geu	Tel: 0730214617 Cell: Email:		

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Attendance Register

EIMS Ref	2520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Radya Strikner	171 Lizzie Breytenbach	Tel: Cell: 0761653942 Email:		
Sinethemba Njokweni	2118 Van Zyl Street	Tel: ~~021 868 6869~~ Cell: 081 668 2363 Email: sinaweyekiwe@gmail.com		
Sinoflepa Tom	816 Van Zyl Street	Tel: 0718264852 Cell: Email:		
Bernlene Boois	Links Str 0 alt	Tel: Cell: Email: —	B Boois	

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00–18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Shannon Mieo	Oongelves 11A	Tel: Cell: 078 500 5982 Email:		
Emmerentia Reid	Saldanha	Tel: Cell: 0640201176 Email:	EReid	
Tamlin Cloete	Piphastraat 42	Tel: Cell: 083 761 8359 Email:	TCloete	
Zinzi Nqaiqai	31 Van Zyl Street	Tel: 0834035351 Cell: Email:	ZNQ	

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Attendance Register

EIMS Ref	1520	Project Name	Proposed 16S Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00–18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Amarene van S	Forest road 66	Tel: Cell: 0603412618 Email:		
Edroy Christian	Conenhas str 3	Tel: Cell: 0633352600 Email: edroyac...@gmail.com		
Reginald Willem Lizzie Bretman		Tel: Cell: Email: 0817126936		
C v/d Heever	BESTERSTR 1	Tel: Cell: 0743364147 Email: vanderheeverlegal		

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T [illegible] | F [illegible]
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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Traan Simon	Hoop STR-206-A	Tel: 0618381410 Cell: 062 248 66 Email: Traan Simon@gmail		
Donald Joop	Boomstraat 132	Tel: Cell: 076 148 2214 Email:		
Johley Wehorst	Barkerstraat 30	Tel: 0785501646 Cell: Email:		
JOHN, Ruhl HEEVER	40 Baster-Bay STR Lamberts Bay 6130	Tel: Cell: 0823995134 Email: www.Johnheever@gmail.com		Visitor

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Attendance Register

EIMS Ref	1520	Project Name	Proposed 765 Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00–18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
[illegible]	[illegible]	Tel: [illegible] Cell: Email: [illegible]	[illegible]	[illegible]
		Tel: Cell: Email:		
SENIOR CHIEF NicolasBayson	LAMBERTSBAY	Tel: 082 7304536 Cell: Email: [illegible]@gmail.com	Bayson	WEST COAST GURIQUA Council
		Tel: Cell: Email:		

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Deandre Coetzee	5 Alpha Street Lambertsbaai 8130.	Tel: — Cell: 0717142658 Email: —	Coetzee	
Pauline Hector	Stanley Street	Tel: 0608950405 Cell: Email:	Hector.	
Jade Aulano	Muirgas Street	Tel: 060 442 7824 Cell: Email:		
Samuel Cloete	Seeker Single	Tel: Cell: 060 819 6855 Email:	Cloete	

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Attendance Register

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EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00–18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
[illegible]	Compound	Tel: Cell: 0731542196 Email: [illegible]		
Jokani Mthubeni	Compound A22	Tel: Cell: 0117648448 Email: Zoetombungu@gmail.com		
Jan Joseph & Athuhle Dalahunga	Fisant STR122 Compound A1	Tel: Cell: 079 926 3462 / 063 927 2711 Email:	J Joseph	

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Attendance Register

EIMS Ref	1520	Project Name	Proposed SGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Mkuseli Bomane	05 VAN Zyl Street	Tel: 0660786394 Cell: Email: mkuseli@gmail.com		
Martha Mgo	04 Faroa Street	Tel: Cell: 063 510 6112 Email: martha@gmail.com		
Marcella Clemson	3 Cornelius str	Tel: Cell: 082 626 7476 Email:		
Melissa Cloete	Coetzee str. 21	Tel: Cell: 0835378903. Email:		

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Attendance Register

EIMS Ref	1320	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Enver Jansen	3e Concelvestr Lambertsbay	Tel: Cell: 065 248 5160 Email:		
Leon Arno Engelbrecht	82 Bakoor St. Lambertsbay	Tel: Cell: 078 007 1968 Email: leonengelbrecht@yahoo.com		
Lolethu Ntsithiya	Compon 1	Tel: Cell: 079 645 6067 Email: lnantshiyo@gmail.com		
Sonwabo Sihle	29 dolphin Street	Tel: Cell: 082 701 0332 Email: SonwaboSihle86@gmail.com		

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TES Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00–18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Lindsay Lamont	Beebers Erwat 103	Tel: 079 454 1643 Cell: 079 454 1643 Email:	L. Lamont	
Rosy Shaholo	Sandyacres 9	Tel: 0669944764 Cell: Email: shaholorosy@gmail.com	RS	Coastal Links
George Lanes ~~Setome Sauk~~	Boyce Str 27	Tel: Cell: 0626789894 Email: lanesgeorge@gmail.com		VISSER.
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Attendance Register

EIMS Ref	1520	Project Name	Proposed 1133 Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Chanell van Rooi	Van Zyl Street 14	Tel: 083 314 5000 Cell: Email:	Rooi	-
LETITIA Philand		Tel: 0120731903 Cell: Email:	L. Philand	
WILLEM Bekker	BARKER STR 38	Tel: Cell: 0638395747 Email:	W. Bekker	
NIKITA TERRY	BARKER ST 97	Tel: Cell: 0638395747 Email:	N. Terry	

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	1 September 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Joshua Jansen	Comaliss 6 N 8.0	Tel: Cell: 0748493788 Email:		
James Duno	-	Tel: Cell: Email:		
Johan Jules		Tel: 0622044246 Cell: Email:		
Bach-Hein Abuse	Malgasse 65	Tel: 071 840 2607 Cell: Email:		

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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*	
EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*: TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

VERADERING BESONDERHEDE/ *MEETING DETAILS*

Vergadering/ *Meeting*	1520 Pre-application Consultation Public Meeting		
Vergadering Plek/ *Meeting Venue*	Erik Baker Hall, Hondeklip Bay	Date	2022/09/02
		Time	16h00-18h00

Teks in *italics* is uit die Afrikaanse teks vertaal. *Text in italics has been translated from the Afrikaans text.*

'n Openbare vergadering is geskeduleer tydens die vooraansoektasse met die Belanghebbende en Geaffekteerde Partye (I&APs). Die doel van die vergadering was om die aanvanklike bekommernisse van die lede van die publiek en belangrike I&APs vas te lê. Tydens die openbare vergadering wat tussen 16:00 en 18:00 plaasgevind het, is 'n aanbieding van die projekbeskrywing, voorlopige impakassessering, projekspan en projektydraamwerke aan alle deelnemers van die vergadering deur Environmental Impact Management Services (EIMS) Pty (Ltd) gelewer. 'n Aanbieding is deur mnr GP Kriel van EIMS in Afrikaans gelewer. SEICHE het 'n aanbieding gelewer oor die omgewingsversagting wat tydens seismiese opnames in terme van die Marine Soogdier Waarnemer (MMO) en Visserykalbeampte (FLO) in Afrikaans uitgevoer is. Die aanbieding is deur mnr Rudian Baily gelewer. Nadat die aanbiedings afgelewer is, is 'n vraag- en antwoord sessie geopen waar deelnemers vrae gevra het of hul kommentaar oor die projek uitgespreek het. Die bywoningsregister is aangeheg as 'n aanhangsel tot hierdie dokument.

A Public Meeting was scheduled during the pre-application phase with the Interested and Affected Parties (I&APs). The aim of the meeting was to capture the initial concerns from the members of the public and key I&APs. During the public meeting which took place between 16h00 and 18h00, a presentation of the project description, preliminary impact assessment, project team and project timeframes was delivered to all attendees of the meeting by Environmental Impact Management Services (EIMS) Pty (Ltd). A presentation was delivered by Mr GP Kriel from EIMS in Afrikaans. SEICHE delivered a presentation on the environmental mitigation carried out during seismic surveys in terms of the Marine Mammal Observer (MMO) and Fishing Liaison Officer (FLO) in Afrikaans. The presentation was delivered by Mr Rudian Baily. After the presentations were delivered, a question and answer session was opened where attendees asked questions or expressed their comments regarding the project. The attendance register has been attached as an appendix to this document.

AGENDA

Item
1. EIMS Aanbieding/ *EIMS Presentation*
a. Bekendstelling van die projekspan/ *Introducing the project team*
b. Projekbeskrywing/ *Project Description*
c. Regsaansoekproses/ *Legal Application Process*
d. Publieke Deelname/ *Public Participation*
e. Impakbepaling/ *Impact Assessment*
f. Projek Kontak Besonderhede/ *Project Contact Details*
g. Aanbieding van SEICHE/ *Presentation from SEICHE*
2. Vraag en Antwoord/ *Questions and Answers*

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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*	
EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

NOTULE/ *MINUTES*

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1.	Alle deelnemers is versoek om die bywoningsregister te onderteken soos hulle ingestryf het. Aanbiedings van EIMS en SEICHE van die projekbeskrywing, aansoekproses en omgewingsversagtings tydens seismiese opname is gelewer volgens die agenda hierbo aan die vergaderinggangers. Daar is aangedui dat die vergadering opgeneem sou word vir die doeleindes van akkurate notule neem. Agtergrondinligtingsdokumente (in Engels, Afrikaans en isiXhosa), kommentaarvorms, registrasie, inligtingsuitdeelstukke en bywoningsregisters is by die vergadering beskikbaar gestel. Die deelnemers is aangemoedig om hul kommentaar en bekommernisse in te dien deur die kommentaarvorms in te vul wat verskaf word of deur kommentaar in te dien by die projek-e-posadres wat verskaf is. Daar is opgemerk dat alle deelnemers wat hul kontakbesonderhede verskaf het, by verstek geregistreer sal word op die I&AP-databasis wat deur EIMS gehandhaaf word. Na aanleiding van die aanbiedings is die vloer oopgemaak vir 'n bespreking en die deelnemers is aangemoedig om enige vrae of bekommernisse wat hulle oor die projek gehad het, op te stel. *All attendees were requested to sign the attendance register as they entered. Presentations from EIMS and SEICHE of the project description, application process and environmental mitigations during seismic survey were delivered as per the agenda above to the meeting attendees. It was indicated that the meeting would be recorded for the purposes of accurate minute taking. Background Information Documents (in English, Afrikaans and isiXhosa), comments forms, registration, information handouts and attendance registers, were made available at the meeting.* *The attendees were encouraged to submit their comments and concerns through filling in the comment forms provided or by submitting comments to the project email address provided. It was noted that all attendees who have provided their contact details would be registered by default on the I&AP database maintained by EIMS. Following the presentations, the floor was opened for a discussion and the attendees were encouraged to bring up any questions or concerns they had about the project.*
2.	Vraag en Antwoord/ *Questions and Answers*
a.	John Adams Dankie, ek is John Adams, woonagtig hier in Hondeklipbaai. Ek het onder dag by die laaste vergadering het ek gevra watter kop het jy nou weer op, die rede vir dit is, presies wat ons nou, die slide-show wat julle vir ons nou gewys het, wat presies in die vorige keer ook gehou, die feit dat dit nou 'n nuwe konsultant is of 'n projek is, is dit presies dieselfde dinge wat gebeur in die vorige projek en wat nou gebeur. As ek nou kyk na die operasie wat hulle daar uitwys van die loei wat hulle nou daar alstour in die water in, dis presies dieselfde. Die werksaamhede daar op die boot, onse vrees is net, op die vorige keer kon ons nie die antwoord gekry het nie, nou is, gaan ons nog steeds nie die antwoorde kry nie, jy het nou tarlocps gesê, ons moet nou nie die twee met die ander ene vergelyk nie. Waar ek nou is, is ek by die laaste keer se ene. En my vraag wat ek daar gaan het is weereens; hoe kommunikeer hierdie apparate met die visse? En dit is eintlik onse grootste knelpunt. Hoelank gaan ons nog vis vang as hierdie proses aan die gang is? Nou is daar 'n eerste ene, hier is nou weer 'n tweede aansoek, daar is nou daar gekoppel vir toekenning gee vir 'n, of die projek kan voortgaan of nie, op die vorige workshops het ons nog nie terugvoering gekry oor die vorige projekte wat aanduiding gegee het van hierdie selfde operasie, ons in nou nie by daardie ene nie, hier is weer 'n nuwe een op die tafel. So, ongelukkig moet ek, as ek praat van die huidige kan ons nou maar net aan luister wat nou vandag gesê word, maar as ons terugfiits

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

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	is ons op dieselfde channel van die vorige ding, so ek wil graag net weet, die kommunikasie met die vis. Want dit is onse groot knelpunt, baie dankie. *Thank you, I am John Adams, living here in Hondeklip Bay. I asked the other day at the last meeting what help do you have back up now, the reason for that is, exactly what we are now, the slide show that you guys held for us now was exactly in the last time also held, the fact that it is now a new consultant or a project, it's the exact same things that happened in the previous project and what's happening now. Now, when I look at the operation they're pointing out there from the bottleneck they're sending down there into the water, it's exactly the same. The activities there on the boat, our fear is just, last time we couldn't have gotten the answer, now is, we're still not going to get the answers, you said casually now, we shouldn't compare the two with the other ones now. Where I am now, I'm at the last time's ones. And my question of what I went there is again; How do these gadgets communicate with the fish? And that's actually our biggest bottleneck. How long are we still going to fish if this process is ongoing? Now there is a first one, here is now another second application, there is now linked there for grant giving for a, whether the project can continue or not, on the previous workshops we have not yet received feedback on the previous projects that gave indication of this same operation, we in now not at that one, there's a new one on the table again. So, unfortunately I have to, when I'm talking about the current one we can just listen to what's being said today, but if we have a flashback we're on the same channel of the previous thing, so I'd like to just know, the communication with the fish. Because that's our big bottleneck, thank you very much.* GP Griel In terme van die kommunikasie met die vis, dit is hoekom ons 'n omgewingsimpak studie moet doen. Dit is omdat dit 'n aktiwiteit is wat kan 'n impak hê op die vis. Dit is die sentrale komponente van ons studie, van ons impak studie is om te gaan kyk na die vissery om te gaan kyk na die verskillende tipes vis wat daar voorkom, waar hulle broei, ens. en dan gaan kyk ons na die verskillende dinge van bo tot onder, soveel as moontlik. So daar is 'n groot klomp reeks studies wat gedoen is in die Suid Afrikaanse geskiedenis deur verskillende ouens hier langs die kus af, daar is 'n groot klomp studies wat huidiglik aan die gang is, so ons gebruik al daai inligting van daai ouens af om te kyk. Ons weet daar is waar die spawning areas is, daar is waar die recruitment area, al daai tipe goeters is, en dan weet ons, gebaseer op al daai inligting kan mens dan 'n besluit gaan maak en sê luister die waarskynlikheid van die impak is so groot of dit. Dis dan ook spesifiek hoekom ons gaan kyk het na die akoestiese goeters. So, wat ons doen met die akoestiese goeters, omdat dit 'n harde knal is, moet 'n mens gaan kyk hoe verander daai knal oor tyd en oor afstand en afhangende van die water en wat daar is en die seestrome doen en die weer en al daai goeters en dan kan die ouens dit gaan, hulle het redelike akkurate modelle wat hulle dan kan gebruik om te sê, oukei, luister hierdie tipe knal gaan op hierdie afstand so hard wees en hy gaan dan binne hierdie frekwensie wees, en dan kan jy uit gaan figure, hierdie, ons weet dan op watse frekwensies kan watse diere dit hoor en dan kan 'n mens sien; oukei luister hierdie walvis gaan heel waarskynlik so reageer op daai ding, hierdie tipe walvis gaan so reageer op daai, hierdie tipe vis met sy verskillende pressure bladders en al daai tipe goeters gaan so reageer. So dan gaan kyk mens na al daai verskillende goeters, en dan is daar verskillende threshold shifts wat 'n mens kan kyk en daai threshold shift beteken basies waar hy sy gedrag gaan verander. So dit is soos basies, as jy 'n verskriklike harde luidspreker aanzit, op watter afstand kan jy staan dat jy gaan oukei voel dat jy nie gaan bedreig voel en gaan wegswem en daai tipe goeters nie. So al daai goeters is die goeters waarna die ouens op hierdie stadium nou besig is om te kyk en dis hoekom dit belangrik is om te modelleer en te kyk waar hulle aansoek area is, wat die omstandighede by daai area is en om dit is, watse mense daai area gebruik, watse visse daar voorkom, al daai tipe goeters en dan op die oor einde van die dag, 'n geheelbeeld te kry daarvoor om te sê oukei hierdie is die waarskynlike impak op die vis, hierdie is die waarskynlike impak op daai dier, op daai dier, op daai dier, op daai gedeelte van die

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	ongewing, en so aan en so aan. So dis min of meer die method behind the madness so dis wat ons probeer doen daar. Ek weet nie of dit jou vraag beantwoord nie. *In terms of communicating with the fish, this is why we should conduct an environmental impact study. This is because it is an activity that can have an impact on the fish. These are the central components of our study, from our impact study is to go and look at the fishery to go and look at the different types of fish that are found there, where they breed, etc. And then we go and look at the different things from top to bottom, as much as possible. So there's a big bunch of series of studies that have been done in South African history by different guys down here along the coast, there's a big bunch of studies that are going on right now, so we're using all that information from those guys to watch. We know there's where the spawning areas are, there's where the recruitment area, all those types of things are, and then we know, based on all that information, one can then go and make a decision and say listen the probability of the impact is so great or that. That's specifically why we went to look at the acoustic stuff. So, what we do with the acoustic stuff, because it's a loud bang, one has to go and see how does that bang change over time and over distance and depending on the water and what's there and the ocean currents do and the weather and all those things and then the guys can go in, they have pretty accurate models that they can then use to say, Okay, listen this type of bang is going to be so loud at this distance and he's going to be within this frequency then, and then you can go out figures, this, we know then at what frequencies can what animals hear it and then one can see; okay listen this whale is probably going to react that way to that thing, this type of whale is going to react so much to that, this type of fish with its different pressure bladders and all those types of things are going to react that way. So then you go and look at all those different things, and then there are different threshold shifts that one can watch and that threshold shift basically means where he's going to change his behaviour.* *So it's like basically, if you put on a terribly loud speaker, at what distance can you stand that you're going to feel okay that you're not going to feel cheated and go swimming away and those types of things. So all these things are the things that the guys are looking at right now and that's why it's important to model and see where their application area is, what the conditions are at that area and what it is, what people use that area, what fish are there, what fish are there, all those types of things and then at the end of the day, get a big picture about saying okay this is the likely impact on the fish, this is the likely impact on that animal, on that animal, on that animal, on that part of the environment, and so on and so on. So that's more or less the method behind the madness so that's what we're trying to do there. I don't know if that answers your question.*
b.	**Dawid Strydom** Die ding sneak dit vir my praat nie, hoe dit ook al sy, can you hear me now? Hoe dit ook al sy, dit wat u nou sê, dit klink nou asof dit nou die eerste keer is wat so 'n opname of navorsing stuk gedoen word, want jy sê sorry, laat ek nou nie sê jy, u sê dat ons gaan nou nog gaan kyk hoe die goeters gebeur, ons gaan nou nog loop kyk, asof dit die eerste keer is. Nou kom ek sê ek het nou ook nou 'n bietjie internet klomp navorsing gedoen en ek gaan nou dit u nou wys op hierdie presentation wat julle nou hierso het, stuur ek nou vir u 'n email sodat u sommer hierdie navorsing stuk van dokters en professore wys wat is die effek en dit kan gelees word en dan gaan ons vir ons moal in Afrikaans ook dan verduidelik wat is die effek en wat sê Dr Kosie en wat sê Dr Klasie. Nou as ek praat van dokters en professore wat hierso is, laat ek nie praat nie, dan moet ons nou vra nou; wat is die manse, is julle honneursgrade, doktorsgrade, PhD, whatever grade, om dan die dokters te counter wat hulle sê, nie wat ek sê nie, wat die dokters sê op hulle se navorsing stukke wat is die effek en op die langtermyn en hoe dit gaan gebeur. So, hoe dit ook [al sy? 0:47:07] ons kan nie gaan sê ons moet nou nog gaan kyk wat het gebeur nie, want die goeters het alreeds gebeur. Nou kom ek sê ook nou, ek is ook 'n gegraduseerde van Stellenbosch Universiteit en ek wil nie nou meer hê, ek wil ook net saam met 'n stroom gaan en aan die neus gelei word nie. Kom

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	ons verstaan daai reg. Ek het ook my research dokumente gedoen en ek ken daai goeters, nou moet ons nou nie aan die neus laat lyk nie, kom ons vat nou ook 'n ander aspek van 'n ander dokter en 'n ander professor dat ons nie net van julle se tafel af staan en eet nie. Miskien gaan ons nou die email adres nou gou-gou vir u net kom lash, stuur dit dan en sit dit daarop. Ons het gekom, ons het tyd, dit behoort seker nie baie lank te vat om vir ons daai dokter se navorsing stuk te gee nie, sodat ons 'n inligting kry van 'n ander oogpunt dan, nie net van hierdie mense hier nie want hierdie mense hou ons soos donkies op onse dinges met klappe en sê luister wat ons wil hê julle moet sê. Ek wil ook net sê, byvoeg, voor ek nou verder aan daarso aangaan, voor ek hulle nou hierdie ding gaan stuur, ons moet onthou waarvan af ons kom. En onse geskiedenis moet 'n maatstaf wees van hoe ons hier vanaf vorentoe gaan beweeg. Nou waarvan praat ek? Kom ek praat nou van die invasion of South Africa. Toe het die mense oorsee gekom en onse gronde en onse land gekom afvat oraait. Nou hulle is nie meer by die grond en die land nie, hulle vat nou die see ook oor. Nou ons, hoe ver wil ons nou nog gekondisioneer word of onse minds gekoloniseer word in die hoop dat hulle gaan vir ons iets moois bring? Ons sit met 'n dangerous en ons sit met 'n very dangerous situation whereby ons glo wat ons nie moet glo nie. Nou kom ons kry ook nou in die verband nou 'n angle, miskien moet ek ook nou in daai selfde asem ook vra, en ek kan jou nou al sê jy sal nie vir my daai vraag kan beantwoord nie, jy verteenwoordig mos nou hierdie mense, nou ek het 'n bietjie gaan oplees dat die maatskappy was in April in die hof gewees, right? En toe hulle in April in die hof was toe sê hulle, hulle het 'n R 450 000 000.00 reeds gespandeer net om die kontrak te kan kry. Of dit nou net om blasting te kan doen. Nou vra die hof; right, as dit die geval is, wys vir my hoe het julle die R 450 000 000.00 gespandeer? En die hof het dit difficult to the extent tot onmoontlik gevind but toe present hulle in die hof, want hulle het nie bewyse hoe hulle daai R 450 000 000.00 gespandeer het nie. Nou wat het van die R 450 000 000.00 gebeur, of is die mense omgekoop. Maar van julle doen 'n presentation, nou kom ek sê net ek doen nie die presentation nie, die dokters en die professore en die navorsing wat so ver soos 2017 gegaan het, hulle kan vir ons dan 'n beter of 'n geheelbeeld ook maar gee van wat gebeur, miskien is dit nou tyd ook nou dat die mense 'n koekietjie kan eet solank die email deurgestuur word na u toe. Met u toestemming, dankie. *The thing tastes like it doesn't speak to me, either way, can you hear me now? Anyway, what you're saying now, it sounds like now it's the first time such a survey or research piece has been done, because you've saying sorry, now let me not say you, you're saying that we're still going to go and see how the stuff happens, we're still going to watch the stuff now, we're still going to watch, as if it were the first time. Now let me say I've also done a little internet bunch of research and I'm going to point out now that you guys have hereso now, I'm sending you an email now so you just show this research piece from doctors and professors what is the effect and it can be read and then we're going to explain to us nicely in Afrikaans also then what is the effect and what does Dr Koole say and what does Dr Klasie say. Now if I'm talking about doctors and professors who are here, let me not speak, then we must ask now; what are the people, are your honours degrees, doctorates, PhD, whatever degrees, to then counter the doctors what they say, not what I'm saying, what the doctors say on their research pieces what is the effect and in the long run and how it's going to happen. So either way [whatever? 0:47:07] we can't go and say we still have to go and see what happened, because the stuff has already happened. Now let me also say, I am also a graduate of Stellenbosch University and I don't want anymore, I also just want to go with a stream and be led by the nose. Let's understood that right. I've also done my research documents and I know these things, now we shouldn't have the nose suffered, now let's take another aspect of another doctor and another professor that we're not just standing and eating from your table. Maybe now we're going to just come and put in the email address for you soon, then send it and put it on it. We've come, we've got time, it probably shouldn't take very long to give us that doctor's research piece, so we get an information from a different point of view then, not just from these people here because these people are holding us like donkeys on our things with slaps and saying listen to what we want you to say. I also just*

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	want to say, add, before I move on to it now, before I'm going to send them this thing now, we have to remember what we're coming from. And our history needs to be a measure of how we're going to move forward here. Now what am I talking about? Now let me talk about the invasion of South Africa. Then the people came overseas and came to take down our lands and our land. Now they are no longer at the ground and the land, they are now taking over the sea as well. *Now we, how far do we still want to be conditioned or our minds colonized in the hope that they are going to bring us something beautiful? We sit with a dangerous situation and we sit with a very dangerous situation whereby we believe what we should not believe. Now let's get an angle now too, maybe I should ask in that same breath too, and I can tell you by now you won't be able to answer that question, you're representing these people now, now I've gone to read up a bit that the company was in court in April, right? And when they were in court in April they said, they had already spent a R 450 000 000.00 just to get the contract. Be it just to be able to do blasting. Now the court asks: right, if that's the case, show me how did you spend the R 450 000 000.00? And the court found that difficult to the extent impossible but then present them in court because they do not have evidence how they spent that R 450 000 000.00. Now what happened to the R 450 000 000.00, or were the people bribed. But some of you are doing a presentation, now let me just say I'm not doing the presentation, the doctors and the professors and the research that went as far as 2017, they can then give us a better or a big picture of what's happening, maybe it's time now that the people can eat a cookie as long as the email is forwarded to you. With your permission, thank you.* **GP Kriel** Ek wil net gou sê ek dink die email is 'n goeie idee, stuur dit asseblief vir ons. Ek wil dit graag sien – ek gaan dit net ongelukkig nie nou kan deurgaan nie. Want ek sal graag net deur dit wil gaan dat ons kan kyk wat die situasie is. Wat ek voorstel en met julle toestemming asseblief, wil ek dit graag voorstel dat ons, kom ons stuur daai epos vir ons, ons gaan dit aanstuur vir ons mense en dan gaan hulle gaan kyk daarna en kan ons gaan kyk of dit navorsing is wat nuut is of nie en dan kan ons dit ook in ag neem in ons verslag. Ek wonder of dit dalk 'n beter manier is om te kyk want op hierdie stadium het ons nog nie, ons is nog in die begin stadium van hierdie proses so ek wil nie, I don't want to jump the gun. Maar ek is baie dankbaar dat jy vir ons dit wil deurstuur. I just want to say, I think the email is a good idea, please send it to us. I'd like to see it – I'm just unfortunately not going to be able to go through it right now. Because I'd love to just go through it that we can see what the situation is. What I'm proposing and with your permission please, I'd like to suggest that we, let's send us that email, we're going to forward it to our people and then they're going to go look at it and we can go see if it's research that's new or not and then we can also take that into account in our report. I wonder if this might be a better way to look because at this point we haven't yet, we're still in the beginning stages of this process so I don't want to, I don't want to jump the gun. But I'm very grateful that you want to send us through this.
4.	**Dawid Markus** Maar nou is julle selektief en julle wil hê ons moet kyk wat julle vir mens wil sê right, so ons moet luister as julle vir ons 'n presentation kom gee right, nou vra ons, wat is die moontlikheid dat julle lieg vir onse mense. Dit behoort vyf minute te vat om daai artikel te kry sodat ons kan sien wat sê die dokters en wat sê die navorsing, wat is die effek op die marine ekosisteem? *But now you're selective and you want us to see what you want to say to you, so we have to listen when you come and give us a presentation, now we're asking, what's the possibility that you're lying to our*

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	people. It should take five minutes to get that article so we can see what the doctors say and what does the research say, what is the effect on the marine ecosystem?
	GP Kriel
	Dit 'n langer proses hierdie. Dis nie net 'n vandag nie, so wat dit is, is ons gaan daai vat, ons wil dit gaan kyk na, ons het dit dan gevat en dan die volgende keer wanneer ons terug kom gaan ons met julle kom terugvoering gee oor daai storie. So, kan ons dit onderneem, want vir my om dit nou te doen, om dit hier te kry, ek dink ons gaan tyd mors, ek gaan 'n halwe inligting hê, ek gaan nie konteks hê van al daai goeters nie, ek moet dit ook eers met my mense gaan bespreek wat die spesialiste is op daai area en dan kan ons vir julle kom terugvoering gee oor wat sê hulle van dit, wat is die situasie en ek dink dan kan ons 'n dialoog hê daaroor. Dan ons op die regte manier gesels daaroor. Ek wil dit met jou doen, ek sal nou 'n onderneming maak dat ons dit doen en dan doen ons dit so.
	Ek stem saam met jou, ek wil jou nie, ons wil julle nie stil maak of wat ook al nie, ons het regtig hiernatoe gekom om oop kaarte te kom speel en vir julle 'n voorlegging te kom gee van dit wat ons weet. Ons is nie hier om iets weg te steek nie. Julle weet van die vorige prosesse, ons het aangegaan met al die goeters, ons is nie eers betaal vir daai vorige proses nie en ons het nog steeds vir julle laat weet wat aangegaan het. Ons wil niks wegsteek nie. Die idee is glad nie om iets weg te steek nie. As daar onsekerhede of tekortkominge of wat ook al in ons proses is moet ons volgens wet dit in sit in ons verslae en al daai tipe van goeters. So ons probeer oop kaarte speel so ver soos wat ons gaan. So asseblief, ons wil rêrig niks wegsteek nie. Ons nie hier met 'n agenda of enige iets nie ons is hier om oop kaarte met julle te kom speel ons wil julle net bekend tel en sê oukei luister; ons weet daar is dalk verwarring daar is verskillende goeters wat aangaan, die wêreld is besig om teen 20 000 kilometer 'n uur te koop maar asseblief, hierso is die situasie, dit is wat aangaan. Ons wil regtig nie kom verwarring saai nie, ons wil kom clarity gee. En dan vir julle 'n geleentheid gee om te dialogue, om te gesels, om te praat. So dit is glad nie om goeters te doen nie, asseblief, ons wil regtig met julle oop kaarte kom speel en ek waardeer dit, dit is vir ons van kritiese belang. Want ons weet ons is geleerde ouens in 'n spesifieke veld maar ons weet daar is mense wat hier bly wat ook goeters weet en dit is belangrik dat julle kennis dan in ag geneem word. Dis belangrik dat julle kennis dan ook gedeel word. As ons 'n gap het moet julle dit kom aanvul dan moet julle vir ons kan sê; julle het op gesig daar. So, ek waardeer dit rêrig dat jy dit doen maar ek dink net op hierdie stadium om dit nou hier in hierdie vergadering te gaan doen gaan nie heeltemal lekker werk nie en ons wil terug kom en ons wil daai ding kom bespreek in die volgende keer, is dit reg so?
	It a longer process this. It's not just a today, so what it is is we're going to take that, we want to go check it out, we took it then and then the next time we come back we're going to come and give you feedback on that story. So, can we undertake this because for me to do it now, to get it here, I think we're going to waste time, I'm going to have half an information, I'm not going to have context of all those things, I also have to go and discuss it with my people first what the specialists are in that area and then we can come and give you feedback on what do they say about it, what is the situation and I think then we can have a dialogue about it. Then we chat about it the right way. I want to do it with you, I'll make a company now that we do it and then we do it that way.
	I agree with you, I don't want you, we don't want to silence you or whatever, we really come here to come and play open cards and come and give you a presentation of what we know. We're not here to hide anything. You know about the previous processes, we went on with all the things, we weren't even paid for that previous process and we still let you know what went on. We don't want to hide anything. The idea is not to hide anything at all. If there are any shortcomings or shortcomings or whatever in our process, we have to put them into our reports and all those types of things by law. So we try to play open cards as far as we go. So please, we really don't want to hide anything. We not here with an agenda or anything we're here to come and play open cards with you we just want to count you know and say okay

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	listen; We know there may be confusion there are different things going on, the world is buying at 20,000 kilometres an hour but please, here's the situation, that's what's going on. We really don't want to come and sow confusion, we want to come. And then give you an opportunity to dialogue, to chat, to talk. So it's not to do things at all, please, we really want to come and play open cards with you guys and I appreciate that, it's critical for us. Because we know we're learned guys in a particular field but we know there are people who live here who also know things and it's important that your knowledge is taken into account. It is important that your knowledge is shared. If we have a gap you have to come and supplement it then you have to be able to tell us; you guys slipped up there. So, I really appreciate you doing it but I just think at this point going to do it right now here in this meeting isn't going to work quite nicely and we want to come back and we'll come and discuss that thing next time. Is that right?
4.	**Patrick Ralph** Ja, my storie is ook maar dieselfde soos laaste, en ek voel baie sterk daaroor dat hierdie is 'n onding. Want elke gevolg is 'n nagevolg. Nè, en die nagevolge van hierdie ding, olle in water is nie maats nie. Government fail ons in hierdie verband. En daarom kan ek ook nie saamstem met wat julle hier kom verkoop nie, in elk geval nie. Julle se vertroue oop hierdie tegnologie is vir my verbasend. Ek is ook hier, ek sit ook hier en ek vat ook tellies en ek sien ook die vis getalle jaarliks sien ek. En dit lyk nie goed nie. Met al hierdie benamings en goed wat gegee word vir aard verwarming en watse goeters en goed, is dit dieselfde ding, dis dieselfde wat hier gebeur nou bo op hierdie aard verwarming, verstaan om nou nog met hierdie tipe van goed te kom. En ander keer is hier gesê waar na toe draai Hondeklipbaai se inwoners hulle? En ek, in hierdie geval die hele Weskus af, waarnatoe draai ons nadat julle sien hoe verwoes hierdie aarde is hierso. Hier is niks, dis 'n dooie stuk aarde hier af, die enigste lewe is hierdie kant, en die enigste lewe wat maar, onse voorouers het nie hierdie reg gehat wat ons vandag het, hulle is nie gevra nie. Ons, hierdie geslag word vandag, word gevra om toestemming te gee om hierdie see te verwoes. So ons kan nie ja sê nie. Ons kan nie saamstem met hierdie oefening nie. So soos ek sê dis 'n onding vir my en hierdie ding moet verwerp word. In elk geval is dit 'n ding van government verstaan vir klein of vertolk kleinskaalse vissers anders as wat die gemeenskap hom vertolk, hulle het 'n paar mense het hulle gegroepeer en gesê ouke julle word erken as Hondeklipbaai se vissermanne, se vissers, so ons gee julle 'n kwota, 'n kwota vir soveel jaar maar hier is deaglike mense wat kom en ek kan nou maar 'n simpel voorbeeld maak, uit die skool uit kom wat klaar maak met skool waarnatoe gaan hierdie manne wat nie werk het nie. Hulle gaan see toe, verstaan? Maar nou moet hulle, hulle moet oor hulle se skouer kyk en loop visvang. Dis wat hier gebeur, in plaas daarvan dat government meer kwotas toestaan aan onse mense wil hy nou die lewe verwoes. So dis hoekom ons sê ons kan nie ja sê nie. Al hierdie knal gelukie en goed wat julle hier aan gaan, kom ek is simpel, daai diere kan mos doof raak as gevolg van daardie klanke en goeters, hè? Wanneer gewaar julle daai dinge? Soos ek sê hier is manne wat met fish finders loop visvang, dan wys daai ding niks, dan vang die man daar vis. Hulle kom op hier, want dan sê hulle, hulle verstaan nie, daai ding het eiks gewys nie, hy is aan, hy is tegnologies aan, daar wys daar is nie vis nie maar hulle vang daar vis. So, die tegnologie is feilbaar. Die tegnologie wat julle so vertrou is feilbaar. So ons kan nie as 'n community met hierdie ding saamstem nie. Dis my dingesse en goete, my bydrae wat ek lewer. Wie wil nog stemps opsit. *Yes, my story is also just the same as last, and I feel very strongly about this being an "onding". Because every consequence is an afterthought. Huh, and the aftereffects of this thing, all in water are not mates. Government fails us in this regard. And that's why I can't agree with what you guys are coming to sell here either, anyway. You're confident in this technology is surprising to me. I'm here too, I sit here too and I also take tellies and I also see the fish numbers every year I see. And it doesn't look good. With all these designations and stuff that's given for earth warming and what's going on and stuff, it's the same*

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	thing, it's the same that's happening here now on top of this kind of warming, understand to come up with this type of stuff now. And other times it has been said here where do Hondeklip Bay residents turn to? And I, in this case the whole West Coast, what we turn to after you see how devastated this earth is hereso. There's nothing here, it's a dead piece of earth down here, the only life is this side, and the only life that but, our ancestors didn't have this right that we have today, they weren't asked. We, this generation today, are being asked to give permission to devastate this sea. So we can't say yes. *We disagree with this exercise. So as I say it's an ending for me and this thing should be rejected. In any case, it's a thing of government understanding for small or interpreted small-scale fishermen differently than the community plays him, they've got a few people grouping them and saying okay you're recognized as Hondeklip Bay's fishermen, so we're giving you a quota, a quota for so many years but here are people coming on a daily basis and I can just make a silly example, coming out of the school that finishes school these men who don't have a job go to. They're going to the sea, understand? But now they have to, they have to look over their shoulder and walk fishing. That's what's happening here, instead of government granting more quotas to our people, he now wants to ruin life. So that's why we say we can't say yes. All these popping sounds and stuff you're going on here, let me be silly, those animals can go deaf because of those sounds and things, huh? When do you notice those things? As I say here are men who walk fishing with fish finders, then that thing shows nothing, then the guy there catches fish. They come up here because then they say, they don't understand, that thing hasn't shown anything, he's on, he's technologically on, there's no fish but they're catching fish there. So, the technology is fallible. The technology you trust so much is fallible. So we can't agree with this thing as a community. It's my things and things, my contribution that I make. Who still wants to put up votes.* **GP Kriel** **Baie dankie vir daai Mnr Rulfe. Kyk ek meen hierdie is nie om noodwendig te kom toestemming praat en daai tipe goeters nie, maar dis belangrik dat julle julle sê sê. Dis belangrik dat julle moet sê hoe julle as gemeenskap voel want daai is belangrik vir die besluit wat geneem moet word oor hoe die mense voel. So dis hoekom ons hierdie keer gekom het en met ons huidige proses en goeters ook die sosiale kant van dinge probeer kry en met die erfenis en daai goeters probeer doen so want dit help nie daar is miskien 'n kleinerige impak gewees of wat ook al nie maar die gevoel in die gemeenskap is dalk nie so hot oor die hele besigheid nie. So daai en is ook vir ons baie belangrik so ek, baie dankie vir dit, ons sal dit opsit in die notules en goeters. Die tegnologie en goeters wat hulle daar gebruik is nie, ek wil net dit sê, dis nie jou gewone fish finder nie, maar dit, daai is 'n impak, dis hoekom ons die impak studie moet doen, dis hoekom hulle nie net kan gaan doen wat hulle wil doen nie, dit is juis die rede daarvoor en ons moet dit gaan identifiseer.** *Thank you so much for that Mr Rulfe. Look I'm not thinking this is necessarily to come and talk permission and those types of things, but it's important that you have your say. It is important that you say how you feel as a community because that is important for the decision that needs to be made about how the people feel. So that's why we came this time and with our current process and things are also trying to get the social side of things and trying to do with the heritage and those things so because it doesn't help there might have been a smallish impact or whatever but the feeling in the community might not be as hot about the whole business. So that and is also very important to us so I, thank you so much for that, we'll put it up in the minutes and stuff. The technology and stuff they're using there isn't, I just want to say this, it's not your usual fish finder, but this, that's an impact, that's why we need to do the impact study, that's why they can't just go and do what they want to do, that's precisely the reason for it and we have to go and identify it.*
4.	**John Adams**

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	Dankie, JP, yes, ek dink op hierdie stadium as 'n konsultant moet jy baie rustig met ons wees, op 'n vorige keer kan ons goed aangespreek het wat ons nog nie antwoorde op gekry het nie. Hierdie is soortgelyk aan dieselfde wat nou hier sal gebeur. En wat ons nou al geleer het en gaan kyk het is dat as ons begin is dit nie 'n fight wat ons opsit nie. So, hanteer vir ons soos wat ons vir julle hanteer. Dis hoekom ek weer gesê het dat die navorsing wat al gedoen is en die huidige proses wat nou lei tot die tweede proses is soortgelyk en dieselfde maar nou wa ons eintlik 'n vraag wat ons met die vorige een gevra het, en dit is nie nou van belang nie, maar dis in lyn wat ons nou wa. So ons het die vorige keer ook gesê dat ons sal moet vir ons 'n regs span moet kry om vir ons te adviseur, jy sien soos wat daar nou gaan kom is daar is reeds navorsing gedoen van 'n gemeenskap lid en dit word nou, volgens my word dit nou bevraagteken. En ons moet na jou luister, jy is nie hier om nou besluite te neem nie, jy moet besluite deel wat jy hoor. Nou net so deel ons nou onse bekwaar wat ons nou sien deel ons nou saam met julle so ons moet vra vir julle ook, hou 'n bietjie geduld nè, dat, ons gaan party kere baie warm voel onder die kraag want as ons nou net moes geluister het dan het ons nou stil gesit soos die vorige keer. En nou sê ons maar die is dieselfde ding, dis net ander mense. So ons sal ook vir hulle 'n geleentheid gee om weer hulle se navorsing te gaan doen en terug te kom na ons as die gemeenskap toe, so ek weet nie, van my kant, my persoonlike mening is dat enige effek op 'n vis is my toekoms, so ek wil my toekoms, wil ek beskerm. Olie en gas is ook deel van my toekoms maar is daar nie ander en ander plekke wat dit ook het as om in die see in te gaan en ander diere te benadeel? Baie dankie. *Thanks, JP, yes, I think at this point as a consultant you have to be very calm with us, at a previous time we may have addressed things that we haven't gotten answers to yet. This is similar to the same that will happen here now. And what we've learned and gone to see is that if we start it's not a fight we put up. So, treat us as we handle for you. That's why I said earlier that the research that's already been done and the current process that now leads to the second process is similar and the same but now we're actually asking a question that we asked with the previous one, and it's not relevant now, but it's in line with what we're asking now. So we also said last time that we're going to have to get ourselves a legal team to advise for us, you see as what's going to come now there's already been research done from a community member and it's now, I think it's being questioned now. And we have to listen to you, you're not here to make decisions right now, you have to share decisions you hear. Now we share our objection that we are now seeing we are now sharing with you so we have to ask for you too, have a little patience huh, that, we are going to feel very hot under the collar some times because if we should have just listened then we were sitting still now like last time.* *And now we're just saying the same thing, it's just other people. So we'll also give them an opportunity to go do their research again and come back to us as the community, so I don't know, for my part, my personal opinion is that any effect on a fish is my future, so I want to protect my future, I want to protect. Oil and gas are also part of my future but aren't there other and other places that also have it than going into the ocean and harming other animals? Thanks a lot.* **GP Kriel** Ja, akkies as ek bietjie warm geraak het daar. So, ek moet jammer sê daarvoor. Ja, so ons wil regtig, ons wil net luister oor die storie maar soos ek gesê het dis 'n meertrappige proses. Yes, if I got a little heated there. So, I have to say sorry about that. Yes, so we really want to, we just want to listen to the story but like I said it's a multi-step process.
f.	**Bernard Cook** My naam is Bernard Cook ek verteenwoordig Long-time Primary Co-operative Handelsbaai, ook die al erkende visserye hier in die plek. Soos ek na die kaart gekyk het ou GP en my sommetjies gemaak het

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	op my calculator is meer as 140 nautical miles waar ons nie vis nie. Kyk, vis soos van prawns al kan jy op die skerm sien, ek het al daar langs het ek getrol ek kan enige skerm in 'n wiel lys, maar 'n kreef kan jy nie sien nie, ons skippers lees maar die grondе waar hulle hulle traps sien, gooi. So, dit kan positief wees vir ons wat teen die wal kreef, daai klank golwe kan onse kreef in laat beweeg, dit kan dit uit ook., ons hoop maar van die beste die kreef sal inbeweeg, maar soos ons mense wat nou vlt in jou keel afspring het, ek laslk nogal nie daai nie. Hier is mense wat moet waar ons werk en daai mense word nie gestop nie, man. Soos die kanne hal, sommer 'n hel of 'n inspuiting vir die dorp wees, so ek sou sê julle moet maar aangaan met julle besigheid en kyk hoe ver julle kom maar ek glo nie dit kan 'n effek op onse vis het nie man. Rêrig want dis net, dis meer die area wat julle dit nie doen nie is baie meer as die area na die internasionale water toe so ons, even ons het nie die geld om even daar uit te kom om daar te loop vis nie, ons kan nie soveel fuel bekostig nie. Die verste wat ons maar seker dit doen is tot op 20 myl en dies meer as 140 nautical miles waar dit sal geskied, dis al wat ek wil sê. *My name is Bernard Cook I represent Long-time Primary Co-operative Hondeklip Bay, also the all recognised fisheries here in the place. As I looked at the map old GP and made my sums on my calculator are over 140 nautical miles where we don't fish. Look, fish like from prawn you can see on the screen, I've been scrolling along there I know any screen in a wheel list, but a lobster you can't see, our skippers just read the grounds where they see their steps. So, it can be positive for us lobstering up the embankment, that sound waves can make our lobsters move in, it can make it out too, we just hope some of the best the lobster will move in, but as we have people who want to jump down your throat now, I kinda don't like that. Here are people who mess up where we work and those people aren't stopped, man. Like the jugs of hell, just be a hell or an injection for the town, so I'd say you guys should just get on with your business and see how far you get but I don't believe it can have an effect on our fish man. Because it's just, it's more the area you don't do is a lot more than the area to the international water so we, even we don't have the money to even get out there to walk there, we can't afford that much fuel. The furthest we do is go up to 20 miles and the like over 140 nautical miles where it will happen, that's all I want to say.* **GP Kriel** Ja, dis 120 kilometer, ja. Dankie vir daai, ek dink dis nog steeds belangrik dat ons kyk jy weet dat ons net seker maak dat ons nie iets verkeerd doen daar of wat ook al nie jy weet so ek dink dis belangrik dat ons, maar dankie vir daai. *Yes, it's 120 kilometers, yes. Thanks for that, I think it's still important that we look you know that we're just making sure we're not doing something wrong there or whatever you know so I think it's important that we, but thanks for that.*
6.	**Patrick Gulpin** Deursy, opinions sal daar wees en ons sal verskil oor 'n sekere ding, nou voordele, voordele van hierdie community moenie uit die oseaan uit kom nie, of nie net uit die oseaan uit kom vir hierdie community nie, dis die goewerment se dingesse daarom is daar munisipaliteite wat in hierdie gemeenskap moet werk om dit so te doen en die aandag word altyd afgetrek verstaan, dit het nie môre 'n effek nie, daai, ons spul en daar kan die goed kan gebeur, dit het al gebeur, nou waarmatoe gaan daai olie? Soos daai vorige spreker gesê het, daai kom wal toe, dan is al die lewe in die near shore tot niet oor 'n paar jaar, nie nou nie. Nou as ek praat oor voordele moet ek nie in my leeftyd voordele wil hê nie, en ek dink nie en ek praat nie oor my nageslagte nie, geld moenie as 'n voordeel gesien word nie. Want dis in ek geval hoe dit hier gebeur, spesifiek in Hondeklipbaai, al hierdie goed wat ons nou hier praat sal government in ek geval seker doen wat hy wil doen, maar ons het gekeer, ons het nie saamgestem nie. Nou wanneer dit dan kom dat government wel inkom en kom maak wat hy wil en die voordele, en nou praat ek daar

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	in terme van kontrakte en werke en you name it, waluitkom, sal ons wildeekween, maar dit is wat hierdie mense, hierdie stadsvaders van Hondekliphaai vir ons probeer verhoed. Hulle doen als wat nie in die boek is, om dit reg te kry. So, wat ek sê is dat die effekte, die effek van wat hier sal gebeur is enorm en dit sal miskien nie in my tyd wees nie maar ek sal my nie laat my nageslag my verwyt laat ek gesê het je vir hierdie ding nie. *That ostie, we'll be there and we'll disagree on a certain thing, now benefits, benefits of this community shouldn't come out of the ocean, or not just come out of the ocean for this community, it's the government's stuff that's why there are municipalities that have to work in this community to do it that way and the attention is always distracted. It doesn't have an effect tomorrow, that, we stuff and there the stuff can happen, it's already happened, now what is that all going to? As that previous speaker said, that come to shore, then all life in the near shore is null and void in a few years, not now. Now when I talk about benefits I shouldn't want benefits in my lifetime, and I don't think and I don't talk about my offspring, money shouldn't be seen as a benefit. Because that's how it happens here anyway, specifically in Hondeklip Bay, all this stuff we're talking about here right now will probably do what he wants to do anyway, but we stopped, we didn't agree. Now when it comes down to government coming in and coming to make what it wants and the benefits, and now I'm talking there in terms of contracts and works and you name it, well come out, we'll want to participate, but that's what these people, these city fathers of Hondeklip Bay are trying to prevent for us. They do everything that's not in the book to get it right. So what I'm saying is that the effects, the effect of what will happen here is enormous and it may not be in my time but I won't let my offspring reproach me let me say yes to this thing.* **GP Hotel** Dankie vir daai kommentaar, ja dit is belangrik, dit is belangrik dat mens na die ding kyk op 'n langer termyn ook. Hierdie proses is net vir die exploration, ek weet, ek weet dat julle weet dat dit eventueel dalk by eksplorasie gaan uitkom en dan by produksie, so die oil spills en daai goeters is 'n moontlikheid in die toekoms, sou hulle daarby uitkom. Maar op hierdie stadium gaan hulle nie goedkeuring kry om eers te drill nie so daar behoort nie olie in die water te wees na die goedkeuring van hierdie ding nie. In die toekoms, sou hulle dalk 'n reserwe kry, vir seker dan gaan hulle kom eksploreer, as die prys reg is, as die toestande reg is, as die wêreld even nog olie soek op daai stadium, verstaan so dan al daai goeters gaan bepaal of dit dan weer 'n opsie gaan wees. En as hulle dan drill, verseker dan moet hulle weer deur daai EIA proses gaan om seker te maak dat daar 'n check and a balance is om seker te maak dat daar nie olie spills is nie of dat jy die kans so ver as moontlik verminder deur sekere dinge in plek te hê. So die oil spills en daai goeters is 'n baie groot issue, dit kan 'n verreikende effek hê, dit kan tot honderde kilometers partykeer verder, as die dinge reg is so dit is 'n baie belangrike ding om na te kyk so wat hulle dan gewoonlik doen is hulle doen 'n oil spill model so hulle weet waar die see currents loop, hulle weet min of meer as jy so groot oil spill het vir so lank en dis op daai plek dan weet hulle min of meer waar dit gaan wees en wat die effek daarvan gaan wees en dan kan jy begin kyk of daai 'n fatal flaw gaan wees en of dit 'n issue gaan wees en daai goeters, so daar is darem 'n check in plek daarso om te sê jy kan nie net gaan doen wat jy wil nie, as jy nou olie en goeters gaan kry kan jy dit nie net produce en uithaal nie, so daar is nog baie fases wat moet kom, so voor, sou hierdie ene goedkeuring kry en hy gaan dan aan, dan is dit net om te kyk wat hulle dink onder die bodem is of daar 'n gesteente is wat dalk olie kan trap en kan hou en dan net omdat daai gesteentes en goeters daar is beteken nie dat daar genoeg olie of dat daar selfs olie in daai ding is nie, hulle moet nog eers gaan boor en gaan kyk. So dis byvoorbeeld wat daai ander ouens nou hier kom doen. So hulle gaan nou kyk wat is daar, as daar 'n groot reserwe is daar nie, kan hulle dit gebruik en so aan. En voor alkeen, en dan as hulle dan besluit hulle wil die produce, hulle wil, daar is iets lewensvatbaar, daar is energie wat hulle kan gebruik en dit is, jy weet hulle moet dit uithaal, dan moet hulle deur nog 'n EIA proses gaan en daai EIA proses laat hierdie ene soos 'n vullatjie lyk. Dis redelik dik, dis redelik moeilik en daar is baie ander goeters, dan begin die

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	goeters soos die social en labour plans, dan begin al daai werkskepping goeters, dan begin al daai goeters 'n konkrete rol speel en dan begin dit baie belangrik raak om te kyk wat is die direkte impak op daai ouens en hoe gaan die, is daar werkskepping, hoe gaan die werkskepping lyk, watse fondse gaan beskikbaar wees, al daai tipe goeters. En dan moet mens krities, dan moet 'n mens weeslik krities daarna kyk so ja, dis baie belangrik dan. So, ja die oil spills kan 'n groot effek hê. In terme van die ouens wat hierso op hulle eie goeters wil staatmaak, ja... dis jammer, ons het die ouens uitgenooi om te kom deel, om hulle sê te kom sê en om te kom insit en hulle gedeeltes ook te sê en goeters maar ja, ons verstaan dat daar 'n dinamiek is in 'n dorp, ons verstaan dat die mense nie altyd saam stem binne in die dorp nie, maar ons wil nie te veel kom inmeng met daai dinamiek nie, ons wil weet van hom, ons wil seker maak dat hy aangespreek word in ons studies en goeters maar ons wil net vir julle die gelaentheid kom gee om kommentaar te lewer hierop sodat julle kan deel hê daarin. *Thanks for those comments, yes it's important, it's important that one looks at the thing in a longer term as well. This process is just for the exploration, I know, I know that you know, it's probably going to come to exploration and then to production, so the oil spills and those things are a possibility in the future, should they get to that. But at this point, they're not going to get approval to drool first so there shouldn't be oil in the water after the approval of this thing. In the future, maybe they're going to get a reserve, for sure then they're going to come and expound, if the price is right, if the conditions are right, if the world is still looking for oil at that point, so understand that all those things are going to determine if it's going to be an option again. And if they drool then, then they have to go through that EIA process again to make sure that there's a check and a balance to make sure that there isn't oil or that you reduce the chance as far as possible by having certain things in place. So the oil spills and those things are a really big deal, it can have a far-reaching effect, it can go up to hundreds of miles away, if the things are right so it's a really important thing to look at so what they usually do is they do an oil spill model so they know where the ocean currents run, they more or less know if you've had that big oil spindle for so long and it's in that place then they more or less know where it's going to be and what the effect of it is going to be and then you can start to see if it's going to be a fatal flaw and if it's going to be an issue and those things. So at least there's a check in place to say you can't just go do whatever you want, if you're going to get oil and stuff now you can't just produce it and take it out, so there's still a lot of stages to come, so before, this one would get approval and he then moves on. Then it's just to see what they think is under the bottom if there's a rock that might be able to tread oil and hold it and then just because those rocks and things are there doesn't mean there's enough oil or that there's even oil in that thing, they still have to go drill and check. So that's what those other guys are coming here to do, for example. So they're now going to see what's there, if there's a huge reserve there, they can use it and so on. And before everybody, and then if they then decide they want it, they want to, there's something viable, there's energy that they can use and it's, you know they have to take it out, then they have to go through another EIA process and that EIA process makes these ones look like a filly. It's pretty thick, it's pretty hard and there's a lot of other stuff, then the things like the social and labour plans, then all those job creations start, then all those things start to play a concrete role and then it starts to become really important to see what's the direct impact on those guys and how do the, is there job creation, what is the job creation going to look like, what funds are going to be available, all those types of things. And then one has to look at it critically, then one has to look at it terribly critically so yes, that's very important then. So, yes the oil spills can have a great effect. In terms of the guys who want to rely on their own stuff here, yes... it's a shame, we invited the guys to come and share, to come and have their say and to come and put their pairs as well and yet, we understand that there is a dynamic in a village, we understand that the people don't always agree inside the village. But we don't want to come and interfere too much with that dynamic, we want to know

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	about him, we want to make sure that he's addressed in our studies and stuff but we just want to give you guys the opportunity to comment on this so you can have a part to it.
h.	**Unidentified lady** Dankie vir die geleentheid, dis nou my derde keer wat ek hier in die vergadering is want ek wil weet wat aangaan. En baie dinge wat ek hoor is by mense wat nie eens vergadering toe kom nie. Dan hoor ek nou wat sê hulle van buitekant af, maar dit is nie wat in die vergadering gesê word nie. Ek wil nie afskiet nie, dis nie my doel nie, maar ek wil ook maar insae lewer van my kant af as 'n vrou en 'n Ma. Destyds het De Beers hier gemyn met al hierdie selfde beloftes hoe hy die dorp vorentoe gaan vat en ander dorpe, en hy het gemyn en gemyn en gemyn en ek was een van die bevoorregtes wat daar gewerk het by De Beers en op die einde van die dag toe hy nie meer kos nym en niks uitkry nie, soos die vorige spreker gesê het, is hier nou dor en droog. Die vuur wat daai jare terug gegaan het, wat daai jare daar was kan nou nie meer terug gaan nie want dis omgedolwe. En nog 'n vorige spreker het ook gesê daar is so baie wat nou hier teen die kus langs gebeur, mense wat nou nog besig is om onse areas om te delwe en vir die see ook 'n gevaar is en ek wil my bekommernis uitspreek en ek sal graag wil nog deel wees om die ding te kan verstaan om, dat ons mekaar kan verstoom en meer met mekaar kan engage want 'n ingeligte persoon kan ingeligte besluite maak. Maar as ons oningelig is dan kan ons nie deel, so vir my persoonlik voel ek een keer in 'n maand is te min, want September maand maak julle dit, November maand maak julle dit, en ek voel ek persoonlik is nog nie op die level om 'n besluit te kan neem of om toestemming te kan gee nie. Maar as ek kyk aan De Beers se jare wat hulle gekom doen het en die Oppenheimers is weg en ons sit vandag, my kinders sit vandag sonder werk. Ons kan nie terug daarnatoe gaan nie. Is my vrese ook, gaan dit in die see, gaan dit hierdie kant ook so wees? Gaan dit vir 'n tyd goed gaan en goed gaan en goed gaan en skielik sê die Oppenheimers of die maatskappye; ons is nou klaar ons gaan nou weg, dan sit Hondeklipbaai. Dit is my bekommernis. Dankie. **GP Kriel** Ja, ongelukkig dit is 'n feit, ons weet in die verlede was daar 'n klomp dinge wat gebeur het hier wat nie reg was nie nè, en ons kan ons sien as ons nog hierdeur ry, die letsels daarvan is hiersо en die geskiedenis daarvan is hiersо. En dit het ongelukkig 'n baie groot rol gespeel hiersо in die area en baie mense seergemaak en baie lewens verwoes en daai tipe goeters so ons verstaan daai. Ons het dit nie self beleef dalk nie maar ons hoor dit van julle af en ons kan dit sien as mens hier inkom en goeters en dis hoekom ons die sosiale owens ook gekry het ons dit bietjie te kons ontleed en te kan kyk hoe julle die projek ervaar, hoe julle dit sien en al daai tipe goeters en wat die omgewing is hier binne waar binne die mense leef en operate en so aan. So, dis vir ons baie belangrik om daai in ag te neem en goeters ook. Die, van hoe die owens in die verlede gewerk het en hoe hulle nou moet werk, daar is darem 'n paar dinge wat verander het. Dis nog nie perfek seker nie, maar daar is darem 'n bietjie dinge wat julle as 'n gemeenskap en as 'n groter Suid Afrika bietjie meer beskerm, so hulle kan eindlik nie net meer kom doen wat hulle wil nie, partykeer as hulle dit doen is daar dan 'n recourse, hulle moet dan, hulle kan dan aangespreek word, hulle kan beboet word, hulle kan hulle lisensies verloor al daai tipe goeters, daar is darem 'n wetlike meganisme om dit te probeer aanspreek. En soos wat ons nou gesien het die week wat in Suid Afrika gebeur het as mens nie gelukkig is nie kan jy jouself tot die hof wend en dit ook doen. So, ek is bly ons bly ten minste nog in 'n land waar jy dit kan doen jy weet waar jy nie heeltemal in geboks word en dat jy nie daar regtig het en daai tipe goeters kan doen nie so daai is baie belangrik. Ek stem saam met jou dat ons 'n ingeligte besluit moet maak. So dis hoekom ons graag nie net hiernatoe wil kom en dan net ons verslag skryf en dan gaan ons weg weer nie. Ongelukkig wat die verslag en daai tipe van goeters vat 'n bietjie tyd so ons wil nou kom, vir julle sê ons is besig met iets, hier is wat ons sover weet van hierdie storie, ons prentjie is nog nie heeltemal klaar van hom nie, maar sodra ons 'n draft prentjie van hom het, sodra ons 'n draft idee van dit het wil ons daai idee met julle kom deel en dan vir julle kom sê; oukei, dis

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	wat ons gekry het. So dis hoekom ons probeer, ons wil die verslag wil ons 'n paar weke voor die tyd vir julle beskikbaar stel, hy gaan hier op die dorp wees, hy sal op ons website wees, ons sal, ons is besig om te kyk na 'n data free model, so met ander woorde as jy die ding aflaai van ons webtuiste af, dan betaal dit, dan gaan dit nie jou data gebruik nie, dit gaan ons data gebruik en daai tipe goeters. So, ons wil al daai tipe goeters toeganklik maak vir almal, en dan gaan ons ook soos 'n non-technical summary bysit by daai ding, so daar is partykeer verskriklike hoë wetenskaplike terme, ek dink daai is nie die regte manier om dit noodwendig te doen nie, dat ons dit meer 'n bietjie minder tegnies maak maar dat ons ten minste steeds die akkurate informasie oorbring dat 'n mens daai goeters kan doen. En dan wil ons terug kom en dan weer in 'n platform soos hierdie, wil ons dit dalk met julle kom bespreek. Sal julle miskien meer van 'n langer tipe sessie hou dat 'n mens dalk 'n paar dokumente het dat jy soos 'n werkswinkel of iets soos dit kan doen? Dan kan, ek weet ons het terug gekom met die ander ene en ons het 'n werkswinkel gedoen oor die vorige EIA, sal so iets miskien 'n ding wees wat ons kan kyk na? Sal julle gelukkig wees met so iets? Dan kan ons miskien 'n paar tafels uitsit, 'n paar dinge uitsit en dan kan ons dit 'n uur of twee ekstra spandeer aan die storie en dan kan ons deur Mnr Marius se navorsing gaan, dan kan ons kyk wat ons gekry het, wat hy gekry het, dan kan ons dit in daai forum, sal dit miskien werk? Is dit, is jy gelukkig met so iets.
I.	**Dawid Marius** Die vissers aan taal. Nou as 'n visser dink ek dis belangrik wanneer ons is krieket en whatever game ook speel dat jy jou wickets moet voor keer. Nou as ek praat ek van hou wickets dan beteken dit die vissermanne is nie veronderstel om met twee tonge te praat nie, right? Jy kan nie jou brood altkant wil gebotter hê nie. Maar dit is nou maar die geval, dit werk mos nou maar so. Toe ek in Johannesburg ry, staan daar 'n groot bord daar bo; choose your lane, kies jou baan nou, anderster gaan jy verdwaal. Nou wanneer wil ons onse bane beginne kies? Choose your lane. Want as jy nie die regte pad vat nie en jy vat enige afdraaipad dan gaan jy by 'n plek uitkom waar jy nie wil wees nie. En as die mense, dis die begin om die proses vorentoe te vat, en dis die seismiese opnames. Kom daar 'n fout is jou lifelines afgesny. Kom daar 'n fout Oom Klein en daar kom nou net 'n oil spill, een spill, julle sal nien China sê luister hier ons soek nie hierdie bamboes nie. Die uitsluitlike rede hoekom hulle bamboes byvoorbeeld hierso soek is omdat daai bamboes wat hulle daai kant is, is nie aanvaarbaar nie want dis ge-contamineate. Right, so moenie, jy sien die ding is, as ons nie ingelig is nie, dan is jou besluitneming gevaarlik en dis 'n gevaarlike wapen wat jy het en jy kan jouself vernietig, wa vir my wat 'n soldaat is, as jy nie weet hoe jy 'n handgranaat gebruik nie, iemand vat die handgranaat en gooi die pen doerie kant toe en die granaat gooi hy hierdie kant hang-gelt, God gelukkig het Geldenhuis geduik en daai is nie ek gewees wat geduik het nie anderster het ek nou weer so gesê, en die handgranaat daai kant toe gegooi. So moenie gevaarlike games wil kom steun en speel mense, en dat geld ons nie divide nie. Laat geld ons nie divide nie want ons sien daar is partykeer nou geleenthede en opportunity, kêrels net-nou gaan ek darem 'n kontrak kry. Net as daai olie geloop spil het sal ons besef daai geld kan ons nie meer nie, daar hardloop daai mense in elk geval ook weg. En ek wil dit vir laas onderstreep, government het nie die kapasiteit om enigsins op grond sy eie planne te kan voor rekenskap gee nie hetsy of dit PRASA is, hetsy of dit ESKOM is, whatever entiteit wat dit ook is, wat sal hy nog soe toe gaan? Ek meen in hierdie inligting hulle is 'n papier span, with all due respect, so ons kan nie eers vir government vertrou, kêrels julle weet mos waarvan ek praat. Ons kan mos nie eens government vertrou en nie net dit nie, as ons praat van die marine lewe wat nou daarso gaan plaasvind met hierdie seismiese blasting right, nou hier word gekonsentreer op soogdiere en dis die soogdiere wat ons kan sien right, nou daar is visse wat diep, diep onder die see is en die marine bioloog wat daarso is, wat ons nie kan sien nie, en ons kan nie so diep afgaan om te kan sien om dan daar 120 kilometers down the line, want hierdie navorsing soos die meneer nou daar sê, hy hardloop hiervan af en hy hardloop byvoorbeeld vyf kilometer binne die radius, maar

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	daai seismiese bomme wat hulle daar in die water ingooi right, daai het vierkante kilometers want die verskil is wanneer daai plof in die water inkom nè, dan het hy 'n groter effek en hy's 'n groter radius wat hy dek right maar as dit gaan kom en hy, in die lug in, dan het hy niks effek nie, net wanneer hy in die water is en dit gaan katastrofiese gevolge vir die dinges maak met die blasting. Let me rest my case, maar wat ek wil sê is, kies jou baan, moenie twee rye spore stap nie, en dis gevaarlik, ek het 'n lisensie, dis gevaarlik om in die middel van die pad te ry, moenie op die wit lyn loop ry nie, dis nie jou lyn nie.
	The fishermen one language. Now as a fisherman, I think it's important when we play in cricket and whatever game too that you have to stop your wickets up front. Now if I'm talking about lines wickets then that means the fishermen aren't supposed to talk with two tongues, right? You can't want your bread buttered all the way. But that's just the case, it just works that way. When I was driving in Johannesburg, there was a big sign up there; choose your lane, choose your lane now, otherwise you're going to get lost. Now when do we want to start choosing our lanes? Choose your lane. Because if you don't take the right path and you take any turnoff then you're going to get to a place where you don't want to be. And as the people, that's the beginning of taking the process forward, and that's the seismic surveys. Come on, an error is your lifelines cut off. Come there a mistake Uncle Klein and there's just an oil spill coming, one spindle, you'll see China says listen here we're not looking for this bamboo. The sole reason why they are looking for bamboo, for example, is because that bamboo they are that side is not acceptable because it is contaminate. Right, so don't, you see the thing is, if we're not informed, then your decision-making is dangerous and it's a dangerous weapon you had and you can destroy yourself, ask me what a soldier is, if you don't know how you use a hand grenade, someone takes the hand grenade and throws the pen doerie to the side and the grenade he throws this side bang-gelt, God thankfully Geldenhuis dived and that's not me who dived, so I said so again, throwing the hand grenade that way.
	So don't want dangerous games to come and stand and play people, and that money doesn't divide us. Let's not divide us because we see there are sometimes opportunities and opportunity now, boyfriends just-now I'm going to get a contract. Only if that all has run its course will we realise that money we can't anymore, there are those people running away anyway. And I want to underline that for last, government doesn't have the capacity to be able to account for its own plans at all, whether it's PRASA, whether it's ESKOM, whoever entity it is, what else will it go to sea? I think in this information they're a paper team, with all due respect, so we can't even trust government, you know what I'm talking about. We can't even trust government and not only that, if we're talking about the marine life that's going to take place there now with this seismic blasting right, now here is concentrated on mammals and it's the mammals we can see, now there are fish that are deep, deep under the sea and the marine biologist that's there, which we cannot see, and we cannot go down so deep as to be able to see then there 220 miles down the line, because this research as the Sir says there now, he runs off of this and he runs, for example, five miles within the radius, but those seismic bombs that they throw into the water there. That has square kilometres because the difference is when that explosive comes into the water heh, then he has a bigger effect and he's a bigger radius that he covers but if it's going to come and he, into the air, then he doesn't have any effect, just when he's in the water and it's going to make catastrophic consequences for the things with the blasting. Let me rest my case, but what I want to say is, pick your lane, don't walk two rows of tracks, and it's dangerous, I have a license, it's dangerous to drive in the middle of the road, don't walk on the white line, it's not your line.
	GP Kriel
	Ja, ons is baie bewus van die feit dat daai klank nie net in daai klein area beweeg nie. So ons gaan definitief kyk daarna. dis hoekom ons al daai studies gaan doen, ons gaan probeer kyk so besmoontlik om daai goeters te probeer aanspreek. Ja in terme van die government en goeters; ja ek weet dit is partykeer 'n moeilike situasie maar dis hoekom ek gesê as die government nie hulle werk gedoen het nie soos wat ons geslen het so paar dae terug, dan is daar darem nog iets anders wat mens daaromtrent kan

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	doen. So die civil society het nog 'n rol om te speel in die hele besigheid. So dit is belangrik dat ons as mensdom daai ouens in check hou, dat ons hulle op hulle tone hou en seker maak dat hulle die regte goeters doen. Ja ek dink, in terme van die contamination en daai tipe goeters, daai, die klankgolf is nie 'n boom wat hulle afgooi nie. Dis net 'n ding wat 'n groot borrel maak soos compressed air implosion wat hy doen so daar is nie 'n contamination wat hy in die water dan afsit en goeters nie so dis, maar dit is 'n harde knal, dis reg en dit kan 'n effek hê, so dis belangrik om daarna te kyk, en die klankgolwe, wat ons nou al weet, hy trek so bietjie anders op 'n ander frekwensie in die water as wat hy bo in die lug travel so dis hoekom dit belangrik is om te gaan kyk wat die water is, hoe die water is en dat daai ouens met die verskriklike dik brille en die wit jasses dan gaan kyk na daai tipe goeters. So dis hoekom ons hulle aangestel het om te kyk na dit. *Yes, we are very aware of the fact that that sound doesn't just move in that small area. So we're definitely going to look at it, that's why we're going to do all those studies, we're going to try to look at trying to address these things. Yes in terms of government and go-getters; Yes I know it's a difficult situation sometimes but that's why I said if the government didn't do their job like we saw about a few days back, then at least there's still something else you can do about it. So civil society has another role to play in the whole business. So it's important that we as humanity keep those guys in check, that we keep them on their toes and make sure they're doing the right things. yes I think, in terms of those types of things, the sound wave isn't a bomb throwing them off. It's just a thing that makes a big bubble like compressed air implosion that he does so there's not a thing he puts down in the water then and stuff like that, but it's a loud bang, that's right and it can have an effect, so it's important to look at it, and the sound waves, What we know by now, he pulls on a different frequency in the water than he does at the top of the sky so that's why it's important to go and see what the water is, what the water is like and that those guys with those awfully thick glasses and the white coats are then going to look at those types of things. So that's why we hired them to look at it.*
J.	**Ilse Aucamp** Mevrou my vraag is vir u, ek wil net graag weet wat het u nodig om 'n ingeligte besluit te neem, ek dink GP het so bietjie daaraan geraak maar vanuit julle perspektief, hoe...hoe moet ons die inligting bekend stel, wat is dit, het u dalk enige voorstelle van hoe ons dit beter kan doen? Dankie. *Madame my question is for you, I would just like to know what do you need to make an informed decision, I think GP touched on it a little bit but from your perspective, how.. how should we introduce the information, what is it, do you perhaps have any suggestions of how we can do it better? Thank you.* **Unidentified Lady** Ek sal, van my kant af, ek praat vir myself nè, as dinge kan gebeur dat ek kan verstaan dat daar meer werkswinkels dan of meer inligtingsessies gehou raak want soos ek sê dis nou die derde keer wat ek hier is en ek begin, ek sê nie ek stem saam met wat met gedoen raak nie maar ek beginne verstaan en dis hoekom ek sê as dit meer inligtingsessies of meer gekommunikeer raak op phones of waar ook al dan kan 'n mens meer 'n ingeligte besluit, want dan is jy meer bewus want daar is baie goed wat daar buite lê, rumours wat jy hoor van mense wat glad nie vergadering toe kom nie sê ek weer, so dit is wat ek voorstel ook, of dit gebeur of nie gebeur nie want dit klink vir my dit sal gebeur of ons nou toestemming gee of nie. Maar dat hoe meer sessies 'n mens, hoe meer sessies ek kan kry kan ek 'n ingeligte besluit maak. Maar vir my is baie dinge nog baie vaag en soos ek sê ek sit met daai vrees dat wanneer dit gewerk raak aan die ander kant of in die see gewerk raak op die einde van die dag as dit gesplit raak, alle kom terug na die land toe dan is, dit is my vrees want hier is 'n groot voorbeeld. onse mense het nie meer werk nie, De Beers het net opgrapak, net gesê ons gee julle pakkette. Dit was in 'n maand se tyd, want die grond is daar. Dit is my vrees wat ek rêrig mee sit. Meer werkswinkels en goed.

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EMS | NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	I will, for my part, I speak for myself huh, if things can happen that I can understand that there are more workshops then or more briefings being held because as I say it's now the third time I've been here and I'm starting, I'm not saying I agree with what's being done but I'm starting to understand and that's why I say if it gets more briefings or more communicated on or wherever or wherever one can make more of an informed decision, because then you're more aware because there's a lot of stuff lying out there, rumours you hear from people who don't come to the meeting at all I say again, so that's what I'm suggesting as well, whether it happens or doesn't happen because it sounds to me it will happen whether we give permission or not. But that the more sessions one has, the more sessions I can get I can make an informed decision. But for me a lot of things are still very vague and as I say I'm sitting with that fear that when it gets worked on the other side or worked in the ocean at the end of the day when it gets split, all comes back to the land then is, that's my fear because here's a big example, our people don't have jobs anymore, De Beers just packed up, just said we give you packages, it was in a month's time, because the ground is finished. It's my fear that I'm really stuck with. Mhonor workshops and stuff.
k.	**Nicolaas Cloete** Ek is Nikolaas Cloete, Onder Voorsitter hier by die Longtime hier te Hondeklipbaai, ek wil net graag weet, ek kom mos nou al 'n tydjie aan met hierdie sessies en die vrae is alreeds al voorheen gevra, daar sal sekerlik glo ek van stellig daar sal hierdie gemeenskappe nie soveel vrae gevra het nie, die maatskappy kom nou al lank aan met hierdie prosesse wat hy wil hierso doen. En die verskillende rolspelers tot by die gemeenskap, hoekom was hulle nie in die eerste plek erken nie? Daar was, glo ek van stellig, dan sou hier nie soveel vrae uit ontstaan het nie as een van Hondeklipbaai se kinders of hetsy hier teen die Wes Kaap af of teen die Wes Kaap hier op, op die betrokke trippe saam gegaan het of iets van die aard sodat hulle kan nou vandag uit een mond uit gesê het; nou is dit net 'n maatskappy, ons sien nie environmental, ons sien nie ander, verskillende rolspelers wat rondom daai tafel vir ons nou die vrae wat hier gevra word moes nou vir ons kon gesê het nee maar ons het darem saam met die Spanjaarde dit gedoen, die navorsing is gedoen, dit kan ons vir julle dit so sê, dit is wat ons vir julle kan sê; nee maar ons kan nou miskien in die voor nabye toekoms in verseker, dit sal nie geskied of so nie want die bekommerde vrae hierso moes hulle nou kon geantwoord het want ek meen dan sou hulle seker baie werk van julle stowers afgehaal het en saam met die gemeenskappe saamgewerk het maar dit is, dit is seker maar die bron van kommer. Dit is die bron van kommer want ek meen op die ding is mos nou nog eers 'n navorsing ding, dis mos eers 'n ondersoek ding voordat daar geboor word, boor prosesse geloods word so dit is mos nou die ding, van die begin af, daai verskillende rolspelers, wie almal het saam met julle saam die paadjie geloop, die gemeenskappe is mos nie erken nie. So dit is maar die bron van kommer. En ek meen dit sal 'n mens maar seker ook dit ook verstaan dat dit sal so gebeur. Kyk soos hierdie wou nou gesê het, De Beers het my ook darem deur daai prosesse so ek weet van die prosesse, verstaan jy en dit is die bron van kommer, mense kom altyd en hulle kom ontgin en hulle vat die rykdom weg en op die end van die dag is dit soos dit is. So verstaan ook maar die gemeenskappe rondom hierdie oil. *I'm Nicholas Cloete, Under Chairman here at the Longtime here at Hondeklip Bay, I just want to know, I've been coming up with these sessions for a while now and the questions have been asked before, I will surely believe that there these communities won't have asked so many questions, the company has been coming up with these processes for a long time now. And the different role players all the way to the community, why weren't they recognised in the first place? There were, I believe, not so many questions would have arisen here if one of Hondeklip Bay's children, or whether here against the Western Cape or up the Western Cape here, had gone along on the trippe in question, or something of the sort so that they*

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	might have said out of one mouth today; now it's just a company, we don't see, we don't see other, different players around that table for us now the questions that are being asked here should have told us now no but at least we did it with the Spaniards, the research has been done, we can tell you so, this is what we can tell you; No but we can now perhaps ensure in the near future, it won't happen or so because the worried questions here they should have answered now because I think then they probably would have taken a lot of work off your shoulders and worked with the communities but that's, that's for sure but the concern.
	That's the concern because I think the thing is still a research thing, it's an investigation thing before drilling, drilling processes are launched so that's the thing, from the beginning, those different players, who all walked the aisle with you, The communities were not recognised. So that's just the concern. And I think it will also be understood that it will happen.
	Look like this woman said now, De Beers has me through those processes too so I know about the processes, you understand and that's the source of concern, people always come and they come and exploit and they take away the wealth and at the end of the day that's the way it is. So do the communities around this.
	BP Kriel
	Ek wil net seker maak ek verstaan reg as Meneer nou sê, dankie vir daai kommentaar, as Meneer sê die rolspelers en hulle erkom, hoe sien Meneer dit uitspeel, ek wil net seker maak dat ek reg verstaan, is dit as ons kom om hierdie sessies te kom doen moet ons eers met iemand anders gesels het en dan weer kom gesels? Is kyk, daar is 'n bron daar buite nê, en dan is daar 'n paar ouens wat dit, daar is verskillende rolspelers binne wat will help ons daai bron te probeer identifiseer en kyk of dit gaan werk of nie. So elke keer as daar 'n nuwe maatskappy is dan is dit omdat dit iemand anders is wat nou wil kom kyk. So dis 'n ander maatskappy so dis hoekom daar, en ek kan verstaan dat dit deurmekaar raak want ek meen dit is 'n groot klomp verskillende ouens jy weet so ja ek, ek meen hel partykeer vir ons is dit deurmekaar jy weet wie is dit nou, wat is dit nou, wat is die struisie, in ons rol van die hele storie is om, ons werk nie vir hulle nie. Alhoewel hulle betaal vir die studies en goeters wat hulle doen en goeters is dit, dit is die wetlike vereiste, hulle moet betaal daarvoor, so ons doen daai studies en goeters om te kyk of die survey wat ook 'n studie is op sy sie, of hulle dit kan gaan doen en goeters. So daar is 'n klomp verskillende rolspelers, een van die rolspelers is hier vandag, hy is van TGS af so hy is ook hierso,
	Michael I don't know if I can maybe ask you to stand up and say hi, but dis Michael hy is van TGS af, hy kom daar van Houston Texas af. So jy weet hy is van TGS af, hy is nou in die begin fase en hulle doen die geofisiese goeters, dan sal daar nou weer ander rolspelers wees na die tyd wat basies dan die eksplorasie ouens is; so dis die ouens wat die lisensie blokke het en daai tipe goeters. En hulle is dan die ouens, die data wat hulle insamel gaan daai ouens dan gebruik om te kyk oukei waar gaan ons drill, wat gaan ons doen. Maar so deurlopend deur die proses behoort daar dan verskillende ouens hier aan te kom so dis hoekom daar ander ouens hier aangekom het met die drill want hulle wil now kom drill. En dis hoekom hulle kom gesig wys het en kom sê oukei wel dis wie ons is. So dis nou weer 'n ander Amerikaner gewees wat hier opgedaag het. So dit is, so die proses gaan aan en daar is verskillende ouens wat soos die proses aanloop deel raak van die hele storie. So as daai ouens klaar is sal daar dan teen een weer 'n ander gesig opdaag en daai ou gaan dan van die produksie maatskappy wees verstaan, so dis omdat dit verskillende stappe van die proses is wat dit dan gaan wees. Wat belangrik is; is dat hulle wel moet kom en kom gesig wys en sê dis hoekom ons hier is en dit is wat ons wil doen, verstaan? So dit is die belangrike deel. En as daar dan 'n EIA is of iets soos dit wat gedoen moet word dan is dit belangrik jy weet dat hulle deur al daai hoops en al daai goeters spring om te kyk of dit actually kan aangaan of nie. So, ek weet nie of dit jou vraag beantwoord nie, ek het dit nou probeer beantwoord, so bietjie, maar as dit nodig is dat ons dit op 'n ander manier verduidelik, ek weet nie of dit daik die vraag beantwoord het nie.

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	I just want to make sure I understand correctly when Sir says now, thank you for those comments, if Sir says the cast members and they acknowledge, how does Sir see this playing out, I just want to make sure I understand correctly, is it when we come to do these sessions we should have talked to someone else first and then come and chat again? yes look, there's a source out there huh, and then there's some guys that have it, there are different players inside who want to help identify that source and see if it's going to work or not. So every time there's a new company then it's because it's someone else who wants to come and see now. So it's a different company so that's why there, and I can understand it getting messed up because I think it's a big bunch of different guys you know so yes I, I think hell sometimes for us it's messed up you know who is it now, what is it now, what's the situation, in our role of the whole story is to, we don't work for them. Although they pay for the studies and things they do and things are that, that's the legal requirement, they have to pay for it, so we do those studies and things to see if the survey that's also a study on its own, if they can go and do it and go-getters. So there's a bunch of different cast members, one of the cast members is here today, he's from TGS so he's here too. *Michael I don't know if I can maybe ask you to stand up and say hi, but it's Michael he's from TGS, he's from Houston Texas there. So you know he's from TGS, he's in the beginning phase now and they're doing the geophysical stuff, then there's going to be other players now after the time that's basically then the exploration guys, so it's the guys who have the license blocks and those types of things. And they're the guys then, the data they collect is going to use those guys then to look okay where are we going to drill, what are we going to do But so continuously throughout the process, there should be different guys coming on here then so that's why there are other guys coming here with the drizzle because they want to come and drill now. And that's why they came to show face and come and say okay well that's who we are. So it's now another American who showed up here. So it is, so the process goes on and there are different guys that like the process going on become part of the whole story. So when those guys are done, there's going to be another face ten against one and that guy is going to be from the production company, so that's because it's different steps of the process that it's going to be then. Which is important is that they do have to come and show face and say that's why we're here and that's what we want to do, understand? So that's the important part. And then if there's an EIA or something like that that that needs to be done then it's important you know that they're jumping through all those hoops and all those things to see if it can actually go on or not. So, I don't know if that answers your question, I've tried to answer it now, that bit, but if it's necessary that we explain it in a different way, I don't know if it might have answered the question.*
L	**Nicolaas Cloete** **Wanneer die proseses moet begin het ons byvoorbeeld verskillende departemente, hetsy is dit die departement by, in wette, marine protected area wat veronderstel is om dan daarso te kan wees of die environmental affairs right, so die omgewings wat die omgewing moet beskerm moet dan eintlik saam met julle op hierdie train is, right. Nou kom julle alleen en op die einde van die dag by die goedkeuring kom teken hulle net 'n blok af; environment sê dit is orraait so. So waar is daai connection? Daar is nie 'n connection nie. OP hierdie stadium wat ek beleef by die Meneer, ons staan op hierdie stadium alleen. En dis nie veronderstel om te wees nie want government het sisteme in plek in om ons dan te kan probeer beskerm en dit is wat die Meneer sê in dieselfde asem wil ek sommer van die geleentheid gebruik maak om dan ook te vra dat die vissers wat nou kwotas het, ons moet weet presies waar staan julle sodat ons vir Saldanha en Lambertsbaai en Doringbaai en Paternoster en whoever kan gesê, luister hier maar Hondeklipbaai se vissers sê hulle staan so, hulle staan vir die seismiese blasting en vir olie se boor, sodat daar 'n boodskap kan gestuur word in die society Hondeklipbaai sal moet weet en ons sal die vissers, julle moet eintlik op julle se agenda ook sê luister hierso dit is wat julle sê.**

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	Maar die boodskap moet so deurgedra word, een kan nie net so sê want as julle is in 'n organisasie in en die ander een sê so nie verstaan jy daar moet soort van 'n mate van dat die vissers, of nou onderster gestel die kwota houers wat nou huidiglik nou hier is, ons ander is ook vissers wat hierdie snoek permits had, dit affekteer ook vir ons alhoewel ons nie die kwota gehad het nie so is nie net dat daai manse die grouping dan nou sê nie maar die manne wat dan nou die kwotas had moet 'n boodskap uitstuur sodat ons kan weet waar ons staan, elke man kan nie in 'n organisasie praat soos 'n lap wat skeur en dan kom sê nee luister ek stem nie stem nie, die man sê so nie. Vissers maak 'n besluit sodat ons kan sê hierso dit is wat die vissers wat kwotas had sê. Ek dink dit is belangrik sodat ons by die volgende vergadering nie met 'n klomp stories hierso staan en aankom nie. Die man en die vissers moet 'n besluit maakSo, ek sê nie dit moet nou wees nie maar dit is volgende op die agenda as ons hier moet kom sodat ons kan weet waar ons staan. When the processes must start we have different departments, for example, whether it's the department at, in laws, marine protected area that is supposed to then be able to be thereso or the environmental affairs right, so the environments that need to protect the environment should then actually be on this train with you, right. Now you come alone and at the end of the day at the approval they just sign off a block; it says it's orsait like that. So where is that connection? There isn't a connection. AT this point I'm experiencing with the Sir, we're standing alone at this point. And it's not supposed to be because we have systems in place to be able to try to protect us and that's what the Sir says in the same breath, I just want to take the opportunity to ask that the fishermen who now have quotas, we need to know exactly where do you stand so that we can say to Saldanha and Lamberts Bay and Thorn Bay and Paternoster and whoever. listen here but Hondeklip Bay's fishermen say they stand like this. they stand for the seismic blasting and for oil's drilling so there can be a message sent in the society Hondeklip Bay will have to know and we will the fishermen, you should actually on your agenda also say listenstr hereso that's what you say. But the message has to be carried through like this, one can't just say so because if you're in an organization in and the other one says so don't understand you there must kind of be some degree that the fishermen, or now put the other star the quota of containers that are now here now, we others are also fishermen who had these pike permits, it also affects us even though we didn't have the quota so is not only that those people say the grouping now but the men who then have the quotas now have to send out a message so we can know where we stand, every man can't talk in an organization like a rag tearing and then come and say no listen I don't agree, The man doesn't say so. fishermen make a decision so we can say hereso that's what the fishermen who had quotas say. I think it's important so that at the next meeting we don't stand here with a bunch of stories and arrive. The man and the fishermen have to make a decisionSo, I'm not saying it should be now but it's next on the agenda if we need to get here so we can know where we stand. **GP Kriel** Ja, dis belangrik, ek wil net sê oor die departemente, ek sal ook baie graag wil hê dat hulle hier is. Rêrig, dit sal vir my great wees as ek omgewingsake en mineraalhulpbronne en environmental affairs en al daai ouens hier kan hê om te staan en dit te sê. Ongelukkig gaan daai nie rêrig baie maklik wees om reg te kry nie. Ek sal dit ook wou gehad het, ons noot hulle ook uit, hulle weet ook van die vergaderings, hulle is ook uitgenooi byvoorbeeld as ons 'n miskien 'n virtuele vergadering of iets soos dit hou dan sal hulle partykeer instk en die hele storie maar partykeer kom PASA na die vergaderings toe, Petroleum Agentskap, dan kom sit hulle hierso, hulle is ook deel van die storie, verlede keer toe ons saam met van die ouens gekom het wat die olie boor en goeters kom doen, dan het hulle ook in die gehoor gesit en kom luister en goeters en deelgeneem maar ja ons sal ook bietjie meer insette van daai departemente

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	wil hê maar hulle lewer insette op ons verslae en goeters so dit is op 'n indirekte manier maar dis dalk nie direk met die gemeenskap altyd nie.
m.	**Patrick Rutph** Nou hier is myne, selfs al kom die kabinet ook hiernatoe, al bring julle die President ook hiernatoe, en dis wat ek vroeër gesê het, wil hulle vir my kom anderster laat dink en my mind switch, ek staan by wat dit is, dis 'n onding. Ek is hier gebore in hierdie plek in en ek het groot geraak in hierdie plek en het gesien wat hier gebeur, dis kurk dood dis mors dood hier agter, hier lewe dit nog, die enigste hoop, die enigste lewe nog hierso, nie 'n kabinet of 'n Minister of 'n President sal vir my anders oortuig nie. Ek sê dis 'n ondig die, dit moenie gedoen word nie. En Gods gedank kom julle nie net na die vissermanne toe of na die kwota houers toe nie, dis 'n community storietjie hierdie en ons moet almal sê. Die vissers het 'n ander denke van wat, van hierdie dinges en goedtie, dis hoekom ek sê ek is nie selfsugtig wanneer ek sê dat voordele, in watter vorm ook al dit net nie in geld nie, kom ook al, ek verwerp sulke goed. Verstaan, want ek wil hê my kinds kindere moet kan 'n snoek vang, moet kan 'n vrulle kry uit die see uit en 'n kreef boen. Dit sal nie meer gebeur as hier aktiwiteite gaan beginne gaan en dit ek sê nie dit sal môre wees nie, dis 'n langtermyn ding dit sal gebeur hierso, dit sal gebeur, die mense is besig om ons tot niet te maak. Ek het dit ander keer gesê, ek sê dit nou vanaand weer, die mense is besig om ons uit te roei. As ek dit moet so stel, dit kan nie weet dat onse enigste brok wat nog daar is, waar ons na toe kyk ook gekom peuter aan word nie. En dis nou maar tree vir tree, dis nou vandag, nee dit sal nie wees, nee dis maar net so. Wat is volgende keer? Wat is volgende? Dan kom hulle met 'n ander ding. En weer 'n ander ding en weer 'n ander ding. So by so dat hulle die afval gasse ook later by ons kom berg want dit was al op 'n jaar net hier agter by Skulpfontein waar dit die koerasie vol was, en daai goed is ge-oppose in die verlede, dit was hier in die vroeë 70's, 80's was daai goeters gewees. Toe moes ons keer, ek sê ons, toe gaan daar stemme op, want ek was in daai vergaderings gewees. Hoekom moet ons nou weer 'n ding toelaat hier om môre, oormôre weer te probeer keer? So, daar kan nie gesê word ja nie. Daar sal divisions wees, daar sal verskil word hier want die vissermanne weet nie alles nie. En dit kan nie net op hulle-se sê gegaan word nie. En ja soos Dawid daar tereg, sy dinges tereg gestel het, dit is nie net hulle wat visvang nie. Dit is nie net hulle wat visvang nie, so die ander se menig tal ook. Nou my ander vraag, en ek hoor van gesigte kom wys en ander manse en ander companies, so dit is hierdie EIMS, is dit 'n Suid Afrikaanse company? TGS, wat is hy dan, daai wat julle is? Ja voor kom praat ja, maar die companies nou wat julle, is dit almal Suid Afrikaanse companies? So hulle-se direktors en die goed is wie? Is dit, verstaan? Sien, dis daai goeters, ons moet die goed fyn kyk en die goed fyn praat en soos KB gesê het van waar was ons al die tyd, dit is die hoeveelste keer wat, daar is elke keer, soos vanaand, sal die goed terug speel soos wat julle nou die goed record, soos elke mens se brein mos meer is en dan, maar my Here, waarmee is hierdie mense te doen? Daar kry jy weer daai dinges en daai goeters. So ja, en dit word gepraat om die goeters, ons is nie rondom professors en doktors en die goed nie, ons kyk ook nou maar hier op hierdie goed wat ons nou, so swak soos hierdie ding hier, sien julle hierdie pale wat hier staan, Vodacom het hom net gekom neersit, hy werk nie, so ons kry moeilik, ons kry swaar om ingelig te word, verstaan. Ons moet maar opkies, ons moet die draadlose aansit en die goeters. Ja, TV kyk en so aan, maar dis anders nêrens as om so te engage nie. So die vir ons moeilik en ons moet terug kom, by die volgende vergadering sal dit weer geraas word en erger geraas word want dan het ons geloop sien en geloop kry wat, maar ons het daai ding gemis en so aan. So ja, nee dit is verskriklik. *Now here's mine, even if the cabinet comes here as well, even if you bring the President here as well, and that's what I said earlier, they want to come and make me think the other star and my mind switch, I stand by what it is, it's an ending. I was born here in this place and I grew up in this place and saw what*

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	happens here. It's cork death it's wasting death behind here, here it is still alive, the only hope, the only life still here, not a cabinet or a Minister or a President will convince me otherwise. I say it's a disservice, it shouldn't be done. And thank Gods you don't just come to the fishermen or to the quota of containers, it's a community story this and we all have to say. The fishermen have a different thinking of what, of these things and things, that's why I say I'm not selfish when I say that benefits, in whatever form they just don't come in money, come in, I reject stuff like that. Understood, because I want my child children to be able to catch a pike, to be able to get a fish out of the sea and a lobster bone. It won't happen anymore if activities are going to start here and that's not saying it will be tomorrow, it's a long term thing it will happen here, it will happen, the people are busy nullifying us. I said it other time, I'm saying it again tonight, the people are eradicating us. *If I have to put it that way, it can't be that our only source that's still there, where we're looking at is also coming along. And it's just step by step, it's today, no it won't be, no it's just like that. What's next then? What's next? Then they come up with another thing. And again another thing and again another thing. So by so that they also come to store the waste gases with us later because it was already a year just back here at Skaapfontein where it filled the newspapers, and that stuff was opposed in the past, it was here in the early 70's, 80's those things were. Then we had to stop, I say we, then votes went up, because I was in those meetings. Why should we allow another thing here now to try to stop tomorrow, tomorrow? So, it cannot be said yes. There will be differences, there will be difference here because the fishermen don't know everything. And it can't just be gone on their say. And yes as David rightly put it, his things on trial, it's not just them fishing. It's not just them fishing, so the others' many count as well. Now my other question, and I hear about faces coming to show and other people and other companies, so it's this EIMS, is it a South African company?* *TGS, what is he then, that you are? Yes before come and speak yes, but the companies now that you are they all South African companies? So their directors and the stuff is who? Is it, understood? See, it's those things, we've got to take a close look at the stuff and talk the stuff fire and as KB said of where have we been all along, it's the umpteenth time that, there's every time, like tonight, the stuff will play back like you're recording the stuff now, like every man's brain is and then, but my Lord, what are these people to do with? There you get those things and those things again. So yes, and it's talked about the stuff, we're not around professors and doctors and the stuff, we're also just looking at this stuff we're doing right now, as weak as this thing here, you see these poles standing here, Vodacom just came to put him down, he's not working, so we're having a hard time, we suffer to be informed, understood. We just have to read up, we have to put on the wireless and the go-getters. Yes, watching TV and so on, but it's nowhere but engaging like that. So it's hard for us and we have to come back, at the next meeting it will get noise again and get worse noise because then we'd see walk and walk get what, but we missed that thing and so on. So yes, no it's terrible.* **SF Kriel** Ons is 'n Suid Afrikaanse maatskappy, TGS is 'n internasionale maatskappy so hulle is in die UK geregistreer. Ja, julle is oorsese ouens, so hulle is 'n oorsese maatskappy. Ja kyk ek meen, ja Mnr Rulfe ons is nie hier om julle te kom stoomroller of iets nie nè, ons is hier om ons werk te kom doen, ons werk is om te kom kyk na die omgewings goeters van verskillende fasette af. So, ons het vir julle gesê daar is marine ekologie, visserye mense, akoestiese ouens, sosiale mense, die erfenis ouens, al daai goeters. En dan gaan ons op 'n manier vir julle kom sê oukei dit is wat ons gekry het uit al daai goeters uit, uit die goeters wat ons gekry het. En ons gaan dit aan julle kom voordra en dit is nie nodig dat julle saamstem nie. Verstaan ons wil julle nie kom oortuig van 'n ding nie. Die ding is om vir julle te kom sê dis die inligting wat ons gekry het, julle is dan geregtig om vir ons julle inligting ook te gee en dan kan ons daar om die tafel sit en gesels.

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	En op die ou einde van die dag wil ons julle die reg gee en die geleentheid gee om te reageer op 'n formele manier soos hierdie, en julle is welkom om julle sê te sê. En ek is bly julle sê julle sê. En julle moet dit doen, en dis ons werk om dan seker te maak dat daai sê wat julle gesê het ingaan na die departements toe wat die besluite moet raak of ons daarmee saamstem of nie. So ons hoef nie hier saam te stem oor die goeters wat ons kry nie. En dis die belangrike ding en dis hoekom ek waardeer wat jy gesê het, dit is rêrig goed, so al stem ons nie saam oor die ding nie, dan moet ons nog steeds daai goeters vat en dit instuur vir die departement dat hulle ook 'n besluit kan neem, dat hulle dit duidelik kan sien, daar is detail, Mnr So en So het gesê nee hy stem nie saam met dit nie. So al daai goeters gaan in, en dis belangrik dat daai goeters dan gesê word. En ons moet ook kyk op daai stadium na die impak wat dit op ons impakte het as ek dit so kan stel, so ons gaan kyk partykeer jy weet sê nou maar dis 'n lae impak maar die gemeenskap sê nee dit is nie, dan kyk ons bietjie na daai ding op 'n ander manier en ons probeer dit op 'n ander manier aanspreek. So dis vir ons baie belangrik, ja, dankie vir daai een en julle is maar geregtig, julle kan maar hard praat. *We are a South African company, TGS is an international company so they are registered in the UK. yes, you're overseas guys, so they're an overseas company. yes look I mean, yes Mr Rulfe we're not here to steamroller you guys or anything huh, we're here to come and do our job, our job is to come and look at the environments from different facets. So, we told you there are marine ecologists, fisheries people, acoustic guys, social people, the heritage guys, all those things. And then somehow we're going to come and tell you okay that's what we got out of all those things, out of the stuff we got. And we're going to come and recite it to you and there's no need for you to agree. Understand we don't want to come and convince you of a thing. The thing is to come and tell you it's the information we got, you're enabled to give us your information as well and then we can sit around the table and chat.* *And at the end of the day, we want to give you the right and the opportunity to respond in a formal way like this, and you're welcome to have your say. And I'm glad you say you say. And you have to do that, and it's our job to then make sure that what you said goes into the departments that have to make the decisions whether we agree with it or not. So we don't have to agree here on the stuff we get. And that's the important thing and that's why I appreciate what you said, it's really good, so even if we don't agree on the thing, then we still have to take those things and send them in for the department that they can also make a decision, that they can see it clearly, there's detail, Mr So and So said no he disagreed with that. So all those things go in, and it's important that those things are said then. And we also have to look at the impact it has on our impacts at that point, if I can put it that way, so we're going to look sometimes you know say it's a low impact but the community says no it's not, then we look at that thing in a different way and we try to address it in a different way. So it's very important to us, yes, thank you for that one and you're just entitled, you can just speak loudly.*
n.	**David Marius** Wat is die algemene gevoel in die ander gemeenskappe hieroor? Weg van die beskuit is die mense. En ons sal moet wakker pies oor hier vanaf verder voortmoe, en nie vaak pies nie. 'n Mens kry wakker pies en vaak pies, maar dankie eers. So ons sal moet wakker wees want die regering kom en dan maak hy soos hy wil, ons sê asseblief tog moenie so maak nie dan maak hy presies wat jy sê moenie so maak nie, dis wat hy doen. En die algemene gevoel op die Wes Kus, soos die Meneer nou daar sê wat daarem nou al ge-travel het nou, ek wonder hy het nog nie blou kolle op sy lyf gehad of hierdie goeters... Dit was naby, maar die tank en die knap is mense [moet met hom? Ons moet saamstaan in hierdie verband. En dat ons nie kyk na 'n kortstrmyn plan om te sê ek sal nou 'n kontrak kry want miskien, die manne wat once even nou ook kom en kom staan en sê nee, dan sal die man wat gedink het ook hier is 'n kontrak dan floor hy sommer uit die saal uit want hy het gekom en gehoop en gedink hier sal darem

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	'n plan uitspring. Maar ons sal moet saam staan en daar soos ek gesê het, daar is 'n spreekwoord wat sê; as ons wil vinnig beweeg, gaan alleen, maar as ons wil ver beweeg moet ons saam beweeg, if you want to go fast, go alone, if you want to go far, go together. En ons moet daai togetherness hê, om te sê luister hierso laat ons bewaar vir generasies om te kan kom. Ek verstaan die menere se dynamics, hulle het 'n werk om te vervul, maar hulle kan ook hoor die pleidooi want ons moet op 'n stadium ook die mondstuk wees vir die wat nie kan praat nie, maar die diere het die vermoë om te kan praat, nie onse taal nie, wat ons nou praat, maar hulle kan sê maar dit is nie reg nie, moenie so maak nie en dit is van die Christelike kant af het ons as die Ons is die hoof, ons is die dominion gekry óf die beheer en die besluitneming oor die diere, maar wanneer ons 'n besluit maak, moet dioen, moet dit ten gunste van hulle ook wees. Ons het 'n funksie en 'n verantwoordelikheid om in harmonie met mekaar saam te lewe met die natuur saam. As ons nie dit gaan doen nie is ons on deadly ground want ons moet besef soos daai ou geleerd, nie eens 'n geleerde nie, of 'n akademikus nie, om te sê geld sal ons nie kan eet nie, die mense was al hier gewees, kyk hoe lyk ons, waar is die rehabilitasie, waar is die one, two, three? Dit sal weer gebeur, dink jy die geskiedenis sal hom nie weer herhaal nie. Ons sal moet fools wees om dan te kan dink dit gaan nie gebeur nie. So daai navorsingstuk, of hy nou wat hulle gesê het in die artikel, sê hulle die vlamme het gebars, en sover soos 64 kilometer met die olieboor was daar 'n probleem gewees. Nou 64 kilometer is so ver hiervan af soos Klipfontein, kon hulle die vlamme gesien het in die see in, in Amerika in, en toe loop sak daai hele olieboor en daai hele spillage en dit was vir 'n, ek meen dit is 'n lifetime ding, so mense ek dink ek is ge-cover oers met dit saam. As ons sê dat die algemene gevoel is op die Weskus om te sê asseblief tog moenie, ons is bestaanmakers ons kan onse lewe hier maak, ons kan onse broodjie maak, maar maak julle 'n fout daarso dan is ons ge-doom. Dan sit ons in 'n groot probleem. *What is the general feeling in the other communities about this? Away from the decision are the people. And we'll have to wake up eating pies here from further ahead, and not vaak pies. One gets woke pies and faint pies, but thank you first. So we're going to have to be awake because the government comes and then he makes as he pleases, we say please don't make it like that then he makes exactly what you say don't make it so, that's what he does. And the general feeling on the West Coast, as the Sir says there now, I wonder he hasn't had blue spots on his body or these things...* *It was close, but the tall and the handsome are people I must with him? We need to stand by in this regard. And that we're not looking at a short-term plan to say I'll get a contract now because maybe, the guys who come and stand and say no, then the guy who thought here was a contract then he'll just come out of the hall because he came and hoped and thought here at least a plan would jump out. But we're going to have to stand together and there as I said, there's a saying that says; if we want to move fast, go alone, but if we want to move far we have to move together, if you want to go fast, go alone, if you want to go far, go together. And we have to have that togetherness, to say listen hereso let's preserve for generations to come. I understand the gentlemen's dynamics, they have a job to fulfill, but they can also hear the plea because at some point we also have to be the mouthpiece for those who can't speak, but the animals have the ability to be able to speak, not our language, which we speak now, but they can say but it's not right, don't make it that way and it's from the Christian side we as the Ons are the head, we've been given the dominion or the control and the decision-making about the animals, but when we make a decision, it has to be in favor of them too. We have a function and a responsibility to live in harmony with each other with nature together. If we're not going to do that we're on deadly ground because we have to realize like that old scholar, not even a scholar, or an academic, to say money won't be able to eat us, the people have been here, look what we look like, where's the rehabilitation, where's the one, two, three? It will happen again, do you think history will not repeat itself again. We're going to have to be fools to then be able to think it's not going to happen. So that research piece, whether he said what they said in the article, they say the flames burst, and as far as 64 kilometres with the oil rig there was a problem. Now 64 kilometres is as far from this as Klipfontein, they could have seen the flames*

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	into the sea, into America, and then that whole oil drill and that whole spillage and it was for a, I think it's a lifetime thing, so people I think I'm covered with it first. If we say that the general feeling is on the West Coast to say please don't, we're subsistence fishermen we can make our life here, we can make our bun, but make a mistake thereso then we're doomed. Then we're stuck in a big problem. **GP Kriel** Die algemene gevoel wat ons gekry het sover is dat daar, is dat die mense bietjie gekant is daarteen so ek gaan nou maar bietjie oop kaarte met julle speel. Ja so dit was maar die gevoel gewees, so jy weet reg van Houtbaai af tot by, ons was in Kaapstad geweet, Saldanha en al daai plekke ook so die mense het hulle sê kom sê, net soos wat julle nou julle sê kom sê het. *The general feeling we've gotten so for is that there's that the people are a little opposed to it so I'm just going to play some open cards with you guys now. yes so that was just the feeling, so you know right from Hout Bay to, we were in Cape Town, Saldanha and all those places as well so the people come to say their say, just like you come to say your say.*

BYLAE/ APPENDICES

1.	**Bywoning Register/ *Attendance Register***
2.	**Aanbieding/ *Presentation***

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Hondeklip Bay - Eric Baker Hall	Date and Time	2 September 2022 - 16:00–18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Hondeklip Bay – Eric Baker Hall	Date and Time	2 September 2022 - 16:00–18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Lorie Papier	Hondeklipbaai	Tel: Cell: 0795453563. Email: marie.papier1@gmail.com	Papier	
John C Adams	Hondeklipbaai	Tel: Cell: 076 034 6173 Email: boyadams1858@gmail.com		
Diana Menteor	Hondeklipbay	Tel: Cell: 0766880414 Email: dianamenteor@gmail.com	Menteor.	
Sam-Mare Arries	Pella	Tel: Cell: 082 913 9687 Email: samarr@xplornet.co.za		

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EIMS

Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Hondeklip Bay - Eric Baker Hall	Date and Time	2 September 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Pia Plougmann	1 Van der Horst Street, Komaggas	Tel: / Cell: 0734642228 Email: piaplougmann@gmail.com		
Colin Cloete	Aasvoeg 128 Hondeklipbaai	Ref: Cell: 0761654936 Email: colin.cloete@gmail.com		
Nicolaas Cloete	Nuwe uitbreiding No 299 Hoofstr. 208	Tel: Cell: 0795655755 Email:		
Melia Filton	Hondeklipbay	Tel: Cell: 0612439206 Email:		

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Attendance Register

EIMS

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Initial Public Meeting.		
Meeting Venue	Hondeklipbaai	Date and Time	02/04/2022

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Sammy Abarris	Hondeklipbaai	Tel: Cell: 0682338486 Email: sammyndonis20@gmail.com		
Callen Clokie	W Dam, Goudq	Tel: Cell: Email: Callen clokie @gmail		SEICHE
Andrue C Bosman	HKB.	Tel: Cell: Email:		
Ilse Aucamp	Pretoria	Tel: Cell: 0828250668 Email: ilse@eqwispectives.co.za		Eqwispectives

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EIMS

Attendance Register

EIMS Ref	1320	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Initial Public Meeting		
Meeting Venue	Hondeklipbaai	Date and Time	2 Sep 2022 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Margaret Koordom	124 Bamboesslot HKBaai	Tel: Cell: 068 258 0975 Email: koordomm105@gmail.com	Koordom	Public
Bernard Cook	124 Bamboesslot	Tel: Cell: 083 721 5953 Email: cookbernard558@gmail.com	Cook	Longtime H.K.B. Farmer/Co-op.
Rosina Waase	Sunnyside 172 H.K.bay	Tel: Cell: 065 870 8983 Email: rosiewaase5@gmail.com	R Waase	Public
JOHNY Doe		Tel: Cell: Email:	Doe	

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Attendance Register

EMS

EMS Ref	1520	Project Name	Proposed TBS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Initial Public Meeting		
Meeting Venue	Hondeklipbaai	Date and Time	2 Sep 2022 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Nilma Cloete	Kung Klipstr. 166 Hondeklipbay	Tel: Cell: 0665081151 Email: daveynil@gmail.com		
Ramey Deckwaard	# E E	Tel: Cell: 071 581 1877 Email: rameydiegaardt@gmail.com		
DAWID MARKUS	ERF 391 HONDEKLIPBAAI	Tel: Cell: 0616542749 Email: dawidmarkus1@gmail.com		
		Tel: Cell: Email:		

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EIMS

Attendance Register

EIMS Ref: 1520 | Project Name: Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment

Meeting: Initial Public Meeting

Meeting Venue: Hondeklipbaai | Date and Time: 2 Sep 2022 16:00 - 18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Louisa Cloete NHB		Tel: Cell: Email:	L Cloete	
		Tel: Cell: Email:		
		Tel: Cell: Email:		
		Tel: Cell: Email:		

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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

VERADERING BESONDERHEDE/ *MEETING DETAILS*

Vergadering/ *Meeting*	1520 Pre-application Consultation Public Meeting		
Vergadering Plek/ *Meeting Venue*	Port Nolloth Municipal Hall, Port Nolloth	Date	2022/09/03
		Time	10h00-12h00

Teks in *italics* is uit die Afrikaanse teks vertaal. *Text in italics has been translated from the Afrikaans text.*

'n Openbare vergadering is geskeduleer tydens die voorraansoekfase met die Belanghebbende en Geaffekteerde Partye (I&APs). Die doel van die vergadering was om die aanvanklike bekommernisse van die lede van die publiek en belangrike I&APs vas te lê. Die gemeenskap het opgedaag met plakkate en het aanvanklik die vergadering bygewoon, maar het geweier om die bywonings register te teken. Nadat Mnr GP Kriel vir hulle probeer verduidelik het hoekom dit belangrik is om die register te teken en dat dit nie toestemming vir die projek sou gee nie, het hulle besluit om die vergadering te verlaat voordat enige voordrag aan hulle gemaak kon word.

A public meeting is scheduled during the pre-application phase with the Interested and Affected Parties (I&APs). The purpose of the meeting was to capture the initial concerns of the members of the public and key I&APs. The community showed up with placards and initially attended the meeting, but refused to sign the attendance register. After Mr GP Kriel tried to explain to them why it was important to sign the register and that it would not consent to the project, they decided to leave the meeting before any presentation could be made to them.

AGENDA

Item
1. *EIMS Aanbieding/ EIMS Presentation* a. Bekendstelling van die projekspan/ *Introducing the project team* b. Projekbeskrywing/ *Project Description* c. Regsaansoekproses/ *Legal Application Process* d. Publieke Deelname/ *Public Participation* e. Impakbepaling/ *Impact Assessment* f. Projek Kontak Besonderhede/ *Project Contact Details* g. Aanbieding van SEICHE/ *Presentation from SEICHE*
2. Vraag en Antwoord/ *Questions and Answers*

NOTULE/ *MINUTES*

No meeting took place

BYLAE/ APPENDICES

1. Bywoning Register/ *Attendance Register*

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EE28

EIMS	Minutes of Meeting		
EIMS Ref	1520	Project Name	TGS Reconnaissance Basic Assessment

Meeting Details

Meeting	PASA EIA Pre-Application Meeting		
Meeting Venue	Microsoft Teams	Date	19 July 2022
		Time	12:00-13:00

Meeting Attendees

Representative	Company	Email Address
Phumla Ngesi (PN)	Petroleum Agency of South Africa (PASA)	
Natasha Thomas (NT)	PASA	
Sharon Adams	PASA	
Liam Whitlow (LW)	Environmental Impact Management Services (EIMS)	
GP Kriel (GPK)	EIMS	
Jevon Hilder	TGS Geophysical Company UK (TGS)	

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EIMS	Minutes of Meeting		
EIMS Ref	1520	Project Name	TGS Reconnaissance Basic Assessment

Agenda

Item
1. Introductions
2. Project Background and Description
3. Project Approach and Timeframes
4. Discussion
5. Conclusion

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EIMS

Minutes of Meeting

EIMS Ref	1520	Project Name	TGS Reconnaissance Basic Assessment

Minutes

Item No	Item	Action	Date
1	**Introductions**		
	GPK introduced the meeting attendees and the purpose of the meeting.	All	Note
2	**Project Background and Description**		
	GPK provided a description of the project in terms of the location of the project, a brief description of the 3D survey proposed to be undertaken, the planned Public Participation and Specialist Studies proposed.	All	Note
3	**Project Approach and Timeframes**		
	GPK presented the NEMA listed activity as being LN1 Activity 21(b) and presented the Basic Assessment and the proposed Public Participation approach.	All	Note
4	**Discussion**		
4.1	GPK indicated that the deadline for the submission of the EA Application was 6 September 2022. GPK noted that a second 30 day BA review period may be required to ensure all concerns are captured. PN that the timing of submission of the application should ideally leave sufficient time for the adequate comment period in order to avoid having to apply for extension in terms of Regulation 3(7). The online portal was not ready yet, and as a result an Electronic EA Application submission via email would be acceptable.	All	Note
4.2	PN highlighted that it would be important to consult with the relevant organisations and stakeholders – and it was important to engage with the Indigenous leaders from the Khoi and San communities and the South African United Fishers Front.	All	Note
4.3	PN confirmed that this application relates to Section 74 of the MPRDA as a Reconnaissance Permit would be required.	All	Note
4.4	GPK asked for PASA for information on any other decision support tools. PN responded that PASA has their own public participation consultation guideline but the NEMA guideline covers this so she	All	Note

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EIMS	Minutes of Meeting		
EIMS Ref	1520	Project Name	TGS Reconnaissance Basic Assessment

Item No	Item	Action	Date
	suggested that the DFFE guideline should be followed. She indicated that EIMS should focus on the EIA regulations and the Needs and Desirability guidelines.		
4.5	GPK asked for clarification on the cumulative impact assessment as it looks like there are multiple application proposed for the same area. PN responded that for now cumulative impacts must be considered in terms of multiple pending reconnaissance permit applications or exploration activities in the area. PN acknowledged that their licensing and regulations department are preparing a response regarding potential multiple reconnaissance permits over the same area but for now.	All	Note
4.6	GPK requested details on hard or electronic copy submission of documents and asked if the PASA online portal was up and running and asked for clarification regarding email transmission and whether the electronic submission proof would be adequate in terms of meeting submission deadlines. PN responded that the portal is not ready yet. PN indicated that electronic submission to the PASA applications administrator would be satisfactory but 1 hard copy of the draft and final BA reports would be required as well as an electronic copy. PN confirmed that this would be satisfactory as long as an overnight courier hard copy would be received shortly thereafter.	All	Note
4.7	JH asked if there was any intention for PASA to do any engagements with the communities considering the scrutiny that these types of projects are facing in South Africa at the moment. PN confirmed that there are a number of pre-colloquium events being planned that would address the impact of climate change, the co-existence of oil and gas with fisheries, etc. in the coming months.		

The meeting closed at 12:30.

Adopted by:

Name	Signature	Organisation

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5025

EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*		
EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

VERADERING BESONDERHEDE/ *MEETING DETAILS*

Vergadering/ *Meeting*	1520 OBAR Review Public Meeting		
Vergadering Plek/ *Meeting Venue*	Port Nolloth Country Club	Date	2022/10/31
		Time	16h00-18h00

Teks in *Italics* is uit die Afrikaanse teks vertaal. *Text in Italics has been translated from the Afrikaans text.*

'n Openbare vergadering is geskeduleer met die Belanghebbende en Geaffekteerde Partye (I&APs). Die doel van die vergadering was om die terugvoering te gee oor die bevindinge van die Basiese Assesserings Verslag aan lede van die publiek en belangrike I&APs vas te lê. Tydens die openbare vergadering wat tussen 16:00 en 18:00 plaasgevind het, is 'n aanbieding van die projekbeskrywing, voorlopige impakassessering, projekspan en projektydraamwerke aan alle deelnemers van die vergadering deur Environmental Impact Management Services (EIMS) Pty (Ltd) gelewer. 'n Aanbieding is deur mnr GP Kriel van EIMS in Afrikaans gelewer. Nadat die aanbieding afgelewer is, is 'n vraag- en antwoord sessie geopen waar deelnemers vrae gevra het of hul kommentaar oor die projek uitgespreek het. Die bywoningsregister is aangeheg as 'n aanhangsel tot hierdie dokument.

A Public Meeting was scheduled with the Interested and Affected Parties (I&APs). The aim of the meeting was to feedback regarding the findings of the Basic Assessment Report the members of the public and key I&APs. During the public meeting which took place between 16h00 and 18h00, a presentation of the project description, preliminary impact assessment, project team and project timeframes was delivered to all attendees of the meeting by Environmental Impact Management Services (EIMS) Pty (Ltd). A presentation was delivered by Mr GP Kriel from EIMS in Afrikaans. After the presentation was delivered, a question and answer session was opened where attendees asked questions or expressed their comments regarding the project. The attendance register has been attached as an appendix to this document.

AGENDA

Item
1. EIMS Aanbieding/ *EIMS Presentation*
a. Bekendstelling van die projekspan/ *Introducing the project team*
b. Projekbeskrywing/ *Project Description*
c. Regsaansoekproses/ *Legal Application Process*
d. Publieke Deelname/ *Public Participation*
e. Impakbepaling/ *Impact Assessment*
f. Versagtings Maatreels/ *Mitigation Measures*
g. Projek Kontak Besonderhede/ *Project Contact Details*
2. Vraag en Antwoord/ *Questions and Answers*

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TGS

EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*		
EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ TGS RECONNAISSANCE BA

NOTULE/ *MINUTES*

Item No	Item
1.	Alle deelnemers is versoek om die bywoningsregister te onderteken soos hulle ingeskryf het. Aanbieding van EIMS van die projekbeskrywing, aansoekproses en omgewingsversagtings tydens seismiese opname is gelewer volgens die agenda hierbo aan die vergaderinggangers. Daar is aangedui dat die vergadering opgeneem sou word vir die doeleindes van akkurate notule neem. Agtergrondinligtingsdokumente (in Engels, Afrikaans en isiXhosa), kommentaarvorms, registrasie, inligtingsuitdeelstukke en bywoningsregisters is by die vergadering beskikbaar gestel. Die deelnemers is aangemoedig om hul kommentaar en bekommernisse in te dien deur die kommentaarvorms in te vul wat verskaf word of deur kommentaar in te dien by die projek-e-posadres wat verskaf is. Daar is opgemerk dat alle deelnemers wat hul kontakbesonderhede verskaf het, by verstek geregistreer sal word op die I&AP-databasis wat deur EIMS gehandhaaf word. Na aanleiding van die aanbiedings is die vloer oopgemaak vir 'n bespreking en die deelnemers is aangemoedig om enige vrae of bekommernisse wat hulle oor die projek gehad het, op te stel. *All attendees were requested to sign the attendance register as they entered. Presentation from EIMS of the project description, application process and environmental mitigations during seismic survey were delivered as per the agenda above to the meeting attendees. It was indicated that the meeting would be recorded for the purposes of accurate minute taking. Background Information Documents (in English, Afrikaans and isiXhosa), comments forms, registration, information handouts and attendance registers, were made available at the meeting.* *The attendees were encouraged to submit their comments and concerns through filling in the comment forms provided or by submitting comments to the project email address provided. It was noted that all attendees who have provided their contact details would be registered by default on the I&AP database maintained by EIMS. Following the presentations, the floor was opened for a discussion and the attendees were encouraged to bring up any questions or concerns they had about the project.*
2.	**Vrae en Antwoord/ *Questions and Answers***
a.	**Mrs Moyser** What assurance is there that the rules will be followed – we know that there are monitors on board the vessel, but in these days, it is sometimes difficult to be confident that the requirements will be implemented as required. What reporting mechanisms are in place to ensure compliance. *Watter versekering is daar dat die reëls gevolg sal word - ons weet dat daar monitors aan boord van die vaartuig is, maar in hierdie dae is dit soms moeilik om vol vertroue te wees dat die vereistes geïmplementeer sal word soos vereis. Watter verslagdoeningsmeganismes in plek is om nakoming te verseker.* **dP Briel** Thank you – that is a good question. It is important to remember that this is an international company that cannot afford to slip up on compliance, since the reputational damage alone will be a massive factor. Furthermore, in the EMPr there are clear requirements for independent Environmental Control Officers (ECO), Marine Mammal Observers (MMO), Passive Acoustics Monitors (PAM) and Fisheries Liaison Officers (FLO). These independent officers are there to monitor and ensure that the requirements of the Environmental Authorisation and EMPr are carried out. The MMOs and PAMs will inform the vessel officers of the need to stop for any animals within the safety zone around the boat, and will do daily,

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JLDS

EIMS | NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	weekly and monthly reporting to the PASA on the level of compliance with the requirements. The independence is key and there is also external independent audits on these operations. *Dankie – dit is 'n goeie vraag. Dit is belangrik om te onthou dat dit 'n internasionale maatskappy is wat nie kan bekostig om te versteen nie, aangesien die reputasieskade alleen 'n massiewe faktor sal wees. Verder is daar in die EMPr duidelike vereistes vir onafhanklike omgewingsbeheerbeamptes (ECO), mariene soogdierwaarnemers (MMO), passiewe akoestiekmonitors (PAM) en visseryskakelbeamptes (FLO). Hierdie onafhanklike beamptes is daar om te monitor en te verseker dat die vereistes van die Omgewingsmagtiging en EMPr uitgevoer word. Die MMO's en PAM's sal die voorsuigbeamptes inlig oor die noodsaaklikheid om vir enige diere binne die veiligheidszone rondom die boot te stop, en sal doeglik, weeklik en maandelik aan die PASA verslag doen oor die vlak van voldoening aan die vereistes. Die onafhanklikheid is die sleutel en daar is ook eksterne onafhanklike oudits oor hierdie bedrywighede.* **Ruelian Bally** There are very clear guidelines that are required and if they don't follow these rules on the vessel, then we report on that and there would then be consequences for them. In general, it must be said, that we find that the survey activities comply with the EMPr. *Daar is baie duidelike riglyne wat vereis word en as hulle nie hierdie reëls op die vaartuig volg nie, rapporteer ons daaroor en daar sal dan gevolge vir hulle wees. Oor die algemeen moet gesê word dat ons vind dat die opname-aktiwiteite aan die EMPr voldoen.*
b.	**Fisherman (Aokotowa fisheries)** Aan Ruelian wat op die bote werk – julle moet nou eerlik vir ons sê of dit wat hulle hier gesê het die waarheid is. *To Ruelian working on the boats – you must now honestly tell us whether what they have said here is the truth.* **Ruelian Bally** Ja alles wat hulle vir ons vertel het is waar. *Yes, everything they told us is true.*

BYLAE/ APPENDICES

1.	**Bywoning Register/ *Attendance Register***
2.	**Aanbieding/ *Presentation***

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TSS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Port Nolloth - Port Nolloth Country Club	Date and Time	31 October 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Morgen [illegible]	3 E Street Port Nolloth	Tel: Cell: 073 487 7040 Email:		Auto & Gen Fisharies Co-op
Michelle Rose		Tel: Cell: 083 770 2166 Email:		Seiche Ltd.
Nico Bezuidenhout	128 Albrechtstr. Calvinia 8190.	Tel: 083 229 3861 Cell: Email: nico.bez@gmail.com		Facilitator
Callen Clokie	UU Dam	Tel: Cell: Email: CallenClokie@gmail.com		Seiche.

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Port Nolloth - Port Nolloth Country Club	Date and Time	31 October 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Andisiwe Xuma	King Williams Town	Tel: Cell: 0711025389 Email:		PPP Consultant
		Tel: Cell: Email:		
		Tel: Cell: Email:		
		Tel: Cell: Email:		

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Attendance Register

EMS Ref	2520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Port Nolloth - Port Nolloth Country Club	Date and Time	31 October 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
D E Moyser	76 Beach Road Port Nolloth	Tel: 027851 7172 Cell: 0842571875 Email: moyser@telkomsa.net		MBS. (SMME)
BWJ du Plessis	76 Beach Road Port Nolloth	Tel: 027 851 7172 Cell: 0842511574 Email: bwjfishing@telkomsa.net		Lavender Moon Trading (fishing)
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Attendance Register

EIMS Ref	1520	Project Name:	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Port Nolloth - Port Nolloth Country Club	Date and Time	31 October 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Allison Fleuser	377 Nolloth Hille Port Nolloth	Tel: Cell: 060 820 5400 Email:		Ai Kotoha
Benjamin De Tolack	Lydia Links Park 3806	Tel: Cell: 0783615476 Email:		Aikotowa
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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*	
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VERADERING BESONDERHEDE/ *MEETING DETAILS*

Vergadering/ *Meeting*	1520 DBAR Review Public Meeting		
Vergadering Plek/ *Meeting Venue*	Eric Baker Hall, Hondeklip Bay	Datum	2022/11/01
		Tyd	16h00-18h00

Teks in *italics* is uit die Afrikaanse teks vertaal. *Text in italics has been translated from the Afrikaans text.*

'n Openbare vergadering is geskeduleer met die Belanghebbende en Geaffekteerde Partye (I&APs). Die doel van die vergadering was om die terugvoering te gee oor die bevindinge van die Basiese Assesserings Verslag aan lede van die publiek en belangrike I&APs vas te stel. Tydens die openbare vergadering wat tussen 16:00 en 18:00 plaasgevind het, is 'n aanbieding van die projekbeskrywing, voorlopige impakassessering, projekspan en projektydraamwerke aan alle deelnemers van die vergadering deur Environmental Impact Management Services (EIMS) Pty (Ltd) gelewer. Nico Bezuidenhout was die vergadering fasiliteerder. 'n Aanbieding is deur mnr GP Kriel van EIMS in Afrikaans gelewer. Nadat die aanbieding afgelewer is, is 'n vraag- en antwoord sessie geopen waar deelnemers vrae gevra het of hul kommentaar oor die projek uitgespreek het. Die bywoningsregister is aangeheg as 'n aanhangsel tot hierdie dokument.

A Public Meeting was scheduled with the Interested and Affected Parties (I&APs). The aim of the meeting was to feedback regarding the findings of the Basic Assessment Report the members of the public and key I&APs. During the public meeting which took place between 16h00 and 18h00, a presentation of the project description, preliminary impact assessment, project team and project timeframes was delivered to all attendees of the meeting by Environmental Impact Management Services (EIMS) Pty (Ltd). Nico Bezuidenhout was the meeting facilitator. A presentation was delivered by Mr GP Kriel from EIMS in Afrikaans. After the presentation was delivered, a question and answer session was opened where attendees asked questions or expressed their comments regarding the project. The attendance register has been attached as an appendix to this document.

AGENDA

Item
1. **EIMS Aanbieding/ *EIMS Presentation***
a. **Bekendstelling van die projekspan/ *Introducing the project team***
b. **Projekbeskrywing/ *Project Description***
c. **Regsaansoekproses/ *Legal Application Process***
d. **Publieke Deelname/ *Public Participation***
e. **Impakbepaling/ *Impact Assessment***
f. **Versagtings Maatreels/ *Mitigation Measures***
g. **Projek Kontak Besonderhede/ *Project Contact Details***
2. **Vraag en Antwoord/ *Questions and Answers***

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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*		
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NOTULE/ *MINUTES*

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1.	Alle deelnemers is versoek om die bywoningsregister te onderteken soos hulle ingeskryf het. Aanbieding van EIMS van die projekbeskrywing, aansoekproses en omgewingsversagtings tydens seismiese opname is gelewer volgens die agenda hierbo aan die vergaderinggangers. Daar is aangedui dat die vergadering opgeneem sou word vir die doeleindes van akkurate notule neem. Agtergrondinligtingsdokumente (in Engels, Afrikaans en isiXhosa), kommentaarvorms, registrasie, inligtingsuitdeelstukke en bywoningsregisters is by die vergadering beskikbaar gestel. Die deelnemers is aangemoedig om hul kommentaar en bekommernisse in te dien deur die kommentaarvorms in te vul wat verskaf word of deur kommentaar in te dien by die projek-e-posadres wat verskaf is. Daar is opgemerk dat alle deelnemers wat hul kontakbesonderhede verskaf het, by verstek geregistreer sal word op die I&AP-databasis wat deur EIMS gehandhaaf word. Na aanleiding van die aanbiedings is die vloer oopgemaak vir 'n bespreking en die deelnemers is aangemoedig om enige vrae of bekommernisse wat hulle oor die projek gehad het, op te stel. *All attendees were requested to sign the attendance register as they entered. Presentation from EIMS of the project description, application process and environmental mitigations during seismic survey were delivered as per the agenda above to the meeting attendees. It was indicated that the meeting would be recorded for the purposes of accurate minute taking. Background information Documents (in English, Afrikaans and isiXhosa), comments forms, registration, information handouts and attendance registers, were made available at the meeting.* *The attendees were encouraged to submit their comments and concerns through filling in the comment forms provided or by submitting comments to the project email address provided. It was noted that all attendees who have provided their contact details would be registered by default on the I&AP database maintained by EIMS. Following the presentations, the floor was opened for a discussion and the attendees were encouraged to bring up any questions or concerns they had about the project.*
2.	**Vraag en Antwoord/ *Questions and Answers***
a.	**Carisa Soudens** Dit wil vir my voorkom dat die vergadering nie reg geadverteer is nie, want daar is baie min mense hier. Ons is bekommerd dat dit 'n baie belangrike vergadering is wat die mense klaarblyklik nie kennis van dra nie. Ek het nie geweet van die vergadering tot vanoggend nie. *(Mev Soudens is ingeskuit in die lys van mense vir wie eposse gestuur is oor die vergadering)* *It seems to me that the meeting was not advertised correctly, because there are very few people here. We are concerned that this is a very important meeting that the people are evidently not aware of. I didn't know about the meeting until this morning. (Mrs Soudens is included in the list of people for whom emails were sent about the meeting)* **GP Kriel** Dit was regtig nie ons intensie om mense uit te sluit nie. Ons het ons databasis opdateer met die inligting van die vorige vergaderings en ons het vir hierdie vergadering kennisgewing uitgestuur per epos, sms, fax en pos vir die mense op ons databasis vir hierdie projek. Ons het egter nie beheer oor of die mense kies om die vergadering by te woon nie. *It really wasn't our intention to exclude people. We updated our database with the information from the previous meetings and we sent out notice for this meeting by email, text, fax and mail to the people on*

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

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	our database for this project. However, we do not have control over whether the people choose to attend the meeting.
b.	**David Markus** Ek wil aansluit by Carisa – ek is op die Kamiesberg Munisipaliteit raad en ek het geen kennisgewing van die vergadering gekry nie. (*Mnr Markus is ingesluit in die lys van mense vir wie eposse gestuur is oor die vergadering*). Die vergadering moet geherskeduleer word. Die munisipaliteit het ons nie laat weet nie. Ons kan nie selektief wees nie. Ons moet saamstaan. Julle moet julle kant skoon hou, hierdie munisipaliteit is 'n korrupte munisipaliteit. Wat doen julle om die kommunikasie stelsel te verbeter. Wat is die inhoud van die vergadering met die Munisipaliteit. Dit is fishy en julle kom baie mischievous voor. *I want to second Carisa – I am on the Kamiesberg Municipality Council and I received no notice of the meeting. (Mr Mark is included in the list of people for whom emails were sent about the meeting). The meeting must be rescheduled. The municipality did not let us know. We can't be selective. We must stand together. You have to keep your side clean, this municipality is a corrupt municipality. What are you doing to improve the communication system? What is the content of the meeting with the Municipality. It is fishy and you guys come across as very mischievous.* **GP Kriel** Ons het ons databasis opdateer met die inligting van die vorige vergaderings en ons het vir hierdie vergadering kennisgewing uitgestuur per epos, sms, faks en pos vir die mense op ons databasis vir hierdie projek. Ons het egter nie beheer oor of die mense kies om die vergadering by te woon nie. Ons het selfs met die munisipale bestuur met die verteenwoordigers op Garies 'n vergadering gestuur. Ons het die regulasies gevolg en ons het almal in kennis gestel wat gesê het hulle stel belang in die projek. Die inhoud van die vergadering was presies dieselfde as dit wat ons vir julle hier gewys het, Mev Soudens was ook vanoggend daar en sal dit kan beaam. Ons kan selfs deur die vrae en antwoorde gaan as julle wil. Ons kan ongelukkig nie verantwoording doen vir die munisipale strukture en hoe hulle intern kommunikeer nie. Ons doen ons bes om seker te maak dat ons almal inlig wat belangstel en geregistreer is. Bevestig asseblief vir ons julle kontak besonderhede. Ons het ook 'n datavrye weergawe van die verslag en die verslag is ook beskikbaar op die dorp en ons het ook 'n opsomming van die verslag beskikbaar gestel. *We updated our database with the information from the previous meetings and we sent out notice for this meeting by email, text, fax and mail to the people on our database for this project. However, we do not have control over whether the people choose to attend the meeting. We even sent a meeting with the municipal management with the representatives at Garies. We followed the regulations and we notified everyone who said they were interested in the project. The contents of the meeting were exactly the same as what we showed you here, Mrs Soudens was also there this morning and will be able to echo that. We can even go through the questions and answers if you want. Unfortunately, we cannot account for the municipal structures and how they communicate internally. We do our best to make sure that we inform everyone who is interested and registered. Please confirm for us your contact details. We also have a data-free version of the report and the report is also available on the town and we have also made a summary of the report available.* **Nico Bezuidenhout** Ons wil net bevestig, daar is geen besluitneming wat plaasvind by die vergaderings nie, dit is vir kommentaar en terugvoering oor die bevindinge van die verslag. *We just want to confirm, there is no decision-making that takes place at the meetings. It is for comments and feedback on the findings of the report.*

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	GP Kriel Dit is korrek. Ons sal al die kommentaar wat ons gekry het insluit in ons verslag en dit dan aan die bevoegde owerhede stuur om die besluit te maak. *That is correct. We will include all the comments we have received in our report and then send them to the competent authorities to make the decision.*
c.	**John Adams** Die vergadering gaan te vinnig. Ons wil verstaan hoe die proses loop van punt A na punt B. Ons is bietjie deurmekaar want dit is 'n soortgelyke voorlegging wat gedoen word, vir 'n ander maatskappy, en daar word gesê dat dit net kommentaar is, maar dan hoor ons by 'n volgende keer dat daar aansoek gedoen word. Ons is behoeftige gemeenskappe en het in die verlede voorgestel dat daar plan gemaak word om te kyk of daar iets gedoen kan word hier. Ek sal graag ook net wil verstaan wat in die vergadering in Garies gesê is. *The meeting goes too fast. We want to understand how the process runs from point A to point B. We're a bit confused because it's a similar submission that's being done, for another company, and it's said that it's just comments, but then we'll hear at a next time there's an application. We are needy communities and have in the past suggested that plans be made to see if anything can be done here. I would also like to understand just what was said in the meeting in Garies.* **GP Kriel** Laat ek begin by wat in Garies se vergadering gesê is. Ons het duidelikheid gegee oor die bestuursplan en die versagtings maatreëls en hoe dit uitgevoer sal word. Daar is gevra oor of dit Vaalputs gaan affekteer. Ons het gesê dat dit nie die Vaalputs gaan beïnvloed nie. Daar is verder ook gesels oor die impak van sin en gees van plek en ook oor die sensitiewe areas soos die seemounts, ens. en hoe die klankgolwe deur die water sal trek. Daar is kritiese biodiversiteitsareas en ons sal later daar oor gesels. GP het 'n oorsig gegee oor die aansoek proses. *Let me start from what was said in Garies' meeting. We have provided clarity on the management plan and the mitigation measures and how they will be carried out. It was asked whether it would affect Vaalputs. We said that this was not going to affect the Vaalputs. There was also discussion about the impact of sense and spirit of place and also about the sensitive areas such as the seamounts, etc. and how the sound waves will pull through the water. There are critical biodiversity areas and we will talk about them later.* *GP gave an overview of the application process.*
d.	**John Adams** A en dan B (dit is Searcher en TGS) daar is areas wat oorvleuel en ons wil net uitsluitsel kry oor of altwee maatskappye aansoek gedoen het en of hulle al twee goedkeuring kan kry? En ook of die goedkeuring op 'n hoër vlak gedoen word. *A and then B (that's Searcher and TGS) there are areas that overlap and we just want to get some closure on whether both companies have applied and whether they can get both approval? And also whether the approval is done at a higher level.* **GP Kriel**

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	GP het 'n kaart gewys wat die Searcher en TGS aansoek areas wys en hoe hulle oorvleuel. TGS se area is groter. Die lisensieblokke sal heel moontlike bepaal watter kliënte hulle sal hê. Die departement sal op die ou einde van die dag die besluit neem oor die goedkeuring al dan nie. Hulle kan nie op dieselfde area op dieselfde tyd werk nie en ons het ook na die kumulatiewe impak van so 'n scenario gaan kyk. Die uiteinde van die geraas modellering het bevestig dat as hulle verder as 40 km van mekaar af werk behoort daar nie 'n kumulatiewe impak te wees nie. Dit is hoogs onwaarskynlik dat hulle dieselfde area sal survey, bloot van 'n kommersiële perspektief. *GP showed a map showing the Searcher and TGS application areas and how they overlapped. TGS's area is larger. The license blocks will most likely determine what customers they will have. At the end of the day, the department will make the decision on whether or not to approve it. They cannot work in the same area at the same time and we also looked at the cumulative impact of such a scenario. The outcome of the noise modelling confirmed that if they work further than 40 km apart there should not be a cumulative impact. It is highly unlikely that they will survey the same area, simply from a commercial perspective.*
e.	**Carissa Saudens** Ek het nou vanoggend se vergadering waargeneem en ek het toe nou weer op sosiale media ingegaan en ek verstaan dat daar in die verslag moet staan oor die werksgeleenthede wat geskep gaan word. Ek verstaan ook dat in die hofbeslissing teen Searcher is daar gestel dat julle vir ons gedetailleerde inligting moet gee oor die werksgeleenthede wat geskep gaan word. Searcher sê nou dat daar olie en gas is, maar ten koste van wat sal dit wees. En as daar olie en gas gevind word, watter infrastruktuur sal dit voortbring op die land of gebruik. En as daar enige probleme kom, is daar enige waarborge vir die visbedryf, want dit is waar die probleme gaan kom as daar iets verkeerd gaan? Wat is die waarde van die visbedryf in die toekoms vorentoe. Is die risiko evalueer en is daar syfers vir ons? Ons is skrikkerig want ons het gesien hoe die myne ryk geword het en toe geloop het, *I have now observed this morning's meeting and I have now gone back into social media and I understand that it must be stated in the report about the jobs that are going to be created. I also understand that in the court decision against Searcher it was stated that you should give us detailed information about the jobs that will be created.* *Searcher now says that there is oil and gas, but at the expense of what it will be. And if oil and gas are found, what infrastructure will it produce on land or use.* *And if any problems come, are there any guarantees for the fishing industry, because that's where the problems are going to come from if something goes wrong? What is the value of the fishing industry going forward. Have the risk been evaluated and are there figures for us? We are startled because we saw how the mines got rich and then walked.* **GP Kriel** Ons wil nie leë beloftes kom maak nie. Vir hierdie projek gaan daar nie noemenswaardige werkskepping wees nie. Dit is ver van die kus af en as hulle mobiliseer gaan hulle van Kaapstad of Saldanha se kant af mobiliseer. En dit is gespesialiseerd. Ons kan ongelukkig nie vir julle uitsluitsel gee oor die gas en die olie en die infrastruktuur nie, omdat buite die bestek van hierdie projek is en om dat dit nog nie bekend is wat gekry gaan word of nie. TGS wil as deel van hierdie survey die TGS wil as deel van hierdie survey die onderliggende gesteentes gaan identifiseer en dan kan ander eksplorasie maatskappye soos byvoorbeeld Azinam (Eco-Atlantic) dit

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	gebruik om te besluit waar hulle wil boor om te toets of daar olie of gas is. Die infrastruktuur kan eers beplan word in moontlike toekomstige produksie fase. Dit sal dus baie onverantwoordelik wees vir my om nou te kom stel watse infrastruktuur daar sal wees as ons nie die besonderhede daarvan weet nie. Oor die waarborge, eerstens is die eerste punt dat daar net regtig een vissery bedryf is wat geaffekteer gaan word. Ons het dan ook gaan seker maak dat daar terugvoerings meganismes is soos die interaksie met die gemeenskappe, die verdere navorsing oor visspesies, die geraas monitering, ens. sodat as daar dan 'n rooi vlag is dat 'n mens dan beter besluite kan maak. Daar is ongelukkig nie 'n vaste waarde oor die vissery bedryf nie, dit sal in 'n mate afhang van die bron wat gekry word, indien wel. *We don't want to come and make empty promises. For this project, there is not going to be significant job creation. It is far from the coast and if they mobilise they will mobilise from Cape Town or Saldanha's side. And it's specialised.* *Unfortunately, we cannot give you closure about the gas and the oil and the infrastructure, because it is beyond the scope of this project and it is not yet known what will or will not be obtained. As part of this survey, TGS wants to go and identify the underlying rocks as part of this survey and then other exploration companies such as, for example, Azinam (Eco-Atlantic) can use it to decide where they want to drill to test whether there is oil or gas. The infrastructure can only be planned in possible future production phase. So it would be very irresponsible for me to come and state now what infrastructure there will be if we don't know the details of it.* *About the guarantees, first of all, the first point is that there is only really one fishing industry that is going to be affected. We then also went to make sure that there were feedback mechanisms such as the interaction with the communities, the further research on fish species, the noise monitoring, etc. so that if there is then a red flag that one can then make better decisions.* *Unfortunately, there is not a fixed value about the fishing industry, it will depend to some extent on the source obtained, if so.* **Carissa Saudens** Ek dink nie my vraag is geantwoord nie. Dit gebeur langs ons kus, maar nou kom die manne van die Kaap af en kom doen die werk, dit is onregverdig. Ons wil hê ons dorp moet ontwikkel maar ons soek waarborge. En julle kan nie eers vir ons syfers gee nie. Hoekom het die olie en gas maatskappye nie 10 jaar gelede na ons gemeenskappe toe gekom en vir ons kinders kom opleil om deel te wees van die industrie nie. *I don't think my question has been answered. It's happening along our coasts, but now the people are coming down from the Cape and coming and doing the work, it's unfair. We want our town to evolve but we are looking for guarantees. And you can't even give us figures. Why didn't the oil and gas companies come to our communities 10 years ago and train our children to be part of the industry.* **Dr Kriel** Ons verstaan dat die gemeenskappe desperaat is vir ontwikkeling, maar dit is baie moeilik om op hierdie stadium te kom uitsprake maak oor die moontlike toekomstige waarborge. Hierdie projek is deel van die beplanning van die beplanning van moontlike toekomstige produksie. Dus kan 'n mens nie 'n konkrete nommer gee nie. Die waarborge wat ons op hierdie stadium vir hierdie projek kan gee is dat daar baie strenge maatreëls in plek gestel is om die omgewing te beskerm en dat daar konstante oorsig oor die projek sal wees. As daar dan verder probleme kom is daar die regstelsel waarna julle julle kan wend indien die oorsig nie voldoende is nie. Dit sal fantasties wees as Hondeklipbaai kan ontwikkel – as die olie

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	en gas bedryf dit kan help, fantasties, maar dit kan nie ten koste van die mense en die omgewing gebeur nie. En dus het ons die maatreëls voorgestel en protokolle in plek gestel. *We understand that the communities are desperate for development, but it is very difficult to come to this point to make judgments about the possible future guarantees. This project is part of planning possible future production. Thus, one cannot give a concrete number. The guarantees that we can give for this project at this stage are that very stringent measures have been put in place to protect the environment and that there will be constant oversight of the project. If there are further problems, there is the legal system that you can turn to if the review is not sufficient. It would be fantastic if Hondeklip Bay could develop - if the oil and gas industry can help that, fantastic, but it can't happen at the expense of the people and the environment. And so we proposed the measures and put protocols in place.*
f.	**Patrick Ralph** 'n Mens het nie meer woorde nie. Ons weet dat as hierdie regering besluit het op 'n ding, dan sal hulle dit laat voortgaan, al sit die hele dorp hier en stem nie saam nie. Sê vir die regering dat as die projek voortgaan dat die Oseaan nie meer 'n Oseaan gaan wees nie, maar 'n "Olieaan". My oupa se oupa het vanuit kreef uitgehaal. Toe word daar daar naworsing gedoen en nou is daar permitte ingestel. Dit is 'n onding wat die regering besig is om aan te vang. Ek staar my nie blind aan moontlike werksgeleenthede nie, dit sal nie gebeur nie. Daar word nie van Hondeklipbaai gepraat nie. Ons is net daar om omgeploeg te word. As daar 'n ongeluk met olie gebeur in die toekoms dan kan dit wel hiernatoe kom. Gaan sê vir die regering dat ons ongelukkig is en mag hulle lewensjare verkort word. *You don't have words anymore. We know that if this government decided on a thing, then they would let it continue, even if the whole town sits here and disagrees. Tell the government that if the project goes ahead that the Ocean is no longer going to be an Ocean, but an "Oilean". My grandfather's grandfather took out lobsters for nothing. Then research was carried out and now permits have been put in place. It's a disservice that the government is catching on.* *I'm don't believe we will see, jobs, that won't happen. Hondeklip Bay is not spoken of. We're just there to be plowed over. If an accident happens with oil in the future then it may well come here. Go and tell the government that we are unhappy and may their years of life be shortened.* **Nico Bezuidenhout** Dankie vir u kommentaar. Dit is opgeneem en sal saal met die verslag ingestuur word. *Thanks for your comments. It has been recorded and will be sent in hall with the report.*
g.	**David Marius** Wat het die sosiale studie bevind? *What did the social study find?* **San-Marie Aucamp** San-Marie het uitgebrei oor die bevindinge van die sosiale assessering volgens die verslag. *San-Marie elaborated on the findings of the social assessment as per the report.*
h.	**David Marius**

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	3520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	Kan ons die link kry na die data-free webtuiste. Mnr Markus het toe stuk aangehaal "With the exception of Florida and Georgia, every governor from Florida to New Hampshire has decided not to allow offshore oil and gas exploration, development and production in the United States Atlantic EEZ". Wat hulle eintlik sê is "dat daar nie eksplorasie in ons land moet plaasvind nie" maar dat hulle internasionaal dit moet gaan doen – buite hulle eie EEZ. Nou kom hulle Mama toe. Die mense wat gaan voordeel trek uit die hele besigheid is nie hier nie, die mense wat sukkel om 'n kreef uit die boot te trek is die mense wat gaan swaarkry. Ons sal moet saam staan en ons sal moet aansoek doen vir ons eie permitte. Moenie praat van die regering nie, ons is die regering. Dit is onverantwoordelik om 'n regering te verkies en dan te wil protes teen die regering. Die fout moet dan by ons gesoek word. Hier is daar nie rules en regulations nie, dis net korrupsie. Moenie 'n situasie aanhits deur hierdie projekte nie. Die wetenskaplikes praat deurmekaar – die tuna het van 2011 tot 2018 heeltemal verdwyn langs die weskus al van Namibië se kant af en dit beweeg nie meer soos dit het nie. Die verslag dui nou aan waar die vis gevang word, maar dit dui nie aan hoe die vorige seismiese opnames die seelewe beinvloed het nie. Die krappe wat nou daar uitkom is nie meer reg nie, hulle is soos mal goed. Ek verwag nie nou 'n antwoord nie, want u is nie 'n marine bioloog nie. Hondeklipbaai se mense – ons moet verstaan dat hierdie ding nie vir ons gaan voordeel het nie. Daar word ook baie gepraat in die naam van ontwikkeling, maar die geskiedenis moet vir ons vertel dat dit nie so gaan wees nie. *Can we get the link to the data-free website.* *Mr Markus then quoted piece "With the exception of Florida and Georgia, every governor from Florida to New Hampshire has decided not to allow offshore oil and gas exploration, development and production in the United States Atlantic EEZ". What they are really saying is "that there should not be exploration in our country" but that they should go and do so internationally – outside of their own EEZ. Now they're coming to this. The people who are going to take advantage of the whole business are not here, the people who are struggling to pull a lobster out of the boat are the people who are going to suffer.* *We will have to stand together and we will have to apply for our own permits. Don't talk about government, we're the government. It is irresponsible to elect a government and then want to protest against the government. The error must then be sought from us. Here there are no rules and regulations, it's just corruption.* *Don't incite a situation through these projects. The scientists talk confused – the tuna completely disappeared along the west coast from Namibia's side from 2011 to 2018 and it is no longer moving as it has. The report now indicates where the fish are caught, but it does not indicate how the previous seismic surveys affected marine life. The crabs that are coming out there now aren't right anymore, they're like crazy stuff. I don't expect an answer right now because you're not a Marine biologist. Hondeklip Bay's people – we have to understand that this thing is not going to benefit us.* *There's also a lot of talk in the name of development, but history has to tell us it's not going to be that way.* San-Marie Ascamp Op hierdie stadium sal die projek van hierdie aard nie veel vir die gemeenskappe inhou nie. Dit is eers in die moontlike volgende fases soos produksie wat die Minerale Hulpbron Wet se vereistes vir sosiale en werkskeppings planne in werking tree. Dit is belangrik om dit in gedagte te hou.

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EMS | Environmental Impact Management Services

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EMS Verw./ *EMS Ref*: 1520

Projek Naam/ *Project Name*: TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	At this stage, the project of this nature will not provide much for the communities. It is only in the possible next phases such as production that the Mineral Resources Act's requirements for social and job creation plans come into effect. It is important to keep this in mind.
	GP Kriel
	Ons spesialiste het in detail gaan kyk na al die navorsing, of dit nou vir of teen seismiese opnames was of nie. En daar word aanvaar dat in alle navorsing dat daar 'n mate van onsekerheid is, maar dit is belangrik dat daardie onsekerheid so laag as moontlik moet wees om 'n impakbepaling akkuraat te kan maak. Die navorsing is ingesluit tot en met die nuutste inligting van hierdie jaar in sommige gevalle. Daar is impakte, maar ons gevolgtrekking was dat die impakte laag is en dat daar terugvoerings meganismes in plek gestel is.
	Ons erken dat daar korrupsie in ons land is en dat die reëls nie altyd gevolg word nie, maar dit maak dit selfs meer belangrik om seker te maak dat 'n mens maatreëls in plek stel om die omgewing te beskerm ten spyte daarvan.
	Our specialists went into detail to look at all the research, whether it was for or against seismic surveys or not. And it's assumed that in all research that there's some uncertainty, but it's important that that uncertainty needs to be as low as possible to be able to make an impact assessment accurate. The research is included up to and including the latest information from this year in some cases. There are impacts, but our conclusion was that the impacts are low and feedback mechanisms have been put in place.
	We acknowledge that there is corruption in our country and that the rules are not always followed, but it makes it even more important to ensure that one puts measures in place to protect the environment despite it.
L	**Carissa Soudens**
	Eco-Atlantic -Is hulle ook deel van die aansoekers hier? Na hulle hier weg is het ons gaan navorsing doen en wat ons gekry het in Namibië is nie wat Mr Markus genoem het nie. So ons is nou deurmekaar. Ons navorsing het gesê dat die seismiese opnames nie nadelig was vir die visspesies nie.
	Eco-Atlantic – are they part of the applicants here too? After they left here we went to do some research and what we got in Namibia is not what Mr Markus mentioned. So we're confused now. Our research stated that the seismic surveys were not detrimental to the fish species.
	GP Kriel
	Eco-Atlantic is nie deel van die aansoekers vir hierdie projek nie. Soos ek vroeër genoem het, het die Mariene Ekoloog na albei kante van die navorsing gekyk om die dubbelsinnigheid te probeer analiseer. Dit is belangrik om te onthou dat daar navorsing en "navorsing" is. Deesdae het dit maklik geword om 'n armchair navorser te word en gou 'n ding of twee op die Internet raak te lees. Maar dan is daar navorsing wat in 'n wetenskaplike joernaal gepubliseer word wat "peer reviewed". En dan is daar selfs in gepubliseerde joernaal artikels teenstrydige navorsing. As 'n mens wil selektief wees raak dit maklik om enige standpunt uit konteks te neem en dit te probeer regverdig. Dit is hoekom ons na die geheelbeeld en die breër stel navorsing te kyk en soveel as moontlik insluit in ons verslag. Daar is dan ook geleentheid vir publieke deelname sodat ander mense en kundiges hulle menings kan lig en staaf as deel van hierdie proses.
	Eco-Atlantic is not part of the applicants for this project. As I mentioned earlier, the Marine Ecologist looked at both sides of the research to try to analyze the ambiguity. It is important to remember that there is research and "research". Nowadays, it has become easy to become an armchair researcher and

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Item No	Item
	soon come across a thing or two on the Internet. But then there is research published in a scientific journal that is "peer reviewed". And then even in published journal articles there is conflicting research. If one wants to be selective it becomes easy to take any point of view out of context and try to justify it. This is why we look at the big picture and the broader set of research and include as much as possible in our report. There is also opportunity for public participation so that other people and experts can express and substantiate their opinions as part of this process.
J.	**John Adams** **Is daar 'n verslag oor die mense se besware – dit is ook inligting wat belangrik is vir ons om te oorweeg.** *Is there a report on the people's objections – it is also information that is important for us to consider.* **GP Kriel** **Die publieke deelname verslag met al die kommentaar tot dusver is deel van die verslag wat beskikbaar is op die webtuiste en hier op die dorp. Die kommentaar word net so ingesit.** *The public participation report with all the comments so far is part of the report that is available on the website and here in town. The comments are put in just like that.*

BYLAE/ APPENDICES

1.	**Bywoning Register/ *Attendance Register***
2.	**Aanbieding/ *Presentation***

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Hondeklip Bay - Eric Beher Hall	Date and Time	01 November 2022 - 16:00-18:00

Names and Surname	Address	Contact Details	Signature	Organisation / Property Details
Michelle Roffe		Tel: Cell: 0837702166 Email:		Saicle Ltd
John Menthoor	Aristea 195 Hondeklipbaai	Tel: 066 073 7332 Cell: Email:		
Colombard		Tel: Cell: 0633190161 Email: chrisable2@gmail.com		
Sheldon Matthys	Hondeklipbaai	Tel: Cell: 0684952755 Email: matthysheldon@gmail.com		Community member

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TOS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Hondeklip Bay - Eric Baker Hall	Date and Time	01 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
WILLIAM SCHNYDERS		Tel: Cell: Email:		
Errol Jurgens	Hester Str 156	Tel: Cell: 0655 65 84 Email:		
John C Thomas	Hondeklipbaai	Tel: 076 034 6173 Cell: 076 034 6173 Email: johnthomas1960@gmail.com		
Sarah Koorsen	Hondeklipbaai	Tel: Cell: Email:		

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Hondeklip Bay - Eric Baker Hall	Date and Time	01 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Diana Menzies	HKBAA, MRE 13	Tel: Cell: 0766897644 Email: dianamenzies@gmail.com	Menzies	
LOUIS CLOETE	HKB	Tel: Cell: Email:	L Cloete	
Patrick Ralph	HKB	Tel: Cell: 0827489322 Email: r		
CLARENCE	HKB	Tel: Cell: Email:		

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Attendance Register

EMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting:	Draft Basic Assessment Report Review Meeting		
Meeting Venue:	Hondeklip Bay - Eric Baker Hall	Date and Time:	01 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Nico Bezuidenhout	128 Allcock Str. Calitzdorp. 6660	Tel: Cell: 083 229 7561 Email: nicobezt@gmail.com		Facilitator.
Kerstin Bell	Wellington	Tel: Cell: Kerstin@Gsm.co.za Email:		Gcite
Callen Cookie	JV Dam	Tel: Cell: 0620442165 Email:		Secne.
Al Krul	East London	Tel: 011 789 7170 Cell: Email: gp@ems.co.za		EMS

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Hondeklip Bay - Eric Baker Hall	Date and Time	01 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
JACQUES BURGERS	m ELKBOSTLAAN	Tel: Cell: 0834604260 Email:		SEICHE
Ardoine Xuma	KWT	Tel: Cell: 0816123567 Email:		
Lenny	[illegible] 140	Tel: Cell: 08 8845993 Email:		
John A Clarke	82 DOLFYNST HKB	Tel: 0879050 20 52 Cell: Email:		

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Attendance Register

EIMS Ref.	1520	Project Name:	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Hondeklip Bay - Eric Baker Hall	Date and Time	01 November 2022 - 16:00-18:00

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Carlo Sauders	Hondeklip	Tel: Cell: 0693955580 Email:		Wyk's kommittee
Andries Sauer	H.K.B	Tel: Cell: Email:		
Delano Titus	Hondeklipbay	Tel: 0664067488 Cell: Email: tibusdelano@gmail.com	Dtitus	CDW Hondeklipbay
DAVID MARKUS	HONDEKLIPBAY	Tel: Cell: 0616542749 Email: dawidmarkus@gmail.com		COUNCILLOR

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

VERADERING BESONDERHEDE/ *MEETING DETAILS*

Vergadering/ *Meeting*	1520 DBAR Review Focus Group Meeting – Kamiesberg Municipality		
Vergadering Plek/ *Meeting Venue*	Kamiesberg Municipal Hall, Garies	Date	2022/11/01
		Time	10h00-12h00

Teks in *Italics* is uit die Afrikaanse teks vertaal. *Text in Italics has been translated from the Afrikaans text.*

'n Fokus groep vergadering is geskeduleer met die Belanghebbende en Geaffekteerde Partye (I&APs). Die doel van die vergadering was om die terugvoering te gee oor die bevindinge van die Basiese Assesserings Verslag aan lede van die publiek en belangrike I&APs vas te lê. Tydens die vergadering wat tussen 10:00 en 12:00 plaasgevind het, is 'n aanbieding van die projekbeskrywing, voorlopige impakassessering, projekspan en projektydraamwerke aan alle deelnemers van die vergadering deur Environmental Impact Management Services (EIMS) Pty (Ltd) gelewer. 'n Aanbieding is deur mnr GP Kriel van EIMS in Afrikaans gelewer. Nadat die aanbieding afgelewer is, is 'n vraag- en antwoord sessie geopen waar deelnemers vrae gevra het of hul kommentaar oor die projek uitgespreek het. Die bywoningsregister is aangeheg as 'n aanhangsel tot hierdie dokument.

A Focus Group Meeting was scheduled with the Interested and Affected Parties (I&APs). The aim of the meeting was to feedback regarding the findings of the Basic Assessment Report the members of the public and key I&APs. During the public meeting which took place between 10h00 and 12h00, a presentation of the project description, preliminary impact assessment, project team and project timeframes was delivered to all attendees of the meeting by Environmental Impact Management Services (EIMS) Pty (Ltd). A presentation was delivered by Mr GP Kriel from EIMS in Afrikaans. After the presentation was delivered, a question and answer session was opened where attendees asked questions or expressed their comments regarding the project. The attendance register has been attached as an appendix to this document.

AGENDA

Item
1. EIMS Aanbieding/ *EIMS Presentation* a. Bekendstelling van die projekspan/ *Introducing the project team* b. Projekbeskrywing/ *Project Description* c. Regsaansoekproses/ *Legal Application Process* d. Publieke Deelname/ *Public Participation* e. Impakbepaling/ *Impact Assessment* f. Versagtings Maatreels/ *Mitigation Measures* g. Projek Kontak Besonderhede/ *Project Contact Details*
2. Vraag en Antwoord/ *Questions and Answers*

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EIMS | Environmental Impact Management Services

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ TGS RECONNAISSANCE BA

NOTULE/ *MINUTES*

Item No	Item
1.	Alle deelnemers is versoek om die bywoningsregister te onderteken soos hulle ingeskryf het. Aanbieding van EIMS van die projekbeskrywing, aansoekproses en omgewingsversagtings tydens seismiese opname is gelewer volgens die agenda hierbo aan die vergaderinggangers. Daar is aangedui dat die vergadering opgeneem sou word vir die doeleindes van akkurate notule neem. Agtergrondinligtingsdokumente (in Engels, Afrikaans en isiXhosa), kommentaarvorms, registrasie, inligtingsuitdeelstukke en bywoningsregisters is by die vergadering beskikbaar gestel. Die deelnemers is aangemoedig om hul kommentaar en bekommernisse in te dien deur die kommentaarvorms in te vul wat verskaf word of deur kommentaar in te dien by die projek-e-posadres wat verskaf is. Daar is opgemerk dat alle deelnemers wat hul kontakbesonderhede verskaf het, by verstek geregistreer sal word op die I&AP-databasis wat deur EIMS gehandhaaf word. Na aanleiding van die aanbiedings is die vloer oopgemaak vir 'n bespreking en die deelnemers is aangemoedig om enige vrae of bekommernisse wat hulle oor die projek gehad het, op te stel. *All attendees were requested to sign the attendance register as they entered. Presentation from EIMS of the project description, application process and environmental mitigations during seismic survey were delivered as per the agenda above to the meeting attendees. It was indicated that the meeting would be recorded for the purposes of accurate minute taking. Background Information Documents (in English, Afrikaans and isiXhosa), comments forms, registration, information handouts and attendance registers, were made available at the meeting.* *The attendees were encouraged to submit their comments and concerns through filling in the comment forms provided or by submitting comments to the project email address provided. It was noted that all attendees who have provided their contact details would be registered by default on the I&AP database maintained by EIMS. Following the presentations, the floor was opened for a discussion and the attendees were encouraged to bring up any questions or concerns they had about the project.*
2.	**Vrae en Antwoorde/ *Questions and Answers***
a.	**Carissa Soudens** Wanneer hulle boor of opnames doen, is daar 'n stelsel wat vir hulle wys waar die vis areas is, sodat hulle kan sien waar die sensitiewe areas is? *When they do drilling or surveying, is there a system that shows them where the fish areas are, so they can see where the sensitive areas are?* **Gif Kriel** Ja hulle is baie bewus van daardie areas en sal al ons inligting hê oor die sensitiewe areas. Hulle sal dan ook die Marine Mammal Observers (MMOs) aan boord hê om hulle te help daarmee, sou dit nodig wees. Hulle sal dan weet waar die sensitiewe areas is en wanneer hulle hulle klankbron kan gebruik en nie. *Yes they are very aware of those areas and will have all our information about the sensitive areas. They will then also have the Marine Mammal Observers (MMOs) on board to help them with that, should it be necessary. They will then know where the sensitive areas are and when they can use their sound source and not.*
b.	**Carissa Soudens**

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	Ek het my eie impakstudie gedoen en ek stem saam dat daar nie eintlik 'n impak op ons hier langs die kus gaan wees nie. Dit is net belangrik om te kyk dat die visse nie geaffekteer word nie. *I've done my own impact study and I agree that there's not actually going to be an impact on us here along the coast.* **GP Kriel** Dankie vir die kommentaar. Dit is goed om te hoor dat u ook gaan kyk het na die impak van die projek. Ons het na die impak op die visse en ander diere gaan kyk en bepaal dat die impak daarop laag is. *Thanks for the comment. It's good to hear that you also went to look at the impact of the project. We looked at the impact on the fish and other animals and determined that the impact on them was low.*
c.	**GP Kriel** GP Kriel introduced Michael Fayard and requested that Michael provide an overview of TGS and their activities.
d.	**John Ellis** Dit is my verstaan dat daar baie prosesse gevolg moet word en dit is belangrik om seker te maak dat die prosesse reg gedoen word. Ons het Vaalputs hier naby, wat seker 100 km van die kus af gelê is. Is daar enige potensiële impak op Vaalputs van die seismiese opnames in die see? Dit wil voorkom dat daar redelik maatreëls ingebou om die gemeenskap se bekommernisse kan verminder. Ek wil net weet wat bedoel jy met die sin en gees van plek – tong in die kies? *It is my understanding that there are many processes to be followed and it is important to make sure that the processes are done correctly.* *We have Vaalputs nearby, which is probably 100 km from the coast. Is there any potential impact on Vaalputs from the seismic surveys into the ocean?* *It seems that there are reasonable measures built in to reduce the community's concerns.* *I just want to know what do you mean by the sense and spirit of place – tongue in cheek?* **GP Kriel** Daar is baie prosesse, dit is korrek. Die Verkennings Permit aansoek vereis dat 'n omgewings impak studie eers gedoen word en dat die verkennings permit eers goedgekeur kan word indien die bevoegde owerhede omgewingsmagtiging gee. Die versagtings maatreëls word dan in 'n Omgewings bestuursplan geskryf en as dit goedgekeur word, word dit wet vir die uitvoering van die projek, met gevolge as dit nie nagekom word nie en dit word geoudit. Daar is terugvoering aan die departemente en Petroleum Agentskap. Daar is verder ook voorgestel dat daar verdere kommunikasie moet wees tou die projek goedgekeur word om te verseker dat daar deursigtigheid en wedersydse respek aan die plaaslike gemeenskappe gewys word. Vaalputs is ver van die kus af, maar die klankgolwe beweeg ver onder die water, maar die seismiese aktiwiteite is nie energiek genoeg om 'n effek so ver in die binneland te hê nie.

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EIMS | Environmental Impact Management Services

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	Die sin en gees van plek behels die persepsie van hoe 'n mens sy omgewing ervaar en daar is gekyk na hoe 'n projek soos hierdie dalk die plaaslike gemeenskappe se uitkyk en persepsie van hulle omgewing kon beïnvloed. *There are many processes, that is correct. The Scouting Permit application requires that an environmental impact study be conducted first and that the exploration permit can only be approved if the competent authorities give environmental authorisation. The mitigation measures are then written into an Environmental Management Plan and if approved, they become law for the execution of the project, with consequences if they are not met and they are audited. There is feedback to the departments and Petroleum Agency. It was also suggested that there should be further communication should the project be approved to ensure that transparency and mutual respect are shown to the local communities.* *Voelpunts are far from the coast, but the sound waves travel far underwater, but the seismic activity is not energetic enough to have an effect this far inland.* *The sense and spirit of place involved the perception of how one experiences one's environment and looked at how a project such as this might have influenced the local communities' outlook and perception of their surroundings.*
e.	**Richard Petrus (Longtime Nondeklipbaai Fishing Co-op)** Mount Vema is daar naby. Selfs al van ons hier vis, dan kan dit van Mout Vema af kom. Alles is deel van 'n ketting, insluitend die pelagiese. So as die orca en die geelvis en die tuna ens. geaffekteer word, dan gaan dit vir ons affekteer langs die kuslyn af wat afhanklik is van snoek, want dit is die spesies wat pelagiese vis aandrywe. So daar moet seker gemaak word dat Mout Vernon en die ander seamounts goed gekyk word na. *Mount Vema is nearby. Even if some of us fish here, then it can come from Mount Vema. Everything is part of a chain, including the pelagic. So if the orca and the yellowfish and the tuna etc. then it's going to affect us down the coastline that depends on pike, because those are the species that drive pelagic fish. So it needs to be made sure that Mout Vernon and the other seamounts are well looked at.* **GP Kriel** Ons het in redelike detail gaan kyk na daardie areas en die broei en migrasie roetes van die see diere. Die aansoek area is geleë seewaarts van die kontinentale bank. Die meeste van die belangrike prosesse gebeur op of kuswaarts van die kontinentale bank. Daar is wel 'n kans dat daar van die seelewe geaffekteer kan word, en die belangrike ding is om te kyk hoe groot die effek op die seelewe is. Elkeen van die omgewings aspekte het 'n ingeboude herstel vermoë en dit is belangrik om te gaan kyk as deel van so 'n studie, of 'n mens daardie herstel vermoë gaan oorskry of nie. In hierdie geval het ons gevind dat die impakte nie hoë impakte gaan wees nie, maar lae impakte op die mariene omgewing en visserye en dat daar nie 'n "irreplaceable loss of resources" behoort te wees nie. Ons het ook gaan kyk na wetter ander impakte daar huidiglik in die see is en hoe dit tesame met die voorgestelde projek dalk kumulatiewe impakte kan hê. *We looked at those areas in fair detail and the breeding and migration routes of the sea animals. The application area is located seaward of the continental bank. Most of the important processes happen on or off the coast of the continental bank. However, there is a chance that marine life could be affected, and the important thing is to see how great the effect is on marine life. Each of the environmental aspects has a built-in recovery capability and it is important to look as part of such a study, whether or not one is going to exceed that recovery ability. In this case, we found that the impacts are not going to be high impacts but low impacts on the marine environment and fisheries and that there should not be an*

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EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	"irreplaceable loss of resources". We also looked at what other impacts there are currently in the ocean and how, together with the proposed project, these might have cumulative impacts.
f.	**Richard Petrus** So die seismiese aktiwiteite gaan die (snoek) "runs" verander. Ons het vroeër die jaar dit gevoel. *So the seismic activities are going to change the (sloek) "runs". We felt it earlier in the year.* **dP Kriel** Dit is nie noodwendig die geval nie. Die "runs" gebeur tipies nader aan die kus en die voorgestelde area is ver van die kus af. Daar is ook natuurlike veranderlikheid in die "runs" en daar is 'n groot hoeveelheid aktiwiteite wat langs die weskus gebeur wat ook 'n rol kan speel. Volgens ons spesialiste het ons nie gevind dat die waarskynlikheid van so 'n impak laag is. Ten spyte hiervan het ons voorgestel dat daar aanhoudende navorsing en terugvoering gedoen word oor die moontlike impakte van die seismiese aktiwiteite op die visserye en die migrasie van vis spesies. Ons het ook in ag geneem dat daar dalk van die data onder rapporteer word vir die visserye. Ons het dus voorgestel dat daar strenger maatreëls in plek is om die onsekerheid te kan buffer. *This is not necessarily the case. The "runs" typically happen closer to the coast and the proposed area is far from the coast. There is also natural variability in the "runs" and there is a large amount of activity happening along the west coast that could also play a role. According to our specialists, we did not find that the probability of such an impact is low. Despite this, we suggested that there be ongoing research and feedback on the possible impacts of the seismic activities on fisheries and the migration of fish species. We also took into account that there may be some of the data under report for the fisheries. So we suggested that there be stricter measures in place to be able to buffer the uncertainty.*
g.	**John Ellis** Daar is soveel wyer velde as wat ons in die skole het. In ander provinsies is daar byvoorbeeld oseanografie, en hier by ons is daar nie. Dis die tipe goed wat in die skole sal moet aangespreek word hier. Sodat die kinders kan sien of hulle dalk 'n belangstelling kan hê. *There are so many wider fields than we have in the schools. For example, in other provinces there is oceanography, and here with us there is not. That's the type of stuff that will need to be addressed in the schools here. So the kids can see if they might have an interest.* **Catrina Bastiaanse** Ons het die ander dag voorgestel dat ons kinder bewus gemaak moet word van die tegnologie en dat hulle wiskunde en wetenskap moet hê. *We suggested the other day that our children should be made aware of the technology and that they should have math and science.* **GP Kriel** Ek stem saam. *I agree.*
h.	**Gentleman** Hoe lank is die permit geldig as hulle dit kry? En as hulle dit kry moet hulle weer terugkom gemeenskap toe?

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EIMS | NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	How long is the permit valid if they get it? And if they get it they have to come back to the community? **GP Kriel** 'n Verkennings permit is geldig vir 'n jaar en dit kan nie hernu word nie. En hulle moet terugkom gemeenskap toe voor hulle begin. Dit is belangrik om te onthou dat hulle eers omgewings magtiging moet kry voordat hulle 'n verkenningspermit mag kry. En daarna sal die verdere gemeenskap interaksie dan in werking tree. *An exploration permit is valid for a year and cannot be renewed. And they need to get back to the community before they start. It's important to remember that they must first obtain environmental authorization before they are allowed to obtain an exploration permit. And after that, the further community interaction will then take effect.*
4.	**Lionel Pieterson** Het Searcher ook 'n permit aansoek gedoen vir dieselfde area? *Did Searcher also apply for a permit for the same area?* **GP Kriel** Hulle het ook aansoek gedoen, maar daar is verskille in hulle aansoek areas, so die twee aansoek is verskillend van mekaar. Ons verstaan dat dit slegs een van die maatskappye gaan wees wat die opname doen. Ons het egter ook voorgestel dat hulle nie op dieselfde tyd in die water op dieselfde plek kan opnames doen nie. *They also applied, but there are differences in their application areas, so the two applications are different from each other. We understand that it's only going to be one of the companies doing the survey. However, we also suggested that they could not conduct surveys in the water at the same location at the same time.*
5.	**Carista Soudant** Was Searcher nie onlangs in die hof nie? *Wasn't Searcher in court recently?* **GP Kriel** Ja hulle was. Met die vorige aansoek het hulle goedkeuring gekry onder die Minerale Hulpbronnwet. Met hulle aansoek nou en met hierdie aansoek ook, word daar aansoek gedoen onder die Omgewings Bestuur Wet. Die hof het bevind dat hulle aan sekere dinge nie voldoen het nie. *Yes, they were. On the previous application, they received approval under the Mineral Resources Act. With their application old and with this application as well, an application is made under the Environmental Management Act. The court found that they did not comply with certain things.*

BYLAE/ APPENDICES

1. **Bywoning Register/ *Attendance Register***
2. **Aanbieding/ *Presentation***

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Attendance Register

EMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Garies	Date and Time	01 November 2022 - 10:00-12:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Rosina Haase	Hondeklipbaai Sunnyside 172	Tel: Cell: 0658708983 Email: rosiehaase@gmail.com Tel:		Kamiesberg
DEKIAN Rooi	Kliets 54	Cell: 0791116342 Email: rooidekian@gmail.com		Kamiesberg
Derick Maritz	GARIES	Tel: 0276520010 Cell: 0761676221 Email: [illegible]		LNC BSO BNC Municipality
Colin Cloete	Hondeklipbaai	Tel: Cell: 0761559936 Email: ColinCloete@gmail.com		

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Garies	Date and Time	01 November 2022 - 10:00-12:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
John Gui	Kamiesberg Municipality P/Sak x200 Garies	Tel: 027-6528000 Cell: 083 214 7674 Email: johnh@kamiesberg.gov.za		Kamiesberg Municipality
Catelin Stationbaas	KAMIESBERG P/SAK X200 GARIES	Tel: Cell: 072 361 6038 Email: catelinb@kamiesberg.gov.za		KAMIESBERG
LIONEL PIETERSEN	HONDEKLIPBAAI	Tel: 0641125664 Cell: Email: lionelpietersen1171@gmail.com		ANC BRANCH CHAIR
RICHARD PETRUS	Hondeklipbaai	Tel: Cell: 075 570 2477 Email: richardpetrus@gmail.com		ANC member

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Attendance Register

EMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Caries	Date and Time:	01 November 2022 - 10:00-12:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
GP Krol	8 Dalneny Rd Pine Park, JHB	Tel: 011 789 7170 Cell: Email: gp@ems.co.za		EMS.
Andisiwe Xema	King Williams Town	Tel: Cell: 0814029169 Email:		PP Consultant.
Carisa Sanders	Hondekliphoai Wykskomitee1	Tel: Cell: 0698955580 Email:		Wyks komitee
Elizabeth Basson	Hondeklipbaai	Tel: 082 891 8058 Cell: Email: bonnefilm@gmail.com		Basson

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EIMS	**NOTULE VAN VERGADERING/ *MINUTES OF MEETING***

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

VERADERING BESONDERHEDE/ *MEETING DETAILS*

Vergadering/ *Meeting*	**1520 DBAR Review Public Meeting**		
Vergadering Plek/ *Meeting Venue*	Lamberts Bay Community Hall	Date	2022/11/02
		Time	16h00-18h00

Teks in *italics* is uit die Afrikaanse teks vertaal. *Text in italics has been translated from the Afrikaans text.*

'n Openbare vergadering is geskeduleer met die Belanghebbende en Geaffekteerde Partye (I&APs). Die doel van die vergadering was om die terugvoering te gee oor die bevindinge van die Basiese Assesserings Verslag aan lede van die publiek en belangrike I&APs vas te lê. Tydens die openbare vergadering wat tussen 16:00 en 18:00 plaasgevind het, is 'n aanbieding van die projekbeskrywing, voorlopige impakassessering, projekspan en projektydraamwerke aan alle deelnemers van die vergadering deur Environmental Impact Management Services (EIMS) Pty (Ltd) gelewer. 'n Aanbieding is deur mnr GP Kriel van EIMS in Afrikaans gelewer. Nadat die aanbieding afgelewer is, is 'n vraag- en antwoord sessie geopen waar deelnemers vrae gevra het of hul kommentaar oor die projek uitgespreek het. Die bywoningsregister is aangeheg as 'n aanhangsel tot hierdie dokument.

A Public Meeting was scheduled with the Interested and Affected Parties (I&APs). The aim of the meeting was to feedback regarding the findings of the Basic Assessment Report the members of the public and key I&APs. During the public meeting which took place between 16h00 and 18h00, a presentation of the project description, preliminary impact assessment, project team and project timeframes was delivered to all attendees of the meeting by Environmental Impact Management Services (EIMS) Pty (Ltd). A presentation was delivered by Mr GP Kriel from EIMS in Afrikaans. After the presentation was delivered, a question and answer session was opened where attendees asked questions or expressed their comments regarding the project. The attendance register has been attached as an appendix to this document.

AGENDA

Item
1. **EIMS Aanbieding/ *EIMS Presentation***
a. **Bekendstelling van die projekspan/ *Introducing the project team***
b. **Projekbeskrywing/ *Project Description***
c. **Regstoepassingsproses/ *Legal Application Process***
d. **Publieke Deelname/ *Public Participation***
e. **Impakbepaling/ *Impact Assessment***
f. **Versagtings Maatreels/ *Mitigation Measures***
g. **Projek Kontak Besonderhede/ *Project Contact Details***
2. Vraag en Antwoord/ *Questions and Answers*

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

NOTULE/ *MINUTES*

Item No	Item
1.	Alle deelnemers is versoek om die bywoningsregister te onderteken soos hulle ingeskryf het. Aanbieding van EIMS van die projekbeskrywing, aansoekproses en omgewingsversagtings tydens seismiese opname is gelewer volgens die agenda hierbo aan die vergaderinggangers. Daar is aangedui dat die vergadering opgeneem sou word vir die doeleindes van akkurate notule neem. Agtergrondinligtingsdokumente (in Engels, Afrikaans en isiKhosa), kommentaarvorms, registrasie, inligtingsuitdeelstukke en bywoningsregisters is by die vergadering beskikbaar gestel. Die deelnemers is aangemoedig om hul kommentaar en bekommernisse in te dien deur die kommentaarvorms in te vul wat verskaf word of deur kommentaar in te dien by die projek-e-posadres wat verskaf is. Daar is opgemerk dat alle deelnemers wat hul kontakbesonderhede verskaf het, by verstek geregistreer sal word op die I&AP-databasis wat deur EIMS gehandhaaf word. Na aanleiding van die aanbiedings is die vloer oopgemaak vir 'n bespreking en die deelnemers is aangemoedig om enige vrae of bekommernisse wat hulle oor die projek gehad het, op te stel. *All attendees were requested to sign the attendance register as they entered. Presentation from EIMS of the project description, application process and environmental mitigations during seismic survey were delivered as per the agenda above to the meeting attendees. It was indicated that the meeting would be recorded for the purposes of accurate minute taking. Background Information Documents (in English, Afrikaans and isiXhosa), comments forms, registration, information handouts and attendance registers, were made available at the meeting.* *The attendees were encouraged to submit their comments and concerns through filling in the comment forms provided or by submitting comments to the project email address provided. It was noted that all attendees who have provided their contact details would be registered by default on the I&AP database maintained by EIMS. Following the presentations, the floor was opened for a discussion and the attendees were encouraged to bring up any questions or concerns they had about the project.*
2.	**Vraag en Antwoord/ *Questions and Answers***
a.	**John Van Der Heever** Wat is die sekuriteit faktore wat betrokke is, want waar Amerika betrokke is gaan daar moeilikheid wees en daar kan dalk terrorisme wees. Gaan die weermag of die vloot beskerming bied. Daar is byvoorbeeld baie geld op die skip, bv. R1 miljoen dollars. Daar kan terrorisme van enige kant af kom. *What are the security factors involved, because where America is concerned there is going to be trouble and there might be terrorism. Is going to give protection to the Army or the Navy. For example, there is a lot of money on the ship, e. R1 million dollars. There can be terrorism coming from either side.* **GP Kriel** Die aansoek area is binne Suid-Afrika se waters en dus sal die Suid-Afrikaanse vloot ens verantwoordelik wees om dit te patrolleer. *The application area is within South Africa's waters and thus the South African Navy etc. will be responsible for patrolling it.* **Michael Fayard (TGS)** 'n Hele interne beoordeling word gedoen oor die sekuriteitkwessies, en as daar 'n risiko vir aanvalle is, werk ons saam met die plaaslike vloot of sekuriteitsmaatskappye, en daar is ook addisionele

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	ondersteuningsvaartuig. Suid-Afrika word gesien as 'n laerisikoland en behoort nie 'n groot probleem te hê nie. Ons hou altyd die plaaslike vloot op hoogte van ons bewegings. *A whole internal assessment is done of the security issues, and if there is a risk of attacs then we work with the local navy or security companies, and there is also additional support vessel. South Africa is seen as a low risk country and should not have a big issue. We always keep the local navies informed of our movements.*
b.	**Chief Regan** Hoe ver is die aansoek area van die land af? En hoe ver trek die klank van die boot af? Van ons kant af, maak ons sonar die visse se koppe deurmekaar. Ons is nie teen projekte nie, maar nou kom julle na ons toe. Vandat hulle lank gelede begin het met die surveys vir olie en gas en nou is daar nie meer visse oor nie. Dit is vir ons onaanvaarbaar dat julle nou na die gemeenskappe toe kom en kom verduidelik, waar julle in die eerste plek met ons moes kom gesels het en toestemming gevra het om die studies te doen. *How far is the application area from the country? And how far does the sound travel from the boat? From our side, our sonar messes up the fish's heads. We are not against projects, but now you are coming to us. Ever since they started with the oil and gas surveys a long time ago and now there are no more fish left. It is unacceptable to us that you now come to the communities and explain, where you should have come and talked to us in the first place and asked permission to do the studies.* **GP Kriel** Die klank kan gehoor word op 'n groot afstand partykeer op 'n paar honderd kilometer. Ons het gaan kyk in ons klank studies na die Threshold shifts (dit is die klank waar daar skade of mortaliteit aan die seelewe kan veroorsaak, of afwykinggedrag veroorsaak). Die maksimum afstand wat die seelewe se threshold shifts gaan veroorsaak, is ongeveer 3.5 km. Ons verstaan dat daar beter gedoen kan word oor die algemeen om met die inheemse en tradisionele mense te konsulteer. Ons het dit as deel van ons proses identifiseer en ons het dus maatreëls in plek gestel om seker te maak dat die konsultasie wat hieruit vloei dit in ag neem. Ons het verder voorgestel dat die navorsing wat gedoen word, die plaaslike gemeenskappe moet betrek. *The sound can be heard at a great distance sometimes at a few hundred kilometers. We looked in our audio studies at the Threshold shifts (which is the sound where there can cause damage or mortality to marine life, or cause deviation behavior). The maximum distance that marine life's threshold shifts will cause is about 3.5 km. We understand that better can be done generally to consult with the indigenous and traditional people. We have identified this as part of our process and we have therefore put measures in place to make sure that the consultation that flows from this takes that into account. We further suggested that the research being done should involve the local communities.*
c.	**George Lanes** Ek is ook 'n visserman. Dolfyne en walvisse maak klanke, maak 'n tuna ook 'n klank of 'n kingklip? En met die klimaatsverandering het die vis nie 'n gereelde kringloop nie. *I'm also a fisherman. Dolphins and whales make sounds, does a tuna also make a sound or a kingklip? And with the climate change, the fish do not have a regular cycle.* **GP Kriel** Daar is allerhande dinge wat 'n invloed op visse se gedrag, ens. kan hê. En ons verstaan dat die klank nie net by die aansoek area bly nie. Dit is waardevol dat ons van die gemeenskappe kan hoor oor die verspreiding van die visspesies. Ons het ons best probeer om die karakteristieke van die area in ag te

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EIMS

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	2520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	neem en seker te maak dat ons die omgewing soveel as moontlik te beskerm. Rudian Baily het bevestig dat die PAM nie die visse kan optel nie, maar hoofsaaklik net die walvisse en die dolfyne. *There are all sorts of things that affect fish's behavior, etc. can have. And we understand that the sound remains not only with the application area. It is valuable that we can hear from the communities about the distribution of the fish species. We tried our best to consider the characteristics of the area and make sure that we could protect the environment as much as possible. Rudian Baily confirmed that the PAM cannot pick up the fish, but mainly only the whales and the dolphins.*
d.	**Basie Shoshole** Ek het nie 'n vraag nie. Ek wil vir julle sê dat ons nie seismic surveys hier soek nie. Julle kom verduidelik vir ons met mooi voorstelle en goed wat geleerde manse gesê het, maar ons ken ons waters en ons weet dat ons vispesies baie sensitief is. Die vispesies wat hier by ons was het weggetrek as gevolg van die versteurings in die see hier naby die hawe. Julle gaan ons seelewe uitroei. Mnr van der Heever hoef nie bekommerd te wees te wees oor die terroris wat van buite kom nie, die terroris sit langs hom en hy gaan ons voedsel sekuriteit affekteer. Wat hulle wil kom doen hier is teenstrydig met hoe ons al vir eeue ons bron bestuur. Ons voorouers het geweet hoe om die bron te bestuur. Die land is in 'n gemors omdat die tegnologie van buite gekom het. Ons voorouers het tradisioneel gelewe en almal was gelukkig en die mag van geld maak dat ons moet baklei vir alles wat ons het. Ons soek nie die goed in ons see nie. 'n Vesserman sal nooit aard in ander werke wees nie. Daar gaan dan ook niks vir ons kinders iets kom uit hierdie projek nie. Die manse is besig om ons dood te maak. *I don't have a question. I want to tell you that we are not looking for seismic surveys here. You come and explain to us with nice suggestions and stuff learned people have said, but we know our waters and we know that our fish species are very sensitive. The fish species that were here with us moved away because of the disturbances in the sea near the harbour. You're going to eradicate our marine life. Mr van der Heever doesn't have to worry about the terrorist coming from outside, the terrorist is sitting next to him and he's going to affect our food security. What they want to come and do here is inconsistent with how we have been managing our source for centuries. Our ancestors knew how to manage the resource. The country is in a mess because the technology has come from outside. Our ancestors lived traditionally and everyone was happy and the power of money makes us have to fight for everything we have. We don't look for the stuff in our sea. A fisherman will never be kind to other works. There's not going to be anything coming out of this project for our kids either. The people are killing us.* **Nico Bezuidenhout/ GP Kriel** Ons het die kommentaar opgeneem en sal u teenkanting teen die projek notuer. Ons kyk na 'n breër prentjie en die idee is nie om 'n groep manse uit te wis nie. Die idee it om seker te maak dat die manse kans gegee word om hulle insae te lewer, en dit is belangrik, sou daar toekomstige eksplorasie of produktie wees, dat die gemeenskappe moet deelneem aan die prosesse en die maatskappye verantwoordelik hou. *We have incorporated the comments and will note your opposition to the project. We are looking at a broader picture and the idea is not to wipe out a group of people. The idea is to make sure that the people are given a chance to deliver their perusal, and importantly, should there be future exploration or production, that the communities should participate in the processes and hold the companies accountable.*
e.	**Natasha James**

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	Groot geraas gaan baie steuring veroorsaak en as 'n oud-bewerings spesialis weet ek wat die impak op die seelewe is. Ons het 'n kort snoek seisoen gehad. Ons sien groot probleme vir ons want ons weet daar is niks in plek gesit vir ons as daar dalk iets verkeerd gaan. Ek het vir Robin gevra van Searcher in Houtbaai is daar enige uitkoms? En hy het gesê dat ongelukkig het die owerhede die laaste sê hieroor. Hoekom ons waters kom ploeg en nie daar gaan werk waar hulle vandaan kom nie? Die inheemse gemeenskappe daar oorsee is heeltemal gekant teen olie en gas. Ons moet opstaan teen die besluite van die regering wat ons lewens wil kom benadeel. *Loud noise is going to cause a lot of disturbance and as an ex-conservation specialist I know what the impact is on marine life. We had a short pike season. We see big problems for us because we know there is nothing put in place for us if something goes wrong. I asked Robin from Searcher in Hout Bay is there any outcome? And he said that unfortunately, the authorities have the final say on this. Why come and plow our waters and not work there where they come from? The indigenous communities there overseas are totally opposed to oil and gas. We must stand up against the decisions of the government that want to come and harm our lives.* **GP Kriel** GP het die appèl proses verduidelik. *GP explained the appeal process.*
f.	**Beverly Schalk** Die ding gaan gebeur maak nie saak wat ons sê nie. Gwede Mantashe het dit self bevestig. Hoe pak julle so iets aan en julle gesels nie met die gemeenskappe nie? Ons kan nie met die projekte kom wat niks vir die gemeenskappe het nie. Ons het nou weer 'n kort snoek seisoen gehad van 2 weke waar ons gewoonlik 3 maande het. Die kreef is ook gesmy. As die snoek seisoen begin is daar manne wat werk saam met die vissermanne. Ons wil vra dat julle dit in ag neem. Ons het 'n groot bekommernis hieroor. Ons het gesien wat met die myne gebeur het nie. Moet ons dan nou weer na die uiterste toe gaan om ons waters te beskerm? *The thing is going to happen no matter what we say. Gwede Mantashe himself confirmed this. How do you tackle something like this and you don't talk to the communities? We can't come up with the projects that have nothing for the communities. We have now had another short pike season of 2 weeks where we usually have 3 months. The crayfish were also cut. When the pike season starts there are people working with the fishermen. We want to ask that you take this into account. We have a major concern about this. We saw what happened to the mines. Should we now go back to the extreme to protect our waters?* **Nico Benuidenhout/ GP Kriel** Ons neem kennis van u kommentaar. Dankie. *We note your comments. Thank you.*
g.	**George Lenee** Het julle sosiale studies gedoen om te kyk na die sosiale omgewing en die verslawings, ens. Ons het groot werkloosheid en wil julle nou kom sê dat die projek vir ons niks nie. Ons is bang dat julle ons visse gaan wegjaag. Julle moet eers die dorp leer ken. Het julle 'n vyf jaar studie gaan doen oor die visserye en kan julle vir ons sê hoe dit ons gaan beïnvloed?

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	Did you guys do social studies to look at the social environment and the addictions, etc. We have huge unemployment and want to come and tell you now that the project is nothing to us. We're afraid you're going to chase our fish away. You have to get to know the town first. Did you guys do a five-year study on the fisheries and can you tell us how it's going to affect us? **Sam-Marie Aucamp** Ons het 'n sosiale studie gedoen en met soweel moontlik mense gepraat op elke dorp. Die mense se bekommernisse was dieselfde – gaan dit ons vis affekteer en hoe gaan dit ons voortbestaan beinvloed. So ons 'n detail verslag saamgestel wat die bevindinge bevat soos wat daar hier voorgedra is. Op hierdie stadium sal die projek van hierdie aard nie veel vir die gemeenskappe inhou nie. Dit is eers in die moontlike volgende fases soos produksie wat die Minerale Hulpbron Wet se vereistes vir sosiale en werkskeppings planne in werking tree. Die voordele sal moontlik eers in daardie fases kom. Gaan kyk asseblief na die verslag op die data vrye website om te kyk of julle saam stem met ons bevindinge. Daar word duidelik in ons verslag gestel dat die gemeenskappe teen die projek is en hoekom hulle so voel – hulle is onseker en bekommerd oor die persepsie dat die projek hulle voortgestaan kan beinvloed. *We did a social study and talked to as many people as possible in each village. The people's concerns were the same – is it going to affect our fish and how is it going to affect our survival. So we put together a detail report that contains the findings as recited here. At this point, the project of this nature will not hold much for the communities. It is only in the possible next phases such as production that the Mineral Resources Act's requirements for social and job creation plans come into effect. The benefits may not come until those phases. Please check the report on the data free website to see if you guys agree with our findings. Our report clearly states that the communities are against the project and why they feel this way – they are unsure and concerned about the perception that the project could affect their survival.* **GP Kriel** Ons verstaan dat projekte mense se lewens kan beinvloed en dus het ons dit goedgedink om vir hierdie projek 'n in diepte sosiale studie te doen om dit te probeer uitklaar. Ons het die data van die visserye vir elke industrie en het seker gemaak dat ons die data voorstel vir 'n hele aantal jare en hoe die visse beweeg, waar hulle broei, ens. Daar is duidelik gekyk na die navorsing. Dit is ons werk om sover moontlik te probeer seker maak dat die projek voorstel nie die omgewing of die mense wat daarin woon noemenswaardig beskadig gaan word nie. GP het die impak bepaling proses verduidelik. *We understand that projects can affect people's lives and so we saw fit to do an in depth social study for this project to try to clarify this. We have the data from the fisheries for each industry and have made sure that we represent the data for quite a number of years and how the fish move, where they breed, etc. The research was clearly looked at. It is our job to try to make sure as far as possible that the project proposed will not significantly damage the environment or the people who live in it.* *GP explained the impact determination process.*
h.	**Chief Regan** Is Searcher deel van hierdie aansoek? En is dit oor Total se blok? Voorheen het hulle gesê dat daar projekte en voordele gaan wees. Ons was verlede week in Houtbaai en daar het Total vir ons allerhande dinge belowe. Nou kom se julle vir ons dat daar geen voordele gaan wees nie. So ons as inheemse bevolking kan nie die projek ondersteun nie want daar is te veel lewens en die regering gee ook nie om oor ons nie. Ons kan net sowel die vergadering stop en huis toe gaan.

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EIMS | ENVIRONMENTAL MANAGEMENT SERVICES

NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	Is Searcher part of this application? And is it about Total's block? Previously, they said that there were going to be projects and benefits. We were in Hout Bay last week and there Total promised us all sorts of things. Now you come and tell us that there are not going to be any benefits. So we as indigenous people can't support the project because there are too many lies and the government doesn't care about us either, We might as well stop the meeting and go home. **GP Kriel** Searcher is nie deel van hierdie projek nie. Hulle wil wel oor dieselfde area inligting insamel. Total is deel van die huidige Eerste blok houers. Ons verstaan dat daar soms verwarring kan wees. Maar dit is nie die idee nie. Die idee van 'n proses soos hierdie is om inligting te kom deel en die gemeenskappe 'n kans te kan gee om insae te lewer. Ons erken dat daar dalk buite hierdie proses deur die regering op 'n meer strategiese manier gekyk moet word na olie en gas hulpbronne en veral in ag geneem die kwessies soos ons verbintenis om net-zero te gaan teen 'n seker datum. *Searcher is not part of this project. They do want to gather information about the same area. Total is part of the current license block holders. We understand that sometimes there can be confusion. But that's not the idea. The idea of a process like this is to come and share information and give the communities a chance to provide input. We recognise that outside this process the government may need to look at oil and gas resources in a more strategic way and especially considering the issues such as our commitment to go net-zero by a sure date.* **Sue-Marie Ancarp** Dit is belangrik om te ontou die projekte op verskillende tye is en verskillende regte voor aansoek doen. Dus kan daar dalk ander vereistes en impakte wees (goed en sleg) wat die geleentheid gee om projekte in die gemeenskappe te loots. *It is important to untangle the projects at different times and apply different rights before. So there may be other requirements and impacts (good and bad) that give the opportunity to launch projects in the communities.*
I.	**Fisherman** Ek maak my bestaan op die see en ek is bekommerd oor die seismiese aktiwiteite. Die owerhede is besig om ons aan 'n kapitalistiese sisteem te verkoop. Ons voorvaders het die bron beskerm en dit teen poachers beskerm. Vandat die groot vissersbote ingekom het vang ons nie meer red roman, makriel ens nie. Dit was visse wat naby aan die kus voorgekom het. Ons het ook van 1984 al aardverwarming waargeneem. Nadat dit gebeur het, het ons na 2002 nie weer goeie vangste gehad nie. Die aardverwarming het veroorsaak dat ons nie meer sulke lang seisoene het nie. Wat gaan die effek dan nou wees as julle nog kom met seismiese aktiwiteite. Die regering gee nie vir ons om nie en hulle is besig om ons uit te verkoop. Ons nageslag sal nie weer kan vis vang nie. Vis dra by daartoe dat die wêreld se bevolking nie honger hy nie en dit voorsien proteïene wat baie nodig is. Ons is klaar geaffekteer deur baie goed, soos COVID en aardverwarming en nou nog dit ook. Ons is gekant teen hierdie seismiese aktiwiteite. *I make my living on the ocean and I worry about the seismic activities. The authorities are selling us to a capitalist system. Our ancestors protected the source and protected it from poachers. Ever since the big fishing boats came in we no longer catch red snoek, mackerel etc. These were fish that occurred close to shore.*

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NOTULE VAN VERGADERING/ *MINUTES OF MEETING*

EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

Item No	Item
	We have also observed global warming since 1994. After that happened, we didn't have good catches again after 2002. The global warming has caused us to no longer have such long seasons. So what will the effect be now if you are still coming up with seismic activity. The government doesn't care about us and they're selling us out. *Our offspring will not be able to fish again. Fish contributes to the fact that the world's population does not go hungry and it provides protins that are very much needed. We're done affecting a lot of stuff, like COVID and global warming and now that too. We are opposed to these seismic activities.* **Nico Bezuidenhout/ GP Kriel** Ons neem kennis van u sterk teenkanting en kommentaar. Dankie. *We note your strong opposition and comments. Thank you.*
j.	**William Jaap** Ek wil net noem dat daar baie beloftes gemaak is van werk toe hulle beplan het om die hawe dieper te maak nie. Ons kry nie meer kreef hier waar ons probeer van naby. Dieselfde gaan gebeur met die seismiese aktiwiteite, ons nageslag gaan nie meer kan vis vang nie. Julle moet dink wat julle aan ons gaan doen. *I just want to mention that many promises were made of work when they planned to make the port deeper. We no longer get lobsters here where we try at close range. The same is going to happen with the seismic activities, our offspring are not going to be able to fish anymore. You have to think about what you're going to do to us.* **Nico Bezuidenhout/ GP Kriel** Ons neem kennis van u sterk teenkanting en kommentaar. Dankie. *We note your strong opposition and comments. Thank you.*
k.	**John van der Heever** Wat is 120 km omgeskakel in seemyl – 66 seemyl – en wat is die afstand tot die aansoek area van Lambertsbaai af. Ek sal graag wil weet want ek wil weet of ek geaffekteer word. As ek DFFE se reëls oorskry kan ek dalk gaan visvang daar. (GP het bevestig dat dit 108 seemyl van Lambertsbaai af is). Dit behoort nie 'n direkte invloed op my te hê nie, maar dit mag 'n impak hê op van die vispesies wat van verder aftom. *What is 120 km converted to nautical miles – 66 nautical miles – and what is the distance to the application area from Lamberts Bay. I would love to know because I want to know if I am affected. If I exceed DFFE's rules I might be able to go fishing there. (GP confirmed it was 108 nautical miles from Lamberts Bay). It shouldn't have a direct impact on me, but it may have an impact on some of the fish species coming from further afield.*

BYLAE/ APPENDICES

1.	**Bywoning Register/ *Attendance Register***
2.	**Aanbieding/ *Presentation***

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Attendance Register

EMS Ref	1520	Project Name:	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Lambertis Bay - Community Hall	Date and Time	02 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
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MARIO Andews	70 Ferreira str Lambertsbay 8130	Tel: Cell: 0834216196 Email: marioandews@gmail.com		
Rosey Shoshola	9 Sardyn str Lambertsbay	Tel: Cell: 0664944764 Email: shosholarosey23@gmail.com		Coastal Links
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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	02 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	02 November 2022 - 16:00-18:00

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	02 November 2022 - 16:00-18:00

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	02 November 2022 - 16:00-18:00

Name and Surname	Affiliation	Contact Details	Signature	Organisation / Property Details
[illegible]	[illegible]	Tel: Cell: Email: [illegible]		
John Moore	C/O Better & Broom Str Lambert	Tel: Cell: 0623995134 Email: [illegible]		Near Shore Subsistance Fisher
Sydney Schaap	39 Pelikaan Str Lamberts Bay	Tel: Cell: 0832565305 Email: Sydneyschaap@gmail.com		Nearshore Subsistance Fisher
Georgia Lenee	Boyce Str 21 Lamberts Bay	Tel: Cell: 0826739374 Email: Sandralenee2@gmail.com		Small Scale Fishers

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Attendance Register

EIMS Ref	1320	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	02 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
William Jaap	198 Kolk Street	Tel: 0 Cell: 0719949548 Email:		Fisherman Lambertsbay
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		Tel: Cell: Email:		
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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*	
EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

VERADERING BESONDERHEDE/ *MEETING DETAILS*

Vergadering/ *Meeting*	1520 DBAR Review Public Meeting		
Vergadering Plek/ *Meeting Venue*	St Helena Bay Municipal Hall, St Helena Way	Date	2022/11/03
		Time	10h00-12h00

Teks in *Italics* is uit die Afrikaanse teks vertaal. *Text in Italics has been translated from the Afrikaans text.*

'n Openbare vergadering is geskeduleer met die Belanghebbende en Geaffekteerde Partye (I&APs). Die doel van die vergadering was om die terugvoering te gee oor die bevindinge van die Basiese Assesserings Verslag aan lede van die publiek en belangrike I&APs vas te lê. Daar het ongelukkig geen mense opgedaag vir die vergadering nie. Die projekspan het gebly tot 11:30 en het toe die vergadering gesluit.

A Public Meeting was scheduled with the Interested and Affected Parties (I&APs). The aim of the meeting was to feedback regarding the findings of the Basic Assessment Report the members of the public and key I&APs. Unfortunately, no people showed up for the meeting. The project team stayed until 11:30 a.m. and then closed the meeting.

AGENDA

Item
1. EIMS Aanbieding/ *EIMS Presentation* a. Bekendstelling van die projekspan/ *Introducing the project team* b. Projekbeskrywing/ *Project Description* c. Regsaansoekproses/ *Legal Application Process* d. Publieke Deelname/ *Public Participation* e. Impakbepaling/ *Impact Assessment* f. Projek Kontak Besonderhede/ *Project Contact Details* g. Aanbieding van SEICHE/ *Presentation from SEICHE*
2. Vraag en Antwoord/ *Questions and Answers*

NOTULE/ *MINUTES*

No meeting took place

BYLAE/ APPENDICES

1. Bywoning Register/ *Attendance Register*

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	St Helena Bay - St Helena Community Hall	Date and Time	03 November 2022 - 10:00-12:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Jacques Burgers	Melkbosstrand	Tel: Cell: 0834604260 Email:		SEICHE
GP Kraal	East London	Tel: 0117897170 Cell: Email: gp@eims.co.za		
Nico Bezuidenhout	128 Alfred Str Cathcart 5064	Tel: Cell: 0832293861 Email: nico.bez1@gmail.com		Facilitator
Chris Hancken	Saldanha	Tel: 082 339 8611 Cell: Email: chris@capfish.co.za		Capfish

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	St Helena Bay - St Helena Community Hall	Date and Time	03 November 2022 - 10:00-12:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Lucian Bailey	Wellington	Tel: Cell: Email: lucianb@gmail.com		Seiche
Michelle Rose	Bien Meubles	Tel: Cell: 0837702160 Email:		Seiche
Callen Clarke	W Dam	Tel: Cell: 0620742115 Email:		Seiche
Andisiwe Xuma	KWT	Tel: Cell: 0814025269 Email:		EIMS

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EIMS	MINUTES OF MEETING		
EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

MEETING DETAILS

Meeting	1520 Draft BAR Consultation Public Meeting		
Meeting Venue	Hoedjies Bay Hotel, Saldanha Bay	Date	2022/11/03
		Time	16h00-18h00

A Public Meeting was scheduled during the draft BAR phase with the Interested and Affected Parties (I&APs). The aim of the meeting was to present the findings of the draft Basic Assessment Report with the members of the public and key I&APs. During the public meeting which took place between 16h00 and 18h00, a presentation of the project description, description of the receiving environment, results of specialist studies, project team, impact assessment results and project timeframes was delivered to all attendees of the meeting by Environmental Impact Management Services (EIMS) Pty (Ltd). The meeting was facilitated by Mr Nico Bezuidenhoudt (NB). The presentation was delivered by Mr GP Kriel from EIMS in English, with Andiswe Xuma available to translation to isiXhosa where required. The presentation was delivered by Michelle Rosch. After the presentations were delivered, a question-and-answer session was opened where attendees asked questions or expressed their comments regarding the project. The presentation and attendance register have been attached as an appendix to this document.

AGENDA

Item
1. **Opening and welcome** Nico welcomed all in attendance and informed the attendees that if they have specific language preferances other than English then this would be accommodated. General ground rules of the meeting were highlighted and the difference between the TGS survey application.
2. ***EIMS Presentation (Attached)*** a. **Introducing the project team** b. **Project Description** c. **Impact Assessment** i. **Marine Ecology** ii. **Fisheries Assessment** iii. **Social Impact Assessment** iv. **Site Sensitivities** d. **Need and Desirability of the Project** e. **Public Participation** f. **Key Mitigation Measures** g. **Way Forward**
3. *Questions and Answers*

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1520

EIMS

MINUTES OF MEETING

EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

Item
1. Opening and welcome
Nico welcomed all in attendance and informed the attendees that if they have specific language preferences other than English then this would be accommodated. General ground rules of the meeting were highlighted and the difference between the TGS survey application.
The audience were invited to ask questions in any language of preference including English, Afrikaans and isiXhosa.

NOTULE/ *MINUTES*

Item No	Item
1.	*All attendees were requested to sign the attendance register as they entered. Presentations from EIMS and SEICHE of the project description, impact assessment findings and environmental mitigations during seismic survey were delivered as per the agenda above to the meeting attendees. It was indicated that the meeting would be recorded for the purposes of accurate minute taking. Background Information Documents (in English, Afrikaans and isiXhosa), comments forms, registration, information handouts and attendance registers, were made available at the meeting.* *The attendees were encouraged to submit their comments and concerns through filling in the comment forms provided or by submitting comments to the project email address provided. It was noted that all attendees who have provided their contact details would be registered by default on the I&AP database maintained by EIMS. Following the presentations, the floor was opened for a discussion and the attendees were encouraged to bring up any questions or concerns they had about the project.*
2.	**Questions and Answers**
a.	**IAPI – Chief Kevin Maart** Chief Maart commented on the turnout from the community being low and concluded that this was not meaningful public participation because the timing is out of sync. He said that has received the notification and report on 25 October 2022 and has not had enough time to really go through the report. The public participation meetings give an opportunity to engage with the specialists while they are here, but the public has not been given sufficient time to interact with the report so that they can ask meaningful questions and concerns regarding the report. The other thing is that the turnout is very lower than the previous meeting in terms of the fishing community because they are engaged in a 2-day workshop for small-scale fishers, so that's why they are not here as well because they probably wanted to be here as well to hear the summary of the report from the EAP. He indicated that for him, meaningful public participation is in the red at this point. The other thing that he identified is meeting fatigue is taking its toll because they have had a lot of public meetings such as those for TGS, government, Searcher and others, hence a low turnout can be anticipated. In terms of what has been presented so far, Chief Maart said that he has a huge problem with in because most of the time when you (the EAP) report on the impacts, for example on the demersal trawl you said that you don't foresee major impacts. If you look at the small-scale fishers, your assessment there is that there won't be a significant impact. My problem firstly is that most of these findings are based on assumptions and desktop modelling. You actually made mention of Austrelians and acoustic impact noise modelling, I will come to that one later on, but your findings are based on that. That will be a problem because we all know and I've spoken to the other environmental specialist last time, that if he wants to be ethical, then any impact, especially in an ecologically sensitive marine environment is normally a major

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EIMS | Environmental Impact Management Services

MINUTES OF MEETING

EIMS Ref	1520	Project Name	TGS RECONNAISSANCE 8A

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	impact. If it is insignificant or low on your scorecard, then that doesn't mean it is insignificant. Any impact on the sensitive marine environment is major and is going to be mostly irreversible. I don't want to take the chance to say yes. I agree with you because those findings are based on desktop modelling and assumptions that I can't attest to and that I can't approve so I have a concern over that. The concern over the cumulative impact is real, and it is still rife, and I still have a huge concern with regards to that. Maybe just to quickly touch on the acoustic impact, it was said that an Australian company was used to do the noise modelling, the fish species that they have in Australia are not the same as the fish we have in our waters so I can't really say that the noise modelling they used is going to be the same for our fish species that we have here. If I just look into the acoustic report, the acoustic impact said the following for example: *"The zones of potential injuries for fish with a swim bladder, for example the snoek, turtles, fish eggs and fish larvae are predicted to be within 80 metres from the noise /array source. However, fish species with swim bladders have higher injury impact thresholds and therefore have smaller zones of potential injuries within 90 metres from the air gun /noise source. I want to reject that source of assumption that is made in terms of the noise impact because we all know that any animal has a higher hearing sensitivity than what we human beings have. So, I have a major problem with those kinds of meters that are indicated there as the area that is a safe zone or not a safe zone. So, what I sense is that there is a lot of sugar coating in these impact reports, but I still have to go through it with a fine comb as I said I didn't have enough time to digest all that information and make a proper assessment but just from a cough I can tell you that I'm not very comfortable.* You have put in mitigation measures, I love that but as I said previously, your PAM technology and MMOs etc, I don't know because by the time your MMOs picks up that there's a mammal in close proximity to the ship, by that time the animal would have picked up the sound (array source) already from thousands of miles away. You also mention that there will be support vessels to communicate with mariners about the seismic activity, yet you can't even inform our fishing community in time about meetings like this, I don't know how it will work with the seismic activity. If you will ever get that message out and how you will get it out to tell them about the seismic activity. I appreciate lastly, that the heritage and social impact is considered to be medium, but I still wanted it to be high actually because we have raised our concerns and I don't want to go into the details of our previous meeting, but I suppose it should be higher. Then lastly, I just want to say that I don't appreciate these meetings at Noordhoekbaai Hotel, far from the community, where half of the community has to take taxis to get to the meeting. If you are serious about public participation, you should consider moving it Dyersberg or another location in ward 1 such as the community centre in Middelpos. **CP Kriel** Thank you very much Chief, we appreciate your comments. We do recognize that the turnout is low, and we would have wanted to see more people attending. We did undertake to notify people as soon as the report became available, there's often a lot of difficulty in arranging these types of meetings so we tried to communicate as much as possible regarding that. We also understand that there are a lot of things happening in this timeframe, so we did try to work around that to make sure it doesn't conflict too much with other meetings. Apologies for that, but this is not the only opportunity for comment, there are other opportunities further down the line, there's also a virtual meeting that we'll have later so that will be held next week Thursday, that's also detailed in the notification that was sent out so please make use of that if you can. If there's a need for us to have a further consultation, we can have a look at that and possibly schedule that. We also do appreciate that there's meeting fatigue, there are multiple processes running at the same time. The constraint that we have is that we are bound by the timeframes of the EIA Regulations, so we tried to stick within that, from the day we submitted the application, it only gave us a certain amount of time to facilitate that so we are trying to make sure that we accommodate as much as possible within that time. Then in terms of the significance of the impacts and how it was measured,

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EIMS Environmental Impact Management Services	MINUTES OF MEETING		
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	so you'll see as with any EIA process, there's a significant review of existing information, we have to understand the background information and look at what was researched before, there can't be a reinventing of the wheel every time we go out to do these studies, especially in the ocean where there is a lot of work that has already been done. There are a lot of surveys that are consistently done, a lot of existing information and research that is up to date and fairly accurate. The opportunity is there to utilize that research so although it might appear that a lot of it is based on Desktop assessment, a lot of it is based on as up to date research as we could find, you'll see that there a lot of refences, some of it is 2022 information. We understand that there are some assumption and limitations, but that is standard, and it is required that we declare that as part of the EIA process. We have a section that specifically deals with assumptions and limitations and that must be taken into consideration by PASA when they make a decision. So, although there was desktop assessment, we are confident of the assessment that was done with high degree, when we rate our impacts, it is according to the standard methodology, and we throw in some additional factors so it's not just the standard methodology. We had a look at things like irreplaceable loss of resources, cumulative impacts assessments, and rating assessment that we do for that. We did build in a lot of conservativeé estimates, we asked our guys to not just be liberal with their assessments but rather to err on the side of caution and to build in a buffer so that we rather rate it to be worse and to take a precautionary principle. For the cumulative impacts, we do realize that there are cumulative impacts and it's not just seismics happening in isolation in the ocean, it's not just mining happening but all these things come together, and we do realize that that is a big concern. The ocean is a noisy and busy place, there are lots of activities happening there. We had a robust discussion regarding the cumulative impacts and the overall consensus was that the cumulative impact would be low. In terms of the noise modelling and the fish species and specifically how that gets addressed, although the guys might have been in Australia and the States as well, they are the ones who do it best. We did try to find the best noise modelling experts, they did use local references to the local fish species, they had a lot of discussions with us about the sensitive areas and where they occur, where the noise would travel to and from and how it would be structured. So, it's not a case of them just applying some random method. We do understand that underwater noise, especially in the ocean, can't be related directly to the noise that you hear on land. It travels a bit faster on land a slower in the ocean and its very dependent on the topography of the ocean floor and what type of currents are in effects so all of that was taken into consideration and we had specific threshold shifts that we had a look at where the fish would be injured. Those are the ones you quoted rightly so, there are certain things but it's important to remember the ocean is a large place and it's not inhabited every time, everywhere with everyone. So, there is a bit of lea weigh in that as well, so 3,5 km for example was the biggest distance where they could see a change in behaviour. So, although the sound might travel further than that, it's a case of where the fish might not react as vociferously as they would to that noise. I can hear the seagull outside, but it doesn't affect me right now, in the same way a whale and other marine animals might there the noise from the array source, it's not a case of them having a major reaction and dying. So, we did try to go quantify with real models, specifically those type of impacts so we can build in some safe zones there. We are not in the business of sugar coating anything, we have been very forth coming about whatever limitations there were and it's not our intention to ensure that TGS gets an authorization, they pay us to do an assessment independently, whether it benefits them or not. If they were to have a signific ant impact on the environment, then we would say so and our reports go out to be scrutinized by the public, so we do not want to hide or sugar coat anything. In terms of the PAM and MMO, Rudian I don't know if you want to provide some input there, I know that there are some animals that don't get directly picked up by the PAM, maybe you can give us some information on how you guys deal with that.

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EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

MINUTES OF MEETING

EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

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	Radim: Introduces himself and mentions that he works as a PAM operator on board. He explained that the equipment only picks up sounds from whales and dolphins on high frequency and low frequency. The PAM system doesn't pick up schools of fish. **Michelle (Seiche):** Introduces herself and mentions that the dolphin species are picked up well in advance of the mitigation zone during the day they use a combination of the PAM as well as visual monitoring, sometimes the animals go quiet for a while so they double their efforts at all times to make sure everything is covered. In terms of the question regarding notification of fisheries, PASA does ensure a 30 notification of fisheries prior to starting a survey. So generally, if Seiche were part of a survey project on a Fisheries Liaison Officer (FLO) level, they would engage with the EAP to get the full stakeholder engagement list from the Basic Assessment process and any other stakeholders post authorisation that notifications are sent out to everyone including fishing companies and corporations. **GP:** The other thing I want to mention as well is that we feel that there are a whole lot of things that need to happen before the survey can start, so auditable mitigation measures that need to be implemented prior to commencement. This won't just be a 30-day notification protocol but there would be community engagement on a broader scale and the communication protocols would have to be developed in conject with the likes of yourself. So, we do understand that in the past, it wasn't done that way, so our intention was to draw a line in the sand and say let's do better. Let's engage with communities, let's get them to be part of the research and part of the feedback loop to make sure it's not just a drop and go exercise, it needs to be consultative and engaging and all that needs to be built in. In terms of the social impacts, San Marie, I don't know if you want to weigh in on how it was done. **San Marie:** So, I think the concern was related to how the social impacts were rated, the kind of rating matrix that we used is based on the standard rating methodology that looks at magnitude and extent and so on, which we have always found is not ideal for rating social impacts but we need to use the same rating for all the impact studies. The challenge is to find a rating system that works for all the various studies, the natural scientific studies tend to focus on the site itself while the social and heritage looks at the surroundings. We would have perhaps wanted to rate some of the impacts a bit higher but we have been limited by rating system that we use and that's not EIMS' fault, you can look at any report, the rating systems are very similar. So that's been a challenge for us from a social perspective for many years. We agree that if something does go wrong, the impact on the communities is quite severe but I think if one does look at the qualitative descriptions of the report , they reflect what the potential impact on the community is to a much closer degree as well as the sentiments of the community about the impacts.
b.	**Siyabulela (Ward Councillor):** Introduced himself and stated that he agrees with the Chief regarding the low turnout of the public in the meeting. Even yesterday there was a similar type of engagement and the attendance was the same. He advised that technology should be used to engage people more, he noted that a link had been circulated for the virtual meeting but is concerned that it might not yield the desired result because the people who are suffering in this country and expect opportunities for such projects may not be able to access it. He contestation received for this project is not from the poor but from the beneficiaries of the previous system who do not want to lose their benefits. I remember when we were discussing issues of Section 25 Expropriation without compensation, people were coming with issues of food security, but you realize that their issue is not really about food security but about who will benefit, because they want to remain in their position of benefit. This issue of oil and gas that you are talking about, we support that the environmental assessment process must be undertaken to make sure that the concerns raised regarding marine animals are addressed. However, we notice that the concern is not really about the animals but it's about who is going to benefit there. You will find that once the government authorizes this project, the same people

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	who were contesting the project will be at the forefront of the project. People will pretend to be opposed to the project but it's because they don't see a gap for themselves to benefit, once they get a space to be there, their language will change. Oil and gas are a National concern in South Africa and we are saying government they must speed up the process, if you go to areas such as Middlepos and White City, you will see that the lives of people, people are suffering. People need job opportunities so they can improve their lives. This is the same thing as Eskom, it is suffering because it was never designed to supply electricity for the entire nation but only a minority. Similarly with the ocean, the number of people who are now fishing has increased due to population growth, we didn't used to eat fish up until there was transformation in the country, that has caused increase in demand. Meaning that we are transforming and that's why it seems like the stocks are depleting because more people are using their resource. So, my point of view is that I support this project 100%, we need this project so that we can improve our lives. If all the environmental assessment processes have been done, we support the project. For any other future engagements, communicate with us directly so that we can mobilize the people to attend. **GP Kriel** Thank you for your comments, I just want to lower your expectations just a bit in terms of the job opportunities. This is the first step in a long line of things that need to happen before job opportunities come. So typically, the reconnaissance phase is highly technical and won't have any mass scale job opportunities or none. There is a requirement for them to use local population and business as much as possible during the process but typically that doesn't materialize. There are some potential benefits that could come further down the line and that is usually in the production phase if oil and gas is discovered. Also, the secondary benefit of local economy stimulation of industries such as hospitality and supplies and clinics etc.
c.	Siyabulela (Ward Committee): introduces himself and stated that similar to the councillor, he supports the project 150%, because people in the community are hungry. Ever since there was development in the sea, big ships are going out into the sea for fishing every day. So, all I'm saying is the project must start, if you need support, our people are available. Even the Minister if he has a problem he must come to us, don't waste our time we need that project. Nico stated that the comments are noted, and support appreciated but the PP Process is not about counting votes but making sure the report reflects the views of the different communities.
d.	Enrico: introduced himself and acknowledged his former colleagues Ruslan and Chris and most importantly TGS representative Michael who came all the way from Houston, Texas. He then said he wants to add another 50 to the 150% too make it 200% support for the project because it is really needed. He also expressed his concern that TGS is spending a lot of money on consultants and studies conducted for the survey application and they are entrusting the EAP do a good job. He pleaded with the EAP to bring the meetings to the community halls not nice hotels that are inaccessible to the people. He also stated that he is concerned that there is no money flowing into the communities currently through jobs or business opportunities. He requested that the EAP and TGS investigates how the community can benefit right from the start of the project. There was also talk about the minimal employment opportunities and space for participation from local communities. A simple example, if the seismic vessel comes in from the port of Saldanha, any foreign vessel coming into a South African port must have a local agent for all land related operations. TGS can't pay a supplier directly, they must work through an agent. When push comes to shove, the local companies don't get these opportunities, because the agents work amongst one another and select who must get work. About employment, he requested that TGS does a breakdown of his entire workforce and supplies so that they can see what they can do starting from this seismic survey instead of waiting for benefits in production stage. Word of mouth is better than anything

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EIMS

MINUTES OF MEETING

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Item No	Item
	because when you hear from someone in your community who has benefitted from the project, it changes perceptions. Nico stated that the comments are noted and certainly TGS will investigate it. Michael stated that the comments are noted and that TGS wants to engage with communities and local suppliers as much as possible. He agreed with the comment about local agents and challenges associated with that, he acknowledged that it's hard to control it but it is an important aspect. It is in TGS best interest to get local people especially those with experience on board as word of mouth is effective. TGS wants to be able to come back into the communities to work with them and so it is beneficial to create good relations with the community.
e.	IAP (Speaks in Afrikaans): I am sorry, I was born in this community, and played in these waters, that were rich with fish. With the development here, we saw a decline in the fish stocks, I hear the people talking about the fishing community. If you stay in the farm you are interested in sheep and other farm animals. That's the farms, but this town is a fishing community/ area, we can't forget the fishermen. If we start with those oil and gas projects, there is no way the fish will stay here, the fish will disappear. When the fish disappear, the fishing community will also disappear. There are fishing communities, farm communities and people with different work /jobs. I am talking specifically about the fishing community, my question is what will happen to them. GP: Thank you for your comments, if we look at the process, we tried to quantify the social impact on the fishing community and we took it further by getting the Social Impact specialist (San Marie) to investigate how the community operates and how the community feels. It's a very important aspect and that's why we've put in measures to ensure that it's not just a hit and run project but that TGS engages with the communities even after the survey is done to make sure that the fishing community is protected. We really tried to make sure we draw the lines through this report, so we've built in conditions that ensure that there is monitoring done on the impact of the noise on the fish species so that the is a feedback mechanism to protect the fishing communities. This is just the reconnaissance phase at this stage, further along, if there is oil and gas in the future, there are things that could go wrong, we're not saying they can't go wrong but we are assessing the impacts for this phase. Each phase in the oil and gas life cycle is required to have its own EIA. If it gets to production stage, then the Social Impact Assessment will state as such and Social Labour Plans will be required. When you have quantified how much oil or gas resource there is, you are able to have concrete plans on how the project will benefit the community. And those things only happen if it has been determined that there will not be any severe harm on the environment and communities. The second thing is that they will need to have financial provisions in place at that stage, if a spill occurs or a large-scale impact during production, they will have to ensure that they utilize those funds to redress the harm caused. This includes implementation of an oil spill response plan and rehabilitation using the funds that are set aside for that purpose. That is all issues that will be addressed in future EIAs which will probably be more stringent as legislation become updated and climate change becomes more of a reality. An important point of an EIA is to ensure that the views and comments of the fishing community are included in the report and that the communities are protected.
f.	Chief Kevin Alert: The one thing that I have realized in my professional life thus far is that when you drive with your car, you can't stop every time a little dog is barking. We have a fishing community and economy that is sustaining many households. It would be irresponsible to kill off one economy, at the cost of people losing their jobs and losing their sustenance out of the sea, hence my questions were speaking to the report because this seismic activity is going to impact on the fish life. Don't try to downplay what I'm asking because of your ignorance and inability to understand what is happening in that ecosystem. But

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EIMS	MINUTES OF MEETING		
EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

Item No	Item
	be as it may, I have a problem because you were there when people were talking about jobs so I don't know why you didn't tell them that there will be no jobs. My assertion is that we need to talk to this specific activity that will have an impact on the environment and our livelihoods. I don't want to be rude but this is the West Coast, the traditional area where the Khoisan people have been living and I want to be very clear on this, I will not go and complain in the Eastern Cape because I'm not from the Eastern Cape. I'm talking about what we see to sustain our livelihood and I don't want people coming here to complain about their issues, we need to talk about this seismic activity that will take place in the sea. I'm talking on behalf of the fishers who are in meeting with Barbara Creecy for a day or so and if they were here, you would hear their concerns about what will happen in the sea, not on land but in the sea. Hence I'm saying I'm driving my car and I don't have to worry about little dogs barking. Ward councillor and committee member complained that the chief's comments were offensive, and that the facilitator should have addressed it but at that time the chief had walked out of the meeting.
4.	**General** Nico thanked everyone for attending and requested that IAPs must please advise if there's anyone who should be consulted or notified during this process.
5.	**Closure** The meeting was closed at 18:15.

APPENDICES

1. **Attendance Register**
2. **Presentation**

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Saldanha Bay - Hoedjies Bay Hotel	Date and Time	03 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Michelle Rose		Tel: Cell: 0837702166 Email:		Seiche Ltd
Antoinette Xuma		Tel: Cell: 0814102369 Email:		EIMS
Chaheen Vanmaan	46 Church STR. Saldanha	Tel: - Cell: 0634830653 Email: Chaheen.vanmaan@sbm.gov.za		SBM.
Lucian Kelly	WELLINGTON	Tel: Cell: 078 799 2575 Email:		SEICHE.

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Saldanha Bay - Hoedjies Bay Hotel	Date and Time	03 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
CHRIS Heneckew	SALDANHA	Tel: 082 879 861 Cell: Email: CHRIS@capfish.co.za		CAPFISH
Jeff Heneckew	SALDANHA	Tel: Cell: 0609712488 Email: Jeffrey.Heneckew@gmail.		KV260
PETER GRIFFITHS	SALDANHA	Tel: [illegible] Cell: Email:		
S Dimmi	29 PEARL STR MIDDELPOS	Tel: Cell: 0737778866 Email:		CIL

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment	
Meeting	Draft Basic Assessment Report Review Meeting			
Meeting Venue	Saldanha Bay - Hoedjies Bay Hotel		Date and Time	03 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Gloria Gilfillan	8856 Leyland St Mossel Bay Saldanha	Tel: Cell: 0632970779 Email: gjfillan@yahoo.com	GGilf	Ward Committee
Cel Kriel	East London	Tel: 0437897170 Cell: Email: ge@eims.co.za		EIMS
		Tel: Cell: Email:		
		Tel: Cell: Email:		

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Attendance Register

EIMS Ref	1320	Project Name:	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Saldanha Bay - Hoedjies Bay Hotel	Date and Time	03 November 2022 - 15:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Gerelda Samuels	13 Dollie St Saldanha	Tel: Cell: 0799274131 Email: gereldasamuels@gmail.com		SBM
Neo Hendricks	128 Attaché St. Colbyn 0083.	Tel: Cell: 083 229 3861 Email: nicholas@gmail.com		Facilitator.
Callen Cloete	40 Dana	Tel: Cell: 0623742115 Email:		Seiche.
Enrico Adams	70 Marnitz St White City Saldanha 7395	Tel: Cell: 076 869 6163 Email: enrico@jobsmanmine.com		

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Attendance Register

EIMS Ref	3520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Saldanha Bay - Hoedjes Bay Hotel	Date and Time	05 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
JACQUES BURGERS	MELKBOSSTRAND	Tel: Cell: 083 460 4260 Email:		SEICHE
CHIEF KHAESON MAARI	9 OESTER STR DALVILLE SALDANHA	Tel: 022-330 5100 Cell: 093 955 977 Email: chief.maart@cochoquatribe.org.za		AIKANESE COCHOQUA TRIBAL COUNCIL
SIYABULELA MAFANUKA	9791 Diamond Str Middelpos Saldanha.	Tel: Cell: 0738777274 Email:		Community leader. ward committee
THOBEKA GLAKAZA	36 NTLANGANO ST MIDDELPOS SALDANHA	Tel: Cell: 0604746618 Email: thobekagiakaza@gmail		Ward Committee

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EIMS

MINUTES OF MEETING

EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

MEETING DETAILS

Meeting	1520 Draft BAR Consultation Public Meeting		
Meeting Venue	Life Church - Sea Point - Cape Town	Date	2022/11/04
		Time	16h00-18h00

A Public Meeting was scheduled during the draft BAR phase with the Interested and Affected Parties (I&APs). The aim of the meeting was to present the findings of the draft Basic Assessment Report with the members of the public and key I&APs. During the public meeting which took place between 16h00 and 18h00, a presentation of the project description, description of the receiving environment, results of specialist studies, project team, impact assessment results and project timeframes was delivered to all attendees of the meeting by Environmental Impact Management Services (EIMS) Pty (Ltd). The meeting was facilitated by Mr Nico Bezuidenhout (NB). The presentation was delivered by Mr GP Kriel from EIMS in English, with Andiswa Xuma available to translation to isiXhosa where required. SEICHE delivered a presentation on the environmental mitigation carried out during seismic surveys in terms of the Marine Mammal Observer (MMO) and Fishing Liaison Officer (FLO) in English. The presentation was delivered by Michelle Bosch. After the presentations were delivered, a question-and-answer session was opened where attendees asked questions or expressed their comments regarding the project. The presentation and attendance register have been attached as an appendix to this document.

AGENDA

Item
1. **Opening and welcome** Nico welcomed all in attendance and informed the attendees that if they have specific language preferences other than English then this would be accommodated. General ground rules of the meeting were highlighted and the difference between the TGS survey application.
2. ***EIMS Presentation (Attached)*** a. **Introducing the project team** b. **Project Description** c. **Impact Assessment** i. **Marine Ecology** ii. **Fisheries Assessment** iii. **Social Impact Assessment** iv. **Site Sensitivities** d. **Need and Desirability of the Project** e. **Public Participation** f. **Key Mitigation Measures** g. **Way Forward**

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EIMS | Environmental Impact Management Services

MINUTES OF MEETING

EIMS Ref	1520	Project Name	TGS RECONNAISSANCE 8A

Item
1. Opening and welcome Nico welcomed all in attendance and informed the attendees that if they have specific language preferences other than English then this would be accommodated. General ground rules of the meeting were highlighted and the difference between the TGS survey application.
3. *Questions and Answers* The audience were invited to ask questions in any language of preference including English, Afrikaans and isiXhosa.

NOTULE/ *MINUTES*

Item No	Item
1.	*All attendees were requested to sign the attendance register as they entered. Presentations from EIMS of the project description, impact assessment findings and environmental mitigations during seismic survey were delivered as per the agenda above to the meeting attendees. It was indicated that the meeting would be recorded for the purposes of accurate minute taking. Background information Documents (in English, Afrikaans and isiXhosa), comments forms, registration, information handouts and attendance registers, were made available at the meeting.* *The attendees were encouraged to submit their comments and concerns through filling in the comment forms provided or by submitting comments to the project email address provided. It was noted that all attendees who have provided their contact details would be registered by default on the I&AP database maintained by EIMS. Following the presentations, the floor was opened for a discussion and the attendees were encouraged to bring up any questions or concerns they had about the project.*
2.	**Questions and Answers**
a.	**IAP1 -Menke (UCT Student)** **Has it been decided if there's still overlap areas with the two different seismic surveys in the same area.** **GP: As far as we understand, they probably won't go for the same area at the same time. I don't know if (Michael) wants to provide input on the overlap between Searcher and TGS.** **Michael (TGS)** **There will not be two surveys, the survey area for Searcher falls within TGS survey area completely so its very unlikely that both companies are going to get a permit. It will probably be us or Searcher. But just because we get the permit or searcher gets the permit, doesn't mean we will do the survey right away, we would need to have discussions with the various companies such as Total, Azinam etc and get financial backing. The likelihood of two surveys happening out there is slim to none.** **IAP1 -Menke (UCT Student)** **Are the coordinates for the two areas in the report?** **GP: Yes, we've double checked them. There's a fairly basic set in the table and there's a more comprehensive set of coordinates on the map itself. You can plot those and I'm happy to send you the kml file as well.**

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OCS

EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

MINUTES OF MEETING

EIMS Ref	1520	Project Name	TGS RECONNAISSANCE BA

Item No	Item
	IAP1 -Menka (UCT Student) I'm only asking because I work in Port Nolloth and there are several other developments there and so we're trying to map it all out. How was the meeting in Port Nolloth by the way? **EP:** There were a few people there. Last time they protested quite a bit and if you take a look at the report, you'll see that they didn't even want to sit down last time. At least this time there were about 5 or 6 people, it was a fairly short meeting, and they had a few questions for Rudian and Callen (MMO and PAMO) and not much else. In Hondeklip there was a bit more people, everyone was obviously concerned about impacts, but I do think they understand. We had similar concerns during the initial phase throughout all the other meetings.
b.	**IAP2- Male UCT Student** I have question about the costs, how much has it cost so far to do the research or studies? And how much will be spent in terms of projections. **EP:** So are you asking how much it will cost to do the EIA? I can tell you it's quite expensive. The reason for that is a large portion is specialist studies and specialist costs. For example the social impact assessment was quite a big thing and they spent a lot of time in the communities, talking to people travelling up and down, spending time with us in the meetings making sure all the bases are covered. So its quite an expensive study. Then also the public consultation is quite expensive because you have to book venues and do radio adverts to try and get the message out and all that is expensive. Basically its all to comply with the regulations.
c.	**IAP1 -Menka (UCT Student)** I've got a comment instead of a question. It was mentioned that there would be a study of how the fisheries respond to the seismic surveys. I think one thing that may be interesting coming out of that is there may be a research proposal on how that is going to be done. Would it be possible to include the small-scale fishers because I know one thing, they keep saying that even though the survey area doesn't directly coincide with their boundaries, they are still worried about how the survey will affect the fish species in the area. So that would be interesting to understand that a bit more and tying it back to the small scale fishers. And the use of seismic data for offshore wind turbine, that's something that the small scale fishers feel like we should have transitioned a while ago. So would your company be willing to include the local guys in the process. **EP:** In terms of the research, yes I agree with you, that's something that we proposed, the details of that would need to be refined. Again, like we said, and San-Marie will agree that there's a need to look at the San Code of Research Ethics. Before they can start with their survey operations, they need to go back and design an engagement protocol and interact with the local communities in that research. For instance if small scale fisheries could provide higher resolution data, then there's an opportunity for people like Sarah to say okay lets go and do some research with you, shows us where you fish and lets design a research proposal in conjunction with a local university to get some concrete research done. Then you would be using people from local communities and industry experts and then providing direct and real-time feedback to the communities. So there's lots of ways you can go about it but that's the idea behind it. Similar thing with the noise, you can assess the acoustic levels and background noise in the ocean, we all know the ocean is noisy place, but you have to put a concrete number on it and say before the survey, this is how much the noise was in the ocean.
d.	**General**

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EIMS	MINUTES OF MEETING	
EIMS Ref: 1520	Project Name:	TGS RECONNAISSANCE BA

Item No	Item
	GP thanked everyone for attending and requested that IAPs must please advise if there's anyone who should be consulted or notified during this process. He advised that the questions on the registration form can be used as a guide to frame a response. Attended were informed about the virtual meeting and EAP contact details.
5.	**Closure** The meeting was closed at 17:00.

APPENDICES

1.	**Attendance Register**
2.	**Presentation**

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TGS

Attendance Register

EIMS Ref	1520	Project Name	Proposed TCS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Cape Town - Life Church 30 Main Road, Anchor Bay, Seapoint)	Date and Time	04 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
JACQUES BURGERS	MELKBOSSTRAAT	Tel: Cell: 0834600760 Email:		SEICHE
Nico Bezuidenhout	128 Allcock str Colbyn 0083.	Tel: Cell: 083 293 3861 Email: nico.bezuidenhout@gmail.com		Facilitator.
MNQOBI NGUBANE	22 STEINBERG STR UNIT 2-2 WESTCLIFFE DISCOVERY JHB	Tel: Cell: 0682845285 Email: Nmuchanemngubi@gmail.com		U. J.
Callen Cokle	VV Dam	Tel: Cell: 0620792115 Email:		Seiche.

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Attendance Register

EIMS Ref:	1510	Project Name:	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting:	Draft Basic Assessment Report Review Meeting		
Meeting Venue:	Cape Town – Life Church 30 Main Road, Anchor Bay, Seapoint)	Date and Time:	04 November 2022 - 16:00-18:00

Name and Surname:	Initials:	Contact Details:	Signature:	Organisation / Property Details:
Michelle Roffe		Tel: Cell: 083 770 2166 Email:		Seiche Ltd
Lucian Bailey		Tel: Cell: 078 799 2545 Email:		Seiche
Menka Vorasan		Tel: 0668192082 Cell: Email:		UCT
Sarah Wilkinson		Tel: Cell: 082 728 673 Email:		CapeNature

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EIMS	NOTULE VAN VERGADERING/ *MINUTES OF MEETING*		
EIMS Verw./ *EIMS Ref*	1520	Projek Naam/ *Project Name*	TGS VERKENNING BA/ *TGS RECONNAISSANCE BA*

VERADERING BESONDERHEDE/ *MEETING DETAILS*

Vergadering/ *Meeting*	**1528 OBAR Review Public Meeting**		
Vergadering Plek/ *Meeting Venue*	Hout Bay Public Library, Hout Bay	Date	2022/11/05
		Time	10h00-12h00

Teks in *italics* is uit die Afrikaanse teks vertaal. *Text in italics has been translated from the Afrikaans text.*

'n Openbare vergadering is geskeduleer met die Belanghebbende en Geaffekteerde Partye (I&APs). Die doel van die vergadering was om die terugvoering te gee oor die bevindinge van die Basiese Assesserings Verslag aan lede van die publiek en belangrike I&APs was te lê. Daar het ongelukkig geen mense opgedaag vir die vergadering nie, ten spyte van die feit dat EIMS 'n taxi gereël het in om gemeenskapslede van Hangberg aan te ry. Die projekspan het gebly tot 11:30 en het toe die vergadering gesluit.

A Public Meeting was scheduled with the Interested and Affected Parties (I&APs). The aim of the meeting was to feedback regarding the findings of the Basic Assessment Report the members of the public and key I&APs. Unfortunately, no people showed up for the meeting, despite the fact that EIMS arranged a taxi in to drive community members from Hangberg. The project team stayed until 11:30 a.m, and then closed the meeting.

AGENDA

Item

1. **EIMS Aanbieding/ *EIMS Presentation***
   a. **Bekendstelling van die projekspan/ *Introducing the project team***
   b. **Projekbeskrywing/ *Project Description***
   c. **Regsaansoekproses/ *Legal Application Process***
   d. **Publieke Deelname/ *Public Participation***
   e. **Impakbepaling/ *Impact Assessment***
   f. **Projek Kontak Besonderhede/ *Project Contact Details***
   g. **Aanbieding van SEACHE/ *Presentation from SEACHE***
2. **Vraag en Antwoord/ *Questions and Answers***

NOTULE/ *MINUTES*

No meeting took place

BYLAE/ APPENDICES

1. **Bywoning Register/ *Attendance Register***

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Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit: Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Hout Bay - Hout Bay Public Library	Date and Time	05 November 2012 - 10:00-12:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Colleen Clarke	W. Dam	Tel: Cell: 0820742115 Email:		Seiche.
Lubin Lacy	Llewellyn	Tel: Cell: 078 799 2548 Email:		SEICHE
Michelle Rose	Melkbos	Tel: Cell: 083770 2166 Email:		Seiche
JACQUES BURGERS	MELKBOSSTRAND	Tel: Cell: 0834604260 Email:		SEICHE

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EIMS

Attendance Register

EIMS Ref	1520	Project Name	Proposed TDS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Hout Bay - Hout Bay Public Library	Date and Time	05 November 2022 - 10:00-12:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Gf Kriel	East London	Tel: 0417897170 Cell: Email: gfe@eims.co.za		EIMS
Strath Wilkinson		Tel: Cell: 0827289695 Email:		Commons
Nico Bezuidenhout	128 Alfred Str Cathcart 5823.	Tel: Cell: 083 229 3861 Email: nico.vest@gmail.com		Facilitator.
		Tel: Cell: Email:		

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"6.1"

Summary for Policymakers

SPM

Summary for Policymakers

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A: Introduction

This Summary for Policymakers (SPM) presents key findings of the Working Group II (WGII) contribution to the Sixth Assessment Report (AR6) of the IPCC[1]. The report builds on the WGII contribution to the Fifth Assessment Report (AR5) of the IPCC, three Special Reports[2], and the Working Group I (WGI) contribution to the AR6 cycle.

This report recognizes the interdependence of climate, ecosystems and biodiversity[3], and human societies (Figure SPM.1) and integrates knowledge more strongly across the natural, ecological, social and economic sciences than earlier IPCC assessments. The assessment of climate change impacts and risks as well as adaptation is set against concurrently unfolding non-climatic global trends e.g., biodiversity loss, overall unsustainable consumption of natural resources, land and ecosystem degradation, rapid urbanisation, human demographic shifts, social and economic inequalities and a pandemic.

The scientific evidence for each key finding is found in the 18 chapters of the underlying report and in the 7 cross-chapter papers as well as the integrated synthesis presented in the Technical Summary (hereafter TS) and referred to in curly brackets {}. Based on scientific understanding, key findings can be formulated as statements of fact or associated with an assessed level of confidence using the IPCC calibrated language[4]. The WGII Global to Regional Atlas (Annex I) facilitates exploration of key synthesis findings across the WGII regions.

The concept of risk is central to all three AR6 Working Groups. A risk framing and the concepts of adaptation, vulnerability, exposure, resilience, equity and justice, and transformation provide alternative, overlapping, complementary, and widely used entry points to the literature assessed in this WGII report.

Across all three AR6 working groups, risk[5] provides a framework for understanding the increasingly severe, interconnected and often irreversible impacts of climate change on ecosystems, biodiversity, and human systems; differing impacts across regions, sectors and communities; and how to best reduce adverse consequences for current and future generations. In the context of climate change, risk can arise from the dynamic interactions among climate-related hazards[6] (see Working Group I), the exposure[7] and vulnerability[8] of affected human and ecological systems. The risk that can be introduced by human responses to climate change is a new aspect considered in the risk concept. This report identifies 127 key risks[9]. {1.3, 16.5}

The vulnerability of exposed human and natural systems is a component of risk, but also, independently, an important focus in the literature. Approaches to analysing and assessing vulnerability have evolved since previous IPCC assessments. Vulnerability is widely understood to differ within communities and across societies, regions and countries, also changing through time.

Adaptation[10] plays a key role in reducing exposure and vulnerability to climate change. Adaptation in ecological systems includes autonomous adjustments through ecological and evolutionary processes. In human systems, adaptation can be anticipatory or reactive, as well as incremental

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1 Decision IPCC-CRP/51-9, The assessment covers scientific literature accepted for publication by 1 September 2021.

2 The three Special Reports are 'Global Warming of 1.5°C, An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (SR1.5)'; 'Climate Change and Land: An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems (SRCCL)'; 'IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC)'.

3 Biodiversity: Biodiversity or biological diversity means the variability among living organisms from all sources including, among other things, terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.

4 Each finding is grounded in an evaluation of underlying evidence and agreement. A level of confidence is expressed using five qualifiers: very low, low, medium, high and very high, and typeset in bold, e.g., **medium confidence**. The following terms have been used to indicate the assessed likelihood of an outcome or a result: virtually certain 99–100% probability, very likely 90–100%, likely 66–100%, as likely as not 33–66%, unlikely 0–33%, very unlikely 0–10%, exceptionally unlikely 0–1%. Assessed likelihood is typeset in bold, e.g., *very likely*. This is consistent with AR5 and the other AR6 reports.

5 Risk is defined as the potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems.

6 Hazard is defined as the potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources. Physical climate conditions that may be associated with hazards are assessed in Working Group I as climate impact-drivers.

7 Exposure is defined as the presence of people, livelihoods, species or ecosystems, environmental functions, services and resources, infrastructure, or economic, social or cultural assets in places and settings that could be adversely affected.

8 Vulnerability in this report is defined as the propensity or predisposition to be adversely affected and encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

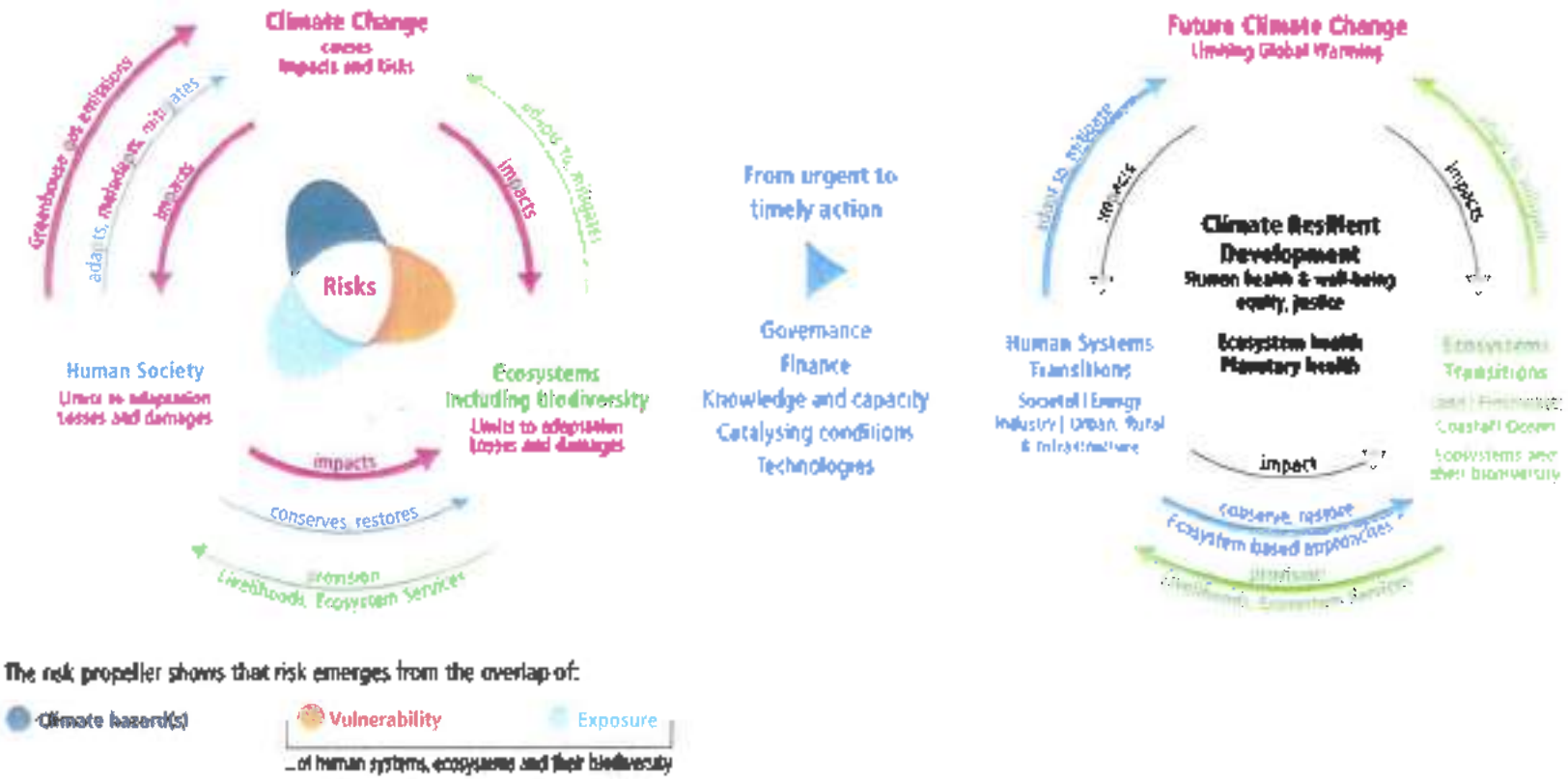
9 Key risks have potentially severe adverse consequences for humans and social-ecological systems, resulting from the interaction of climate-related hazards with vulnerabilities of societies and systems exposed.

10 Adaptation is defined, in human systems, as the process of adjustment to actual or expected climate and its effects, in order to moderate harm or take advantage of beneficial opportunities. In natural systems, adaptation is the process of adjustment to actual climate and its effects; human intervention may facilitate this.

From climate risk to climate resilient development: climate, ecosystems (including biodiversity) and human society as coupled systems

(a) Main interactions and trends

(b) Options to reduce climate risks and establish resilience



The risk propeller shows that risk emerges from the overlap of:

Climate hazard(s) | Vulnerability | Exposure

...of human systems, ecosystems and their biodiversity

Figure SPM.1 | This report has a strong focus on the interactions among the coupled systems climate, ecosystems (including their biodiversity) and human society. These interactions are the basis of emerging risks from climate change, ecosystem degradation and biodiversity loss and, at the same time, offer opportunities for the future.

(a) Human society causes climate change. Climate change, through hazards, exposure and vulnerability generates impacts and risks that can surpass limits to adaptation and result in losses and damages. Human society can adapt to, moderate and mitigate climate change. Ecosystems can adapt and mitigate within limits. Ecosystems and their biodiversity provision livelihoods and ecosystem services. Human society impacts ecosystems and can restore and conserve them.

(b) Meeting the objectives of climate resilient development thereby supporting human, ecosystem and planetary health, as well as human well-being, requires society and ecosystems to move over (transition) to a more resilient state. The recognition of climate risks can strengthen adaptation and mitigation actions and transitions that reduce risks. Taking action is enabled by governance, finance, knowledge and capacity building, technology and catalysing conditions. Transformation entails system transitions strengthening the resilience of ecosystems and society (Section D). In (a) arrow colours represent principle human society interactions (blue), ecosystem (including biodiversity) interactions (green) and the impacts of climate change and human activities, including losses and damages, under continued climate change (red). In (b) arrow colours represent human system interactions (blue), ecosystem (including biodiversity) interactions (green) and reduced impacts from climate change and human activities (grey) (1.2, Figure 1.2, Figure TS. 2)

and/ or transformational. The latter changes the fundamental attributes of a social-ecological system in anticipation of climate change and its impacts. Adaptation is subject to hard and soft limits[11].

Resilience[12] in the literature has a wide range of meanings. Adaptation is often organized around resilience as bouncing back and returning to a previous state after a disturbance. More broadly the term describes not just the ability to maintain essential function, identity and structure, but also the capacity for transformation.

This report recognises the value of diverse forms of knowledge such as scientific, as well as Indigenous knowledge and local knowledge in understanding and evaluating climate adaptation processes and actions to reduce risks from human-induced climate change. AR6 highlights adaptation solutions which are effective, feasible[13], and conform to principles of justice[14]. The term climate justice, while used in different ways in different contexts by different communities, generally includes three principles: *distributive justice* which refers to the allocation of burdens and benefits among individuals, nations and generations; *procedural justice* which refers to who decides and participates in decision-making; and *recognition* which entails basic respect and robust engagement with and fair consideration of diverse cultures and perspectives.

Effectiveness refers to the extent to which an action reduces vulnerability and climate-related risk, increases resilience, and avoids maladaptation[15].

This report has a particular focus on transformation[16] and system transitions in energy; land, ocean, coastal and freshwater ecosystems; urban, rural and infrastructure; and industry and society. These transitions make possible the adaptation required for high levels of human health and well-being, economic and social resilience, ecosystem health[17], and planetary health[18] (Figure SPM.1). These system transitions are also important for achieving the low global warming levels (Working Group III) that would avoid many limits to adaptation[11]. The report also assesses economic and non-economic losses and damages[19]. This report labels the process of implementing mitigation and adaptation together in support of sustainable development for all as climate resilient development[20].

Box SPM.1 | AR6 Common Climate Dimensions, Global Warming Levels and Reference Periods

Assessments of climate risks consider possible future climate change, societal development and responses. This report assesses literature including that based on climate model simulations that are part of the fifth and sixth Coupled Model Intercomparison Project Phase (CMIP5, CMIP6) of the World Climate Research Programme. Future projections are driven by emissions and/or concentrations from Illustrative Representative Concentration Pathways (RCPs)[21] and Shared Socioeconomic Pathways (SSPs)[22] scenarios, respectively[23]. Climate impacts literature is based primarily on climate projections assessed in AR5 or earlier, or assumed global warming levels, though some recent impacts literature uses newer projections based on the CMIP6 exercise. Given differences in the impacts literature regarding

11 Adaptation limits: The point at which an actor's objectives (or system needs) cannot be secured from intolerable risks through adaptive actions.
Hard adaptation limit—no adaptive actions are possible to avoid intolerable risks.
Soft adaptation limit—Options may exist but are currently not available to avoid intolerable risks through adaptive actions.

12 Resilience in this report is defined as the capacity of social, economic and ecosystems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure as well as biodiversity in case of ecosystems while also maintaining the capacity for adaptation, learning and transformation. Resilience is a positive attribute when it maintains such a capacity for adaptation, learning, and/or transformation.

13 Feasibility refers to the potential for an adaptation option to be implemented.

14 Justice is concerned with valuing fair the moral or legal principles of fairness and equity in the way people are treated, often based on the norms and values of society. Social justice comprises fair or fair relations within society that seek to address the distribution of wealth, access to resources, opportunity and support according to principles of justice and fairness. Climate justice considers human rights, development and human rights to achieve a rights-based approach to addressing climate change.

15 Maladaptation refers to actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas emissions, increased or shifted vulnerability to climate change, more inequitable outcomes, or diminished welfare, now or in the future. More often, maladaptation is an unintended consequence.

16 Transformation refers to a change in the fundamental attributes of natural and human systems.

17 Ecosystem health: a metaphor used to describe the condition of an ecosystem, by analogy with human health. Note that there is no commonly accepted benchmark for a healthy ecosystem. Rather, the assessed health status of an ecosystem is judged on the ecosystem's resilience to change, with details depending upon which metrics (such as species richness and abundance) are employed in judging it and which societal aspirations are driving the assessment.

18 Planetary health: a concept based on the understanding that human health and human civilization depend on ecosystem health and the wise stewardship of ecosystems.

19 In this report, the term 'losses and damages' refers to observed impacts and/or projected risks and can be economic and/or non-economic.

20 In the WGIII report, climate resilient development refers to the process of implementing greenhouse gas mitigation and adaptation measures to support sustainable development for all.

21 RCP-based scenarios are referred to as RCPy, where 'y' refers to the level of radiative forcing (in watts per square metre, or W/m^2) resulting from the scenario in the year 2100.

22 SSP-based scenarios are referred to as SSPx-y, where 'SSPx' refers to the Shared Socioeconomic Pathway describing the socioeconomic trends underlying the scenarios, and 'y' refers to the level of radiative forcing (in watts per square metre, or W/m^2) resulting from the scenario in the year 2100.

23 IPCC is neutral with regard to the scenarios underlying the SSPs, which do not cover all possible scenarios. Alternative scenarios may be considered or developed.

Box SPM.1 (continued)

socioeconomic details and assumptions, WGII chapters conceptualize impacts with respect to exposure, vulnerability and adaptation as appropriate for their literature, this includes assessments regarding sustainable development and climate resilient development. There are many emissions and socioeconomic pathways that are consistent with a given global warming outcome. These represent a broad range of possibilities as available in the literature assessed that affect future climate change exposure and vulnerability. Where available, WGII also assesses literature that is based on an integrative SSP-RCP framework where climate projections obtained under the RCP scenarios are analysed against the backdrop of various illustrative SSPs[33]. The WGII assessment combines multiple lines of evidence including impacts modelling driven by climate projections, observations, and process understanding. (1.2, 16.5, 18.2, CCB CLIMATE, WGI AR6 SPM.C, WGI AR6 Box SPM.1, WGI AR6 1.6, WGI AR6 12, AR6 WGI)

A common set of reference years and time periods are adopted for assessing climate change and its impacts and risks: the reference period 1850–1900 approximates pre-industrial global surface temperature, and three future reference periods cover the near-term (2021–2040), mid-term (2041–2060) and long-term (2081–2100). (CCB CLIMATE)

Common levels of global warming relative to 1850–1900 are used to conceptualize and facilitate analysis, synthesis and communication of assessed past, present and future climate change impacts and risks considering multiple lines of evidence. Robust geographical patterns of many variables can be identified at a given level of global warming, common to all scenarios considered and independent of timing when the global warming level is reached. (16.5, CCB CLIMATE, WGI AR6 Box SPM.1, WGI AR6 4.2, WGI AR6 CCB11.1)

WGI assessed the increase in global surface temperature is 1.09 [0.95 to 1.20][34] °C in 2011–2020 above 1850–1900. The estimated increase in global surface temperature since AR5 is principally due to further warming since 2003–2012 (+0.19 [0.16 to 0.22] °C).[35] Considering all the illustrative scenarios assessed by WGI, there is at least a greater than 50% likelihood that global warming will reach or exceed 1.5°C in the near-term, even for the very low greenhouse gas emissions scenario[36]. (WGI AR6 SPM A1.2, WGI AR6 SPM B1.3, WGI AR6 Table SPM.1, WGI AR6 CCB 2.3)

B: Observed and Projected Impacts and Risks

Since AR5, the knowledge base on observed and projected impacts and risks generated by climate hazards, exposure and vulnerability has increased with impacts attributed to climate change and key risks identified across the report. Impacts and risks are expressed in terms of their damages, harms, economic, and non-economic losses. Risks from observed vulnerabilities and responses to climate change are highlighted. Risks are projected for the near-term (2021–2040), the mid (2041–2060) and long term (2081–2100), at different global warming levels and for pathways that overshoot 1.5°C global warming level for multiple decades[37]. Complex risks result from multiple climate hazards occurring concurrently, and from multiple risks interacting, compounding overall risk and resulting in risks transmitting through interconnected systems and across regions.

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34 In the WGI report, square brackets [x to y] are used to provide the assessed *very likely* range, or 90% interval.

35 Since AR5, methodological advances and new datasets have provided a more complete spatial representation of changes in surface temperature, including in the Arctic. These and other improvements have also increased the estimate of global surface temperature change by approximately 0.1°C, but this increase does not represent additional physical warming since AR5.

36 Global warming of 1.5°C relative to 1850–1900 would be exceeded during the 21st century under the intermediate, high and very high greenhouse gas emissions scenarios considered in this report (SSP2-4.5, SSP3-7.0 and SSP5-8.5, respectively). Under the five illustrative scenarios, in the near-term (2021–2040), the 1.5°C global warming level is *very likely* to be exceeded under the very high greenhouse gas emissions scenario (SSP5-8.5), *likely* to be exceeded under the intermediate and high greenhouse gas emissions scenarios (SSP2-4.5 and SSP3-7.0), *more likely than not* to be exceeded under the low greenhouse gas emissions scenario (SSP1-2.6) and *more likely than not* to be reached under the very low greenhouse gas emissions scenario (SSP1-1.9). Furthermore, for the very low greenhouse gas emissions scenario (SSP1-1.9), it is *more likely than not* that global surface temperature would decline back to below 1.5°C toward the end of the 21st century, with a temporary overshoot of no more than 0.1°C above 1.5°C global warming.

37 Overshoot in this report, pathways that first exceed a specified global warming level (usually 1.5°C, by more than 0.1°C), and then return to or below that level again before the end of a specified period of time (e.g., before 2100). Sometimes the magnitude and likelihood of the overshoot is also characterized. The overshoot duration can vary from at least one decade up to several centuries.

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Observed Impacts from Climate Change

B.1 Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability. Some development and adaptation efforts have reduced vulnerability. Across sectors and regions the most vulnerable people and systems are observed to be disproportionately affected. The rise in weather and climate extremes has led to some irreversible impacts as natural and human systems are pushed beyond their ability to adapt. *(high confidence)* (Figure SPM.2) [TS B.1, Figure TS.5, 1.3, 2.3, 2.4, 2.6, 3.3, 3.4, 3.5, 4.2, 4.3, 5.2, 5.12, 6.2, 7.2, 8.2, 9.6, 9.8, 9.10, 9.11, 10.4, 11.3, 12.3, 12.4, 13.10, 14.4, 14.5, 15.3, 16.2, CCP1.2, CCP3.2, CCP4.1, CCP5.2, CCP6.2, CCP7.2, CCP7.3, CCB DISASTER, CCB EXTREMES, CCB ILLNESS, CCB MIGRATE, CCB NATURAL, CCB SLR]

B.1.1 Widespread, pervasive impacts to ecosystems, people, settlements, and infrastructure have resulted from observed increases in the frequency and intensity of climate and weather extremes, including hot extremes on land and in the ocean, heavy precipitation events, drought and fire weather *(high confidence)*. Increasingly since AR5, these observed impacts have been attributed[24] to human-induced climate change particularly through increased frequency and severity of extreme events. These include increased heat-related human mortality *(medium confidence)*, warm-water coral bleaching and mortality *(high confidence)*, and increased drought-related tree mortality *(high confidence)*. Observed increases in areas burned by wildfires have been attributed to human-induced climate change in some regions *(medium to high confidence)*. Adverse impacts from tropical cyclones, with related losses and damages[11], have increased due to sea level rise and the increase in heavy precipitation *(medium confidence)*. Impacts in natural and human systems from slow-onset processes[25] such as ocean acidification, sea level rise or regional decreases in precipitation have also been attributed to human induced climate change *(high confidence)*. [1.3, 2.3, 2.4, 2.5, 3.2, 3.4, 3.5, 3.6, 4.2, 5.2, 5.4, 5.6, 5.12, 7.2, 9.6, 9.7, 9.8, 9.11, 11.3, Box 11.1, Box 11.2, Table 11.9, 12.3, 12.4, 13.3, 13.5, 13.10, 14.2, 14.3, 15.7, 15.8, 16.2, CCP1.2, CCP2.2, Box CCP5.1, CCP7.3, CCB DISASTER, CCB EXTREME, CCB ILLNESS, WGI AR6 SPM.3, WGI AR6 9, WGI AR6 11.3–11.8, SROCC Chapter 4]

B.1.2 Climate change has caused substantial damages, and increasingly irreversible losses, in terrestrial, freshwater and coastal and open ocean marine ecosystems *(high confidence)*. The extent and magnitude of climate change impacts are larger than estimated in previous assessments *(high confidence)*. Widespread deterioration of ecosystem structure and function, resilience and natural adaptive capacity, as well as shifts in seasonal timing have occurred due to climate change *(high confidence)*, with adverse socioeconomic consequences *(high confidence)*. Approximately half of the species assessed globally have shifted poleward or, on land, also to higher elevations *(very high confidence)*. Hundreds of local losses of species have been driven by increases in the magnitude of heat extremes *(high confidence)*, as well as mass mortality events on land and in the ocean *(very high confidence)* and loss of kelp forests *(high confidence)*. Some losses are already irreversible, such as the first species extinctions driven by climate change *(medium confidence)*. Other impacts are approaching irreversibility such as the impacts of hydrological changes resulting from the retreat of glaciers, or the changes in some mountain *(medium confidence)* and Arctic ecosystems driven by permafrost thaw *(high confidence)*. (Figure SPM.2a). [TS B.1, Figure TS.5, 2.3, 2.4, 3.4, 3.5, 4.2, 4.3, 4.5, 9.6, 10.4, 11.3, 12.3, 12.8, 13.3, 13.4, 13.10, 14.4, 14.5, 14.6, 15.3, 16.2, CCP1.2, CCP3.2, CCP4.1, CCP5.2, Figure CCP5.4, CCP6.1, CCP6.2, CCP7.2, CCP7.3, CCB EXTREMES, CCB ILLNESS, CCB MOVING PLATE, CCB NATURAL, CCB PALEO, CCB SLR, SROCC 2.3]

B.1.3 Climate change including increases in frequency and intensity of extremes have reduced food and water security, hindering efforts to meet Sustainable Development Goals *(high confidence)*. Although overall agricultural productivity has increased, climate change has slowed this growth over the past 50 years globally *(medium confidence)*, related negative impacts were mainly in mid- and low latitude regions but positive impacts occurred in some high latitude regions *(high confidence)*. Ocean warming and ocean acidification have adversely affected food production from shellfish aquaculture and fisheries in some oceanic regions *(high confidence)*. Increasing weather and climate extreme events have exposed millions of people to acute food insecurity[26] and reduced water security, with the largest impacts observed in many local areas and/or communities in Africa, Asia, Central and South America, Small Islands and the Arctic *(high confidence)*. Jointly, sudden losses of food production and access to food compounded by decreased diet diversity have increased malnutrition in many communities *(high confidence)*, especially for Indigenous Peoples, small-scale food producers and low-income households *(high confidence)*, with children, elderly people and pregnant women particularly impacted *(high confidence)*. Roughly half of the world's population currently experience severe water scarcity for at least some part of the year due to climatic and non-climatic drivers *(medium confidence)*. [Figure SPM.2b] [3.5, 4.3, 4.4, Box 4.1, 5.2, 5.4, 5.8, 5.9, 5.12, 7.1, 7.2, 9.8, 10.4, 11.3, 12.3, 13.5, 14.4, 14.5, 15.3, 16.2, CCP5.2, CCP6.2]

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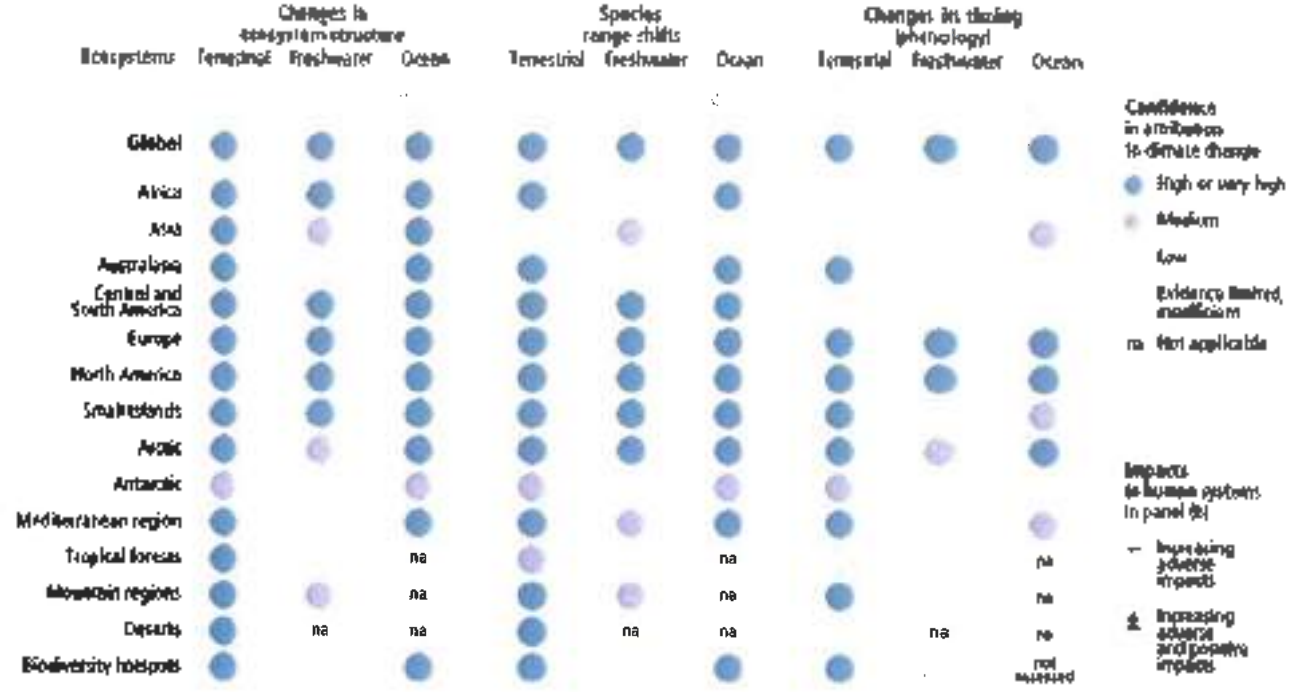
24 Attribution is defined as the process of evaluating the relative contributions of multiple causal factors to a change or event with an assessment of confidence [Annex II Glossary, CHAP EXTRA]

25 Impacts of climate change are caused by slow onset and extreme events. Slow onset events are described among the climate-related drivers of the WGII AR6 and refer to the risks and impacts associated with e.g. increasing temperature means, desertification, decreasing precipitation, loss of biodiversity, land and forest degradation, glacier retreat and related impacts, ocean acidification, sea level rise and salinization [https://interactive-atlas.ipcc.ch].

26 Acute food insecurity can occur at any time with a severity that threatens lives, livelihoods or both, regardless of the causes, context or duration, as a result of shocks-driving determinants of food security and nutrition, and used to assess the need for humanitarian action.

Impacts of climate change are observed in many ecosystems and human systems worldwide

(a) Observed impacts of climate change on ecosystems



(b) Observed impacts of climate change on human systems

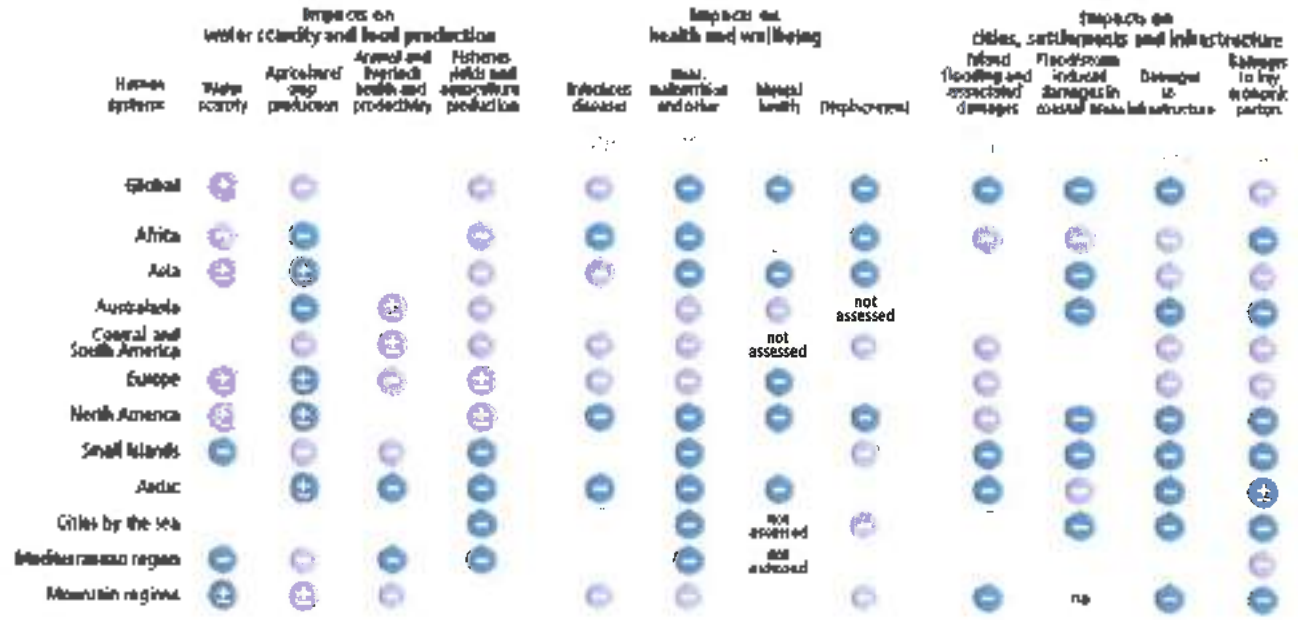


Figure SPM.2 | Observed global and regional impacts on ecosystems and human systems attributed to climate change. Confidence levels reflect uncertainty in attribution of the observed impact to climate change. Global assessments focus on large studies, multi-species, meta-analyses and large reviews. For that reason they can be assessed with higher confidence than regional studies, which may often rely on smaller studies that have more limited data. Regional assessments consider evidence on impacts across an entire region and do not focus on any country in particular.

(a) Climate change has already affected terrestrial, freshwater and ocean ecosystems at global scale, with multiple impacts evident at regional and local scales where there is sufficient literature to make an assessment. Impacts are evident on ecosystem structure, species geographic ranges and timing of seasonal life cycle (phenology) (for methodology and detailed references to chapters and cross-chapter papers see SMTS.1 and SMTS.1.1).

(b) Climate change has already had diverse adverse impacts on human systems, including on water security and food production, health and well-being, and cities, settlements and infrastructure. The + and – symbols indicate the direction of observed impacts, with a – denoting an increasing adverse impact and a + denoting that, within a region or globally, both adverse and positive impacts have been observed (e.g., adverse impacts in one area or food item may occur with positive impacts in another area or food item). Globally, '–' denotes an overall adverse impact. 'Water scarcity' considers, e.g., water availability in general, groundwater, water quality, demand for water, drought in cities. Impacts on food production were assessed by excluding non-climatic drivers of production increases; Global assessments for agricultural production is based on the impacts on global aggregated production; 'Reduced animal and livestock health and productivity' considers, e.g., heat stress, diseases, productivity, mortality; 'Reduced fisheries yields and aquaculture production' includes marine and freshwater fisheries/production; 'Infectious diseases' include, e.g., water-borne and vector-borne diseases; 'Heat, malnutrition and other' considers, e.g., human heat-related mobility and mortality, labour productivity, harm from wildfire, nutritional deficiencies; 'Mental health' includes impacts from extreme weather events, cumulative events, and variances or anticipatory events; 'Displacement' assessments refer to evidence of displacement attributable to climate and weather extremes; 'Inland flooding and associated damages' considers, e.g., river overflow, heavy rain, glacier outbursts, urban flooding; 'Flooding/storm induced damages in coastal areas' include damages due to, e.g., cyclones, sea level rise, storm surges. Damages by key economic sectors are observed impacts related to an attributable mean or extreme climate hazard or directly attributed. Key economic sectors include standard classifications and sectors of importance to regions (for methodology and detailed references in chapters and cross-chapter papers see SMTS.1 and SMTS.1.2).

B.1.4 Climate change has adversely affected physical health of people globally (*very high confidence*) and mental health of people in the assessed regions (*very high confidence*). Climate change impacts on health are mediated through natural and human systems, including economic and social conditions and disruptions (*high confidence*). In all regions extreme heat events have resulted in human mortality and morbidity (*very high confidence*). The occurrence of climate-related food-borne and water-borne diseases has increased (*very high confidence*). The incidence of vector-borne diseases has increased from range expansion and/or increased reproduction of disease vectors (*high confidence*). Animal and human diseases, including zoonoses, are emerging in new areas (*high confidence*). Water and food-borne disease risks have increased regionally from climate-sensitive aquatic pathogens, including *Vibrio* spp. (*high confidence*), and from toxic substances from harmful freshwater cyanobacteria (*medium confidence*). Although diarrheal diseases have decreased globally, higher temperatures, increased rain and flooding have increased the occurrence of diarrheal diseases, including cholera (*very high confidence*) and other gastrointestinal infections (*high confidence*). In assessed regions, some mental health challenges are associated with increasing temperatures (*high confidence*); trauma from weather and climate extreme events (*very high confidence*), and loss of livelihoods and culture (*high confidence*). Increased exposure to wildfire smoke, atmospheric dust, and aeroallergens have been associated with climate-sensitive cardiovascular and respiratory distress (*high confidence*). Health services have been disrupted by extreme events such as floods (*high confidence*). {4.5, 5.12, 7.2, Box 7.3, 8.2, 8.3, Box 8.6, Figure 8.10, 9.10, Figure 9.33, Figure 9.34, 10.4, 11.3, 12.3, 13.7, 14.4, 14.5, Figure 14.8, 15.3, 16.2, CCP5.2, Table CCP5.1, CCP6.2, Figure CCP6.3, Table CCB ILLNESS.1}

B.1.5 In urban settings, observed climate change has caused impacts on human health, livelihoods and key infrastructure (*high confidence*). Multiple climate and non-climate hazards impact cities, settlements and infrastructure and sometimes coincide, magnifying damage (*high confidence*). Hot extremes including heatwaves have intensified in cities (*high confidence*), where they have also aggravated air pollution events (*medium confidence*) and limited functioning of key infrastructure (*high confidence*). Observed impacts are concentrated amongst the economically and socially marginalized urban residents, e.g., in informal settlements (*high confidence*). Infrastructure, including transportation, water, sanitation and energy systems have been compromised by extreme and slow-onset events, with resulting economic losses, disruptions of services and impacts to well-being (*high confidence*). {4.3, 6.2, 7.1, 7.2, 9.9, 10.4, 11.3, 12.3, 13.6, 14.5, 15.3, CCP2.2, CCP4.2, CCP5.2}

B.1.6 Overall adverse economic impacts attributable to climate change, including slow-onset and extreme weather events, have been increasingly identified (*medium confidence*). Some positive economic effects have been identified in regions that have benefited from lower energy demand as well as comparative advantages in agricultural markets and tourism (*high confidence*). Economic damages from climate change have been detected in climate-exposed sectors, with regional effects to agriculture, forestry, fishery, energy, and tourism (*high confidence*), and through outdoor labour productivity (*high confidence*). Some extreme weather events, such as tropical cyclones, have reduced economic growth in the short-term (*high confidence*). Non-climatic factors including some patterns of settlement, and siting of infrastructure have contributed to the exposure of more assets to extreme climate hazards increasing the magnitude of the losses (*high confidence*). Individual livelihoods have been affected through changes in agricultural productivity, impacts on human health and food security, destruction of homes and infrastructure, and loss of property and income, with adverse effects on gender and social equity (*high confidence*). {3.5, 4.2, 5.12, 6.2, 7.2, 8.2, 9.6, 10.4, 13.10, 14.5, Box 14.6, 16.2, Table 16.5, 18.3, CCP6.2, CCB GENDER, CWGB ECONOMICS}

B.1.7 Climate change is contributing to humanitarian crises where climate hazards interact with high vulnerability (*high confidence*). Climate and weather extremes are increasingly driving displacement in all regions (*high confidence*), with Small Island States disproportionately affected (*high confidence*). Flood and drought-related acute food insecurity and malnutrition have increased in Africa (*high confidence*) and Central and South America (*high confidence*). While non-climatic factors are the dominant drivers of existing intrastate violent conflicts, in some assessed regions extreme weather and climate events have had a small, adverse impact on their length, severity or frequency, but the statistical association is weak (*medium confidence*). Through displacement and involuntary migration from extreme weather and climate events, climate change has generated and perpetuated vulnerability (*medium confidence*). {4.2, 4.3, 5.4, 7.2, 9.8, Box 9.9, Box 10.4, 12.3, 12.5, 16.2, CCB DISASTER, CCB MIGRATE}

SPM

Vulnerability and Exposure of Ecosystems and People

B.2 Vulnerability of ecosystems and people to climate change differs substantially among and within regions *(very high confidence)*, driven by patterns of intersecting socioeconomic development, unsustainable ocean and land use, inequity, marginalization, historical and ongoing patterns of inequity such as colonialism, and governance[31] *(high confidence)*. Approximately 3.3 to 3.6 billion people live in contexts that are highly vulnerable to climate change *(high confidence)*. A high proportion of species is vulnerable to climate change *(high confidence)*. Human and ecosystem vulnerability are interdependent *(high confidence)*. Current unsustainable development patterns are increasing exposure of ecosystems and people to climate hazards *(high confidence)*. {2.3, 2.4, 3.5, 4.3, 6.2, 8.2, 9.3, 9.4, 9.7, 10.4, 12.3, 14.5, 15.3, CCP5.2, CCP6.2, CCP7.3, CCP7.4, CCB GENDER}

B.2.1 Since AR5 there is increasing evidence that degradation and destruction of ecosystems by humans increases the vulnerability of people *(high confidence)*. Unsustainable land-use and land cover change, unsustainable use of natural resources, deforestation, loss of biodiversity, pollution, and their interactions, adversely affect the capacities of ecosystems, societies, communities and individuals to adapt to climate change *(high confidence)*. Loss of ecosystems and their services has cascading and long-term impacts on people globally, especially for Indigenous Peoples and local communities who are directly dependent on ecosystems, to meet basic needs *(high confidence)*. {2.3, 2.5, 2.6, 3.5, 3.6, 4.2, 4.3, 4.6, 5.1, 5.4, 5.5, 5.7, 5.8, 7.2, 8.1, 8.2, 8.3, 8.4, 8.5, 9.6, 10.4, 11.3, 12.2, 12.5, 13.8, 14.4, 14.5, 15.3, CCP1.2, CCP1.3, CCP2.2, CCP3, CCP4.3, CCP5.2, CCP6.2, CCP7.2, CCP7.3, CCP7.4, CCB ILLNESS, CCB MOVING PLATE, CCB SLR}

B.2.2 Non-climatic human-induced factors exacerbate current ecosystem vulnerability to climate change *(very high confidence)*. Globally, and even within protected areas, unsustainable use of natural resources, habitat fragmentation, and ecosystem damage by pollutants increase ecosystem vulnerability to climate change *(high confidence)*. Globally, less than 15% of the land, 21% of the freshwater and 8% of the ocean are protected areas. In most protected areas, there is insufficient stewardship to contribute to reducing damage from, or increasing resilience to, climate change *(high confidence)*. {2.4, 2.5, 2.6, 3.4, 3.6, 4.2, 4.3, 5.8, 9.6, 11.3, 12.3, 13.3, 13.4, 14.5, 15.3, CCP1.2, Figure CCP1.15, CCP2.1, CCP2.2, CCP4.2, CCP5.2, CCP6.2, CCP7.2, CCP7.3, CCB NATURAL}

B.2.3 Future vulnerability of ecosystems to climate change will be strongly influenced by the past, present and future development of human society, including from overall unsustainable consumption and production, and increasing demographic pressures, as well as persistent unsustainable use and management of land, ocean, and water *(high confidence)*. Projected climate change, combined with non-climatic drivers, will cause loss and degradation of much of the world's forests *(high confidence)*, coral reefs and low-lying coastal wetlands *(very high confidence)*. While agricultural development contributes to food security, unsustainable agricultural expansion, driven in part by unbalanced diets[32], increases ecosystem and human vulnerability and leads to competition for land and/or water resources *(high confidence)*. {2.2, 2.3, 2.4, 2.6, 3.4, 3.5, 3.6, 4.3, 4.5, 5.8, 5.12, 5.13, 7.2, 12.3, 13.3, 13.4, 13.10, 14.5, CCP1.2, CCP2.2, CCP5.2, CCP6.2, CCP7.2, CCP7.3, CCB HEALTH, CCB NATURAL}

B.2.4 Regions and people with considerable development constraints have high vulnerability to climatic hazards *(high confidence)*. Global hotspots of high human vulnerability are found particularly in West-, Central- and East Africa, South Asia, Central and South America, Small Island Developing States and the Arctic *(high confidence)*. Vulnerability is higher in locations with poverty, governance challenges and limited access to basic services and resources, violent conflict and high levels of climate-sensitive livelihoods (e.g., smallholder farmers, pastoralists, fishing communities) *(high confidence)*. Between 2010–2020, human mortality from floods, droughts and storms was 15 times higher in highly vulnerable regions, compared to regions with very low vulnerability *(high confidence)*. Vulnerability at different spatial levels is exacerbated by inequity and marginalization linked to gender, ethnicity, low income or combinations thereof *(high confidence)*, especially for many Indigenous Peoples and local communities *(high confidence)*. Present development challenges causing high vulnerability are influenced by historical and ongoing patterns of inequity such as colonialism, especially for many Indigenous Peoples and local communities *(high confidence)*. {4.2, 5.12, 6.2, 6.4, 7.1, 7.2, Box 7.1, 8.2, 8.3, Box 8.4, Figure 8.6, Box 9.1, 9.4, 9.7, 9.9, 10.3, 10.4, 10.6, 12.3, 12.5, Box 13.2, 14.4, 15.3, 15.6, 16.2, CCP6.2, CCP7.4}

B.2.5 Future human vulnerability will continue to concentrate where the capacities of local, municipal and national governments, communities and the private sector are least able to provide infrastructures and basic services *(high confidence)*. Under the global trend of urbanization, human vulnerability will also concentrate in informal settlements and rapidly growing smaller settlements *(high*

31 Governance: The structures, processes and actors through which private and public actors interact to address societal goals. This includes formal and informal institutions and the associated norms, rules, laws and procedures for deciding, managing, implementing and monitoring policies and measures at any geographic or political scale, from global to local.

32 Balanced diets: Balanced diets feature plant-based foods, such as those based on coarse grains, legumes, fruits and vegetables, nuts and seeds, and animal-source foods produced in resilient, sustainable and low-greenhouse-gas-emitting systems, as described in SR2CCL.

confidence). In rural areas vulnerability will be heightened by compounding processes including high emigration, reduced habitability and high reliance on climate-sensitive livelihoods (*high confidence*). Key infrastructure systems including sanitation, water, health, transport, communications and energy will be increasingly vulnerable if design standards do not account for changing climate conditions (*high confidence*). Vulnerability will also rapidly rise in low-lying Small Island Developing States and atolls in the context of sea level rise and in some mountain regions, already characterised by high vulnerability due to high dependence on climate-sensitive livelihoods, rising population displacement, the accelerating loss of ecosystem services and limited adaptive capacities (*high confidence*). Future exposure to climatic hazards is also increasing globally due to socioeconomic development trends including migration, growing inequality and urbanization (*high confidence*). (4.5, 5.5, 6.2, 7.2, 8.3, 9.9, 9.11, 10.5, 10.6, 12.3, 12.5, 13.6, 14.5, 15.3, 15.4, 16.5, CCP2.3, CCP4.5, CCP5.2, CCP5.3, CCP5.4, CCP6.2, CCB MIGRATE)

Risks in the near term (2021–2040)

B.3 Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans (*very high confidence*). The level of risk will depend on concurrent near-term trends in vulnerability, exposure, level of socioeconomic development and adaptation (*high confidence*). Near-term actions that limit global warming to close to 1.5°C would substantially reduce projected losses and damages related to climate change in human systems and ecosystems, compared to higher warming levels, but cannot eliminate them all (*very high confidence*). (Figure SPM.2, Box SPM.1) (16.4, 16.5, 16.6, CCP1.2, CCP5.3, CCB SLR, WGI AR6 SPM B1.3, WGI AR6 Table SPM.1)

B.3.1 Near-term warming and increased frequency, severity and duration of extreme events will place many terrestrial, freshwater, coastal and marine ecosystems at high or very high risks of biodiversity loss (*medium to very high confidence*, depending on ecosystem). Mass-term risks for biodiversity loss are moderate to high in forest ecosystems (*medium confidence*), kelp and seagrass ecosystems (*high to very high confidence*), and high to very high in Arctic sea-ice and terrestrial ecosystems (*high confidence*) and warm-water coral reefs (*very high confidence*). Continued and accelerating sea level rise will encroach on coastal settlements and infrastructure (*high confidence*) and commit low-lying coastal ecosystems to submergence and loss (*medium confidence*). If trends in urbanisation in exposed areas continue, this will exacerbate the impacts, with more challenges where energy, water and other services are constrained (*medium confidence*). The number of people at risk from climate change and associated loss of biodiversity will progressively increase (*medium confidence*). Violent conflict and, separately, migration patterns, in the near-term will be driven by socioeconomic conditions and governance more than by climate change (*medium confidence*). (Figure SPM.3) (2.5, 3.4, 4.5, 6.2, 7.3, 8.7, 9.2, 9.9, 11.6, 12.5, 13.6, 13.10, 14.6, 15.3, 16.5, 16.6, CCP1.2, CCP2.1, CCP2.2, CCP5.3, CCP6.2, CCP6.3, CCB MIGRATE, CCB SLR)

B.3.2 In the near term, climate-associated risks to natural and human systems depend more strongly on changes in their vulnerability and exposure than on differences in climate hazards between emissions scenarios (*high confidence*). Regional differences exist, and risks are highest where species and people exist close to their upper thermal limits, along coastlines, in close association with ice or seasonal rivers (*high confidence*). Risks are also high where multiple non-climate drivers persist or where vulnerability is otherwise elevated (*high confidence*). Many of these risks are unavoidable in the near-term, irrespective of emissions scenario (*high confidence*). Several risks can be moderated with adaptation (*high confidence*). (Figure SPM.3, Section C) (2.5, 3.3, 3.4, 4.5, 6.2, 7.1, 7.3, 8.2, 11.6, 12.4, 13.6, 13.7, 13.10, 14.5, 16.4, 16.5, CCP2.2, CCP4.3, CCP5.3, CCB SLR, WGI AR6 Table SPM.1)

B.3.3 Levels of risk for all Reasons for Concern (RFC) are assessed to become high to very high at lower global warming levels than in AR5 (*high confidence*). Between 1.2°C and 4.5°C global warming level very high risks emerge in all five RFCs compared to just two RFCs in AR5 (*high confidence*). Two of these transitions from high to very high risk are associated with near-term warming: risks to unique and threatened systems at a median value of 1.5 [1.2 to 2.0] °C (*high confidence*) and risks associated with extreme weather events at a median value of 2.0 [1.8 to 2.5] °C (*medium confidence*). Some key risks contributing to the RFCs are projected to lead to widespread, pervasive, and potentially irreversible impacts at global warming levels of 1.5–2°C if exposure and vulnerability are high and adaptation is low (*medium confidence*). Near-term actions that limit global warming to close to 1.5°C would substantially reduce projected losses and damages related to climate change in human systems and ecosystems, compared to higher warming levels, but cannot eliminate them all (*very high confidence*). (Figure SPM.3b) (16.5, 16.6, CCB SLR)

Mid to Long-term Risks (2041–2100)

B.4 Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems (*high confidence*). For 127 identified key risks, assessed mid- and long-term impacts are up to multiple times higher than currently observed (*high confidence*). The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming (*very high confidence*). (Figure SPM.3) (2.5, 3.4, 4.4, 5.2, 6.2, 7.3, 8.4, 9.2, 10.2, 11.6, 12.4, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.8, 14.6, 15.3, 16.5, 16.6, CCP1.2, CCP2.2, CCP3.3, CCP4.3, CCP5.3, CCP6.3, CCP7.3)

B.4.1 Biodiversity loss and degradation, damages to and transformation of ecosystems are already key risks for every region due to past global warming and will continue to escalate with every increment of global warming (*very high confidence*). In terrestrial ecosystems, 3 to 14% of species assessed[33] will *likely* face very high risk of extinction[34] at global warming levels of 1.5°C, increasing up to 3 to 18% at 2°C, 3 to 29% at 3°C, 3 to 39% at 4°C, and 3 to 48% at 5°C. In ocean and coastal ecosystems, risk of biodiversity loss ranges between moderate and very high by 1.5°C global warming level and is moderate to very high by 2°C but with more ecosystems at high and very high risk (*high confidence*), and increases to high to very high across most ocean and coastal ecosystems by 3°C (*medium to high confidence*, depending on ecosystem). Very high extinction risk for endemic species in biodiversity hotspots is projected to at least double from 2% between 1.5°C and 2°C global warming levels and to increase at least tenfold if warming rises from 1.5°C to 3°C (*medium confidence*). (Figure SPM.3c, d, f) (2.4, 2.5, 3.4, 3.5, 12.3, 12.5, Table 12.6, 13.4, 13.10, 16.4, 16.6, CCP1.2, Figure CCP1.6, Figure CCP1.7, CCP5.3, CCP6.3, CCB PALEO)

B.4.2 Risks in physical water availability and water-related hazards will continue to increase by the mid- to long-term in all assessed regions, with greater risk at higher global warming levels (*high confidence*). At approximately 2°C global warming, snowmelt water availability for irrigation is projected to decline in some snowmelt dependent river basins by up to 20%, and global glacier mass loss of 18 ± 13% is projected to diminish water availability for agriculture, hydropower, and human settlements in the mid- to long-term, with these changes projected to double with 4°C global warming (*medium confidence*). In Small Islands, groundwater availability is threatened by climate change (*high confidence*). Changes to streamflow magnitude, timing and associated extremes are projected to adversely impact freshwater ecosystems in many watersheds by the mid- to long-term across all assessed scenarios (*medium confidence*). Projected increases in direct flood damages are higher by 1.4 to 2 times at 2°C and 2.5 to 3.9 times at 3°C compared to 1.5°C global warming without adaptation (*medium confidence*). At global warming of 4°C, approximately 10% of the global land area is projected to face increases in both extreme high and low river flows in the same location, with implications for planning for all water use sectors (*medium confidence*). Challenges for water management will be exacerbated in the near, mid and long term, depending on the magnitude, rate and regional details of future climate change and will be particularly challenging for regions with constrained resources for water management (*high confidence*). (2.3, 4.4, 4.5, Box 4.2, Figure 4.20, 15.3, CCP5.3, CCB DISASTER, SROCC 2.3)

B.4.3 Climate change will increasingly put pressure on food production and access, especially in vulnerable regions, undermining food security and nutrition (*high confidence*). Increases in frequency, intensity and severity of droughts, floods and heatwaves, and continued sea level rise will increase risks to food security (*high confidence*) in vulnerable regions from moderate to high between 1.5°C and 2°C global warming level, with no or low levels of adaptation (*medium confidence*). At 2°C or higher global warming level in the mid-term, food security risks due to climate change will be more severe, leading to malnutrition and micro-nutrient deficiencies, concentrated in Sub-Saharan Africa, South Asia, Central and South America and Small Islands (*high confidence*). Global warming will progressively weaken soil health and ecosystem services such as pollination, increase pressure from pests and diseases, and reduce marine animal biomass, undermining food productivity in many regions on land and in the ocean (*medium confidence*). At 3°C or higher global warming level in the long term, areas exposed to climate-related hazards will expand substantially compared with 2°C or lower global warming level (*high confidence*), exacerbating regional disparity in food security risks (*high confidence*). (Figure SPM.3) (1.1, 3.3, 4.5, 5.2, 5.4, 5.5, 5.8, 5.9, 5.12, 7.3, 8.3, 9.11, 13.5, 15.3, 16.5, 16.6, CCB MOVING PLATE, CCB SLR)

33 Number of species assessed are in the tens of thousands globally.

34 The term 'very high risk of extinction' is used here consistently with the IUCN categories and criteria and equates with 'critically endangered'.

B.4.4 Climate change and related extreme events will significantly increase ill health and premature deaths from the near- to long-term *(high confidence)*. Globally, population exposure to heatwaves will continue to increase with additional warming, with strong geographical differences in heat-related mortality without additional adaptation *(very high confidence)*. Climate-sensitive food-borne, water-borne, and vector-borne disease risks are projected to increase under all levels of warming without additional adaptation *(high confidence)*. In particular, dengue risk will increase with longer seasons and a wider geographic distribution in Asia, Europe, Central and South America and sub-Saharan Africa, potentially putting additional billions of people at risk by the end of the century *(high confidence)*. Mental health challenges, including anxiety and stress, are expected to increase under further global warming in all assessed regions, particularly for children, adolescents, elderly, and those with underlying health conditions *(very high confidence)*. (9.5, 5.12, Box 5.10, 7.3, Figure 7.9, 8.4, 9.10, Figure 9.32, Figure 9.35, 10.4, Figure 10.11, 11.3, 12.3, Figure 12.5, Figure 12.6, 13.7, Figure 13.23, Figure 13.24, 14.5, 15.3, CCP6.2)

B.4.5 Climate change risks to cities, settlements and key infrastructure will rise rapidly in the mid- and long-term with further global warming, especially in places already exposed to high temperatures, along coastlines, or with high vulnerabilities *(high confidence)*. Globally, population change in low-lying cities and settlements will lead to approximately a billion people projected to be at risk from coastal-specific climate hazards in the mid-term under all scenarios, including in Small Islands *(high confidence)*. The population potentially exposed to a 100-year coastal flood is projected to increase by about 20% if global mean sea level rises by 0.15 m relative to 2020 levels; this exposed population doubles at a 0.75 m rise in mean sea level and triples at 1.4 m without population change and additional adaptation *(medium confidence)*. Sea level rise poses an existential threat for some Small Islands and some low-lying coasts *(medium confidence)*. By 2100 the value of global assets within the future 1-in-100 year coastal floodplains is projected to be between US$7.9 and US$12.7 trillion (2011 value) under RCP4.5, rising to between US$8.8 and US$14.2 trillion under RCP8.5 *(medium confidence)*. Costs for maintenance and reconstruction of urban infrastructure, including building, transportation, and energy will increase with global warming level *(medium confidence)*, the associated functional disruptions are projected to be substantial particularly for cities, settlements and infrastructure located on permafrost in cold regions and on coasts *(high confidence)*. (6.2, 9.9, 10.4, 13.6, 13.10, 15.3, 16.5, CCP2.1, CCP2.2, CCP5.3, CCP6.2, CCB SLR, SROCC 2.3, SROCC CCB9)

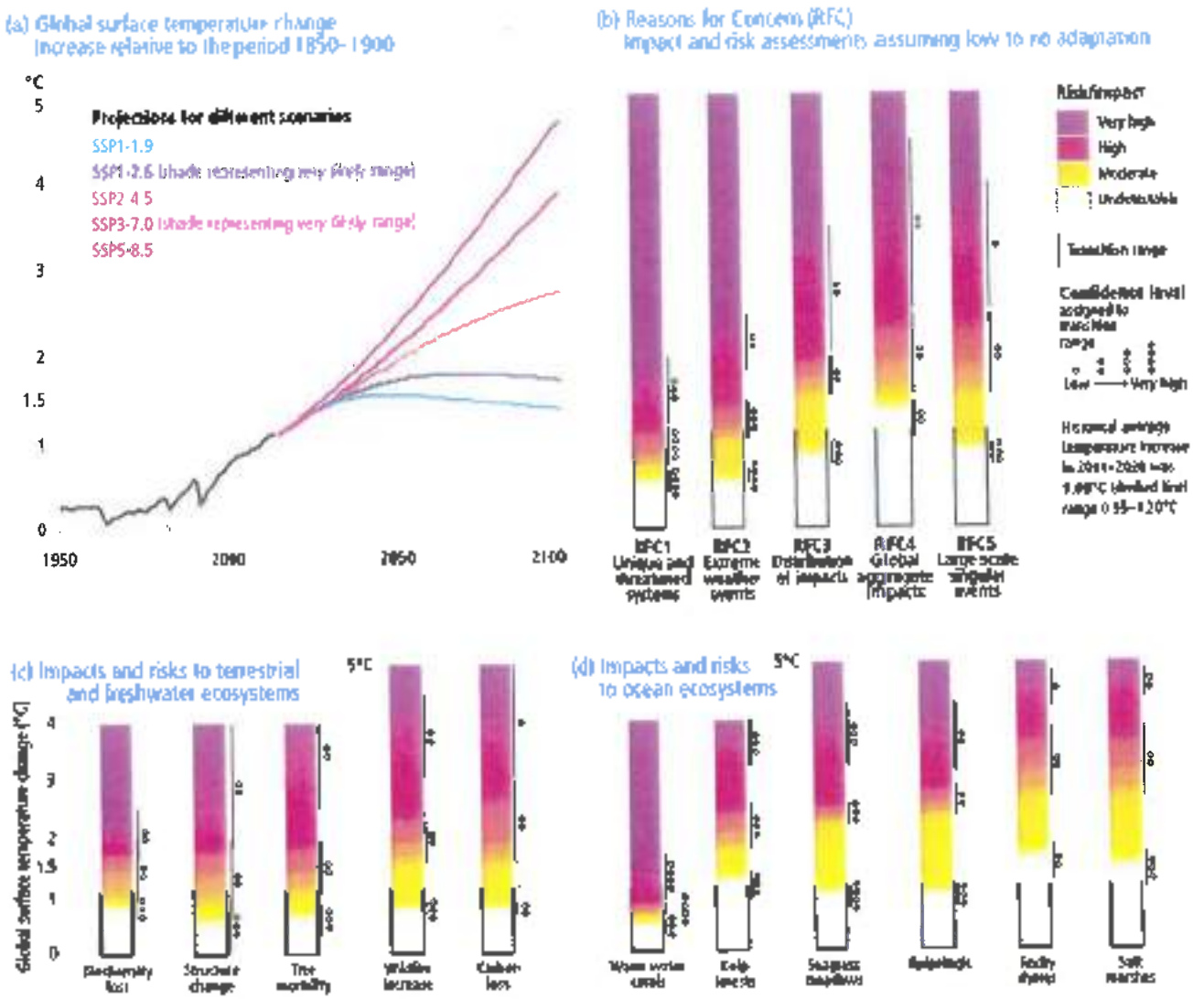
B.4.6 Projected estimates of global aggregate net economic damages generally increase non-linearly with global warming levels *(high confidence)*.[M] The wide range of global estimates, and the lack of comparability between methodologies, does not allow for identification of a robust range of estimates *(high confidence)*. The existence of higher estimates than assessed in AR5 indicates that global aggregate economic impacts could be higher than previous estimates *(low confidence)*.[M] Significant regional variation in aggregate economic damages from climate change is projected *(high confidence)* with estimated economic damages per capita for developing countries often higher as a fraction of income *(high confidence)*. Economic damages, including both those represented and those not represented in economic markets, are projected to be lower at 1.5°C than at 3°C or higher global warming levels *(high confidence)*. (8.4, 9.11, 11.5, 13.10, Box 14.6, 16.5, CWGB ECONOMIC)

B.4.7 In the mid- to long-term, displacement will increase with intensification of heavy precipitation and associated flooding, tropical cyclones, drought and, increasingly, sea level rise *(high confidence)*. At progressive levels of warming, involuntary migration from regions with high exposure and low adaptive capacity would occur *(medium confidence)*. Compared to other socioeconomic factors the influence of climate on conflict is assessed as relatively weak *(high confidence)*. Along long-term socioeconomic pathways that reduce non-climatic drivers, risk of violent conflict would decline *(medium confidence)*. At higher global warming levels, impacts of weather and climate extremes, particularly drought, by increasing vulnerability will increasingly affect violent intrastate conflict *(medium confidence)*. (TS B.7.4, 7.3, 16.5, CCB MIGRATE)

[M] The assessment found estimated rates of increase in projected global economic damages that were both greater than linear and less than linear as global warming level increases. There is evidence that some regions could benefit from low levels of warming *(high confidence)*. (CWGB ECONOMIC)

[M] *Low confidence* assigned due to the assessed lack of comparability and robustness of global aggregate economic damage estimates. (CWGB ECONOMIC)

Global and regional risks for increasing levels of global warming



* Mortality projections include demographic trends but do not include future effects on exposure or quality that influence ozone concentrations.

(f) Examples of regional key risks

Absence of risk diagrams does not imply absence of risks within a region. The development of synthetic diagrams for Small Islands, Asia and Central and South America was limited due to the paucity of adequately downscaled climate projections, with uncertainty in the direction of change, the diversity of climatologies and socioeconomic contexts across countries within a region, and the resulting low numbers of impact and risk projections for different warming levels.

The risks listed are of at least moderate confidence level

Small Islands
- Loss of terrestrial, marine and coastal biodiversity and ecosystem services
- Loss of lives and assets, risk to food security and economic disruptions due to destruction of settlements and infrastructure
- Economic decline and livelihood failure of fisheries, agriculture, tourism and from biodiversity loss from traditional agroecosystems
- Reduced habitability of rural and non-coastal islands leading to increased displacement
- Risk to water security in almost every small island

North America
- Climate-sensitive mental health outcomes, human mortality and morbidity due to increasing average temperature, weather and climate extremes, and compound climate hazards
- Risk of degradation of marine, coastal and terrestrial ecosystems, including loss of biodiversity, function, and provisioning services
- Risk to freshwater resources with consequences for ecosystems, reduced surface water availability for irrigated agriculture, other human uses, and degraded water quality
- Risk to food and nutritional security through changes in agriculture, livestock, farming, fisheries, and aquaculture productivity and access
- Risks to well-being, livelihoods and economic activities from cascading and compounding climate hazards, including risks to coastal cities, settlements and infrastructure from sea level rise

Europe
- Risks to people, economies and infrastructures due to coastal and inland flooding
- Stress and mortality to people due to increasing temperatures and heat extremes
- Marine and terrestrial ecosystems disruptions
- Water scarcity in multiple interconnected sectors
- Losses in crop production, due to compound heat and dry conditions, and extreme weather

Central and South America
- Risk to water security
- Severe health effects due to increasing epidemics, in particular vector-borne diseases
- Coral reef ecosystems degradation due to coral bleaching
- Risk to food security due to frequent/extreme droughts
- Damages to life and infrastructure due to floods, landslides, sea level rise, storm surges and coastal erosion

Australasia
- Degradation of tropical shallow coral reefs and associated biodiversity and ecosystem service values
- Loss of human and natural systems in low-lying coastal areas due to sea level rise
- Impact on livelihoods and incomes due to decline in agricultural production
- Increase in heat-related mortality and morbidity for people and wildlife
- Loss of alpine biodiversity in Australia due to less snow

Asia
- Urban infrastructure damage and impacts on human well-being and health due to flooding, especially in coastal cities and settlements
- Biodiversity loss and habitat shifts as well as associated disruptions in dependent human systems across freshwater, land, and ocean ecosystems
- More frequent, extensive coral bleaching and subsequent coral mortality induced by ocean warming and acidification, sea level rise, marine heat waves and resource extraction
- Decline in coastal fishery resources due to sea level rise, decrease in precipitation in some parts and increase in temperature
- Risk to food and water security due to increased temperature extremes, rainfall variability and drought

Africa
- Species extinction and reduction or irreversible loss of ecosystems and their services, including freshwater, land and ocean ecosystems
- Risk to food security, risk of malnutrition (micronutrient deficiency), and loss of livelihood due to reduced food production from crops, livestock and fisheries
- Risks to marine ecosystem health and to livelihoods in coastal communities
- Increased human mortality and morbidity due to increased heat and infectious diseases (including vector-borne and waterborne) diseases
- Reduced economic output and growth, and increased inequality and poverty rates
- Increased risk to water and energy security due to drought and heat

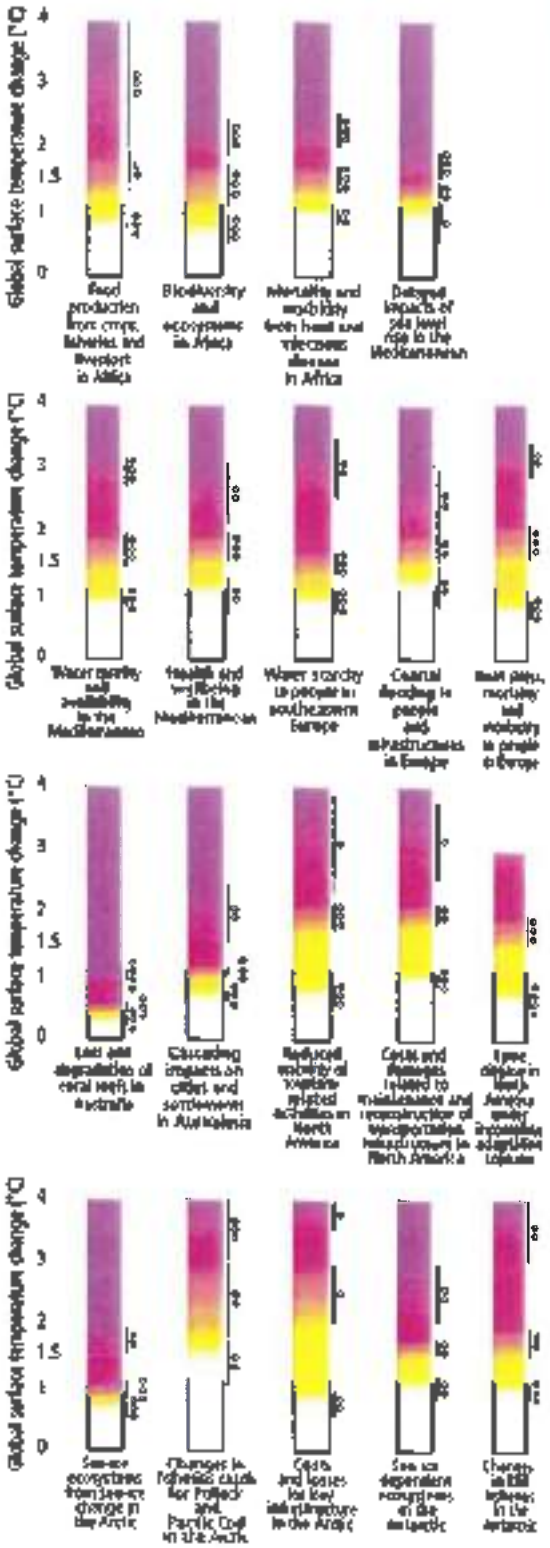


Figure SPM.3 | Synthetic diagrams of global and sectoral assessments and examples of regional key risks. Diagrams show the change in the levels of impacts and risks assessed for global warming of 0–5 °C global surface temperature change relative to pre-industrial period (1850–1900) over the range.

(a) Global surface temperature changes in °C relative to 1850–1900. These changes were obtained by combining CMIP6 model simulations with observational constraints based on past simulated warming, as well as an updated assessment of equilibrium climate sensitivity (Box SPM.1). Changes relative to 1850–1900 based on 20-year averaging periods are calculated by adding 0.85°C (the observed global surface temperature increase from 1850–1900 to 1995–2014) to simulated changes relative to 1995–2014. Very likely ranges are shown for SSP1-2.6 and SSP3-7.0 (WGI AR6 Figure SPM.8). Assessments were carried out on the global scale for (b1, b2), (c) and (d).

(b) The Reasons for Concern (RFC) framework communicates scientific understanding about accrual of risk for five broad categories. Diagrams are shown for each RFC, assuming low to no adaptation (i.e., adaptation is fragmented, localized and comprises incremental adjustments to existing practices). However, the transition to a very high risk level has an emphasis on irreversibility and adaptation limits. Undetectable risk level (white) indicates no attributed impacts are detectable and attributable to climate change; moderate risk (yellow) indicates attributed impacts are both detectable and attributable to climate change with at least medium confidence, also accounting for the other specific criteria for key risks; high risk (red) indicates severe and widespread impacts that are judged to be high on one or more criteria for assessing key risks, and very high risk level (purple) indicates very high risk of severe impacts and the presence of significant irreversibility or the persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks. The horizontal line denotes the present global warming of 1.09°C which is used to separate the observed, past impacts below the line from the future projected risks above it. RFC1: Unique and threatened systems: ecological and human systems that have restricted geographic ranges constrained by climate-related conditions and have high endemism or other distinctive properties. Examples include coral reefs, the Arctic and its indigenous Peoples, mountain glaciers and biodiversity hotspots. RFC2: Extreme weather events: risks/impacts to human health, livelihoods, assets and ecosystems from extreme weather events such as heatwaves, heavy rain, drought and associated wildfire, and coastal flooding. RFC3: Distribution of impacts: risks/impacts that disproportionately affect particular groups due to uneven distribution of physical climate-change hazards, exposure or vulnerability. RFC4: Global aggregate impacts: impacts to socio-ecological systems that can be aggregated globally into a single metric, such as monetary damages, thus affected species lost or ecosystem degradation at a global scale. RFC5: Large-scale singular events: relatively large, abrupt and sometimes irreversible changes in systems caused by global warming, such as ice sheet disintegration or thermohaline circulation slowing. Assessment methods are described in SM16.6 and are identical to AR5, but are enhanced by a structured approach to improve robustness and facilitate comparison between AR5 and AR6.

Risks for (c) terrestrial and freshwater ecosystems and (d) ocean ecosystems. For c) and d), diagrams shown for each risk assume low to no adaptation. The transition to a very high risk level has an emphasis on irreversibility and adaptation limits.

(e) Climate-sensitive human health outcomes under three scenarios of adaptation effectiveness. The assessed projections were based on a range of scenarios, including SRES, CMIP5, and ISIMIP, and, in some cases, demographic trends. The diagrams are truncated at the nearest whole °C within the range of temperature change in 2100 under those SSP scenarios in panel (b).

(f) Examples of regional key risks. Risks identified are of at least medium confidence level. Key risks are identified based on the magnitude of adverse consequences (pervasiveness of the consequences, degree of change, irreversibility of consequences, potential for impact thresholds or tipping points, potential for cascading effects beyond system boundaries); likelihood of adverse consequences; temporal characteristics of the risk; and ability to respond to the risk, e.g., by adaptation. The full set of 127 assessed global and regional key risks is given in SM16.7. Diagrams are provided for some risks. The development of synthetic diagrams for Small Islands, Asia and Central and South America were limited by the availability of adequately downscaled climate projections, with uncertainty in the direction of change, the diversity of climatologies and socioeconomic contexts across countries within a region, and the resulting low number of impact and risk projections for different warming levels. Absence of risks depicted does not imply absence of risks within a region. (Box SPM.1) (Figure TS.4, Figure 2.11, Figure SM2.1, Figure 7.9, Figure 9.6, Figure 11.4, Figure 13.28, 16.5, 16.6, Figure 16.15, SM16.3, SM16.4, SM16.5, SM16.6 (methodologies), SM16.7, Figure CCP4.9, Figure CCP4.10, Figure CCP6.5, WGI AR6 2, WGI AR6 SPM A.1.2, WGI AR6 Figure SPM.8)

Complex, Compound and Cascading Risks

B.5 **Climate change impacts and risks are becoming increasingly complex and more difficult to manage. Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions. Some responses to climate change result in new impacts and risks. (*high confidence*)** {1.3, 2.4, Box 2.2, Box 9.5, 11.5, 13.5, 14.6, Box 15.1, CCP1.2, CCP2.2, CCB COVID, CCB DISASTER, CCB INTERACT, CCB SAND, }

B.5.1 Concurrent and repeated climate hazards occur in all regions. Increasing impacts and risks to health, ecosystems, infrastructure, livelihoods and food (*high confidence*). Multiple risks interact, generating new sources of vulnerability to climate hazards, and compounding overall risk (*high confidence*). Increasing concurrence of heat and drought events are causing crop production losses and tree mortality (*high confidence*). Above 1.5°C global warming increasing concurrent climate extremes will increase risk of simultaneous crop losses of maize in major food-producing regions, with this risk increasing further with higher global warming levels (*medium confidence*). Future sea level rise combined with storm surge and heavy rainfall will increase compound flood risks (*high confidence*). Risks to health and food production will be made more severe from the interaction of sudden food production losses from heat and drought, exacerbated by heat-induced labour productivity losses (*high confidence*). These interacting impacts will increase food prices, reduce household incomes, and lead to health risks of malnutrition and climate-related mortality with no or low levels of adaptation, especially in tropical regions (*high confidence*). Risks to food safety from climate change will further compound the risks to health by increasing food contamination of crops from mycotoxins and contamination of seafood from harmful algal blooms, mycotoxins, and chemical contaminants (*high confidence*). (Figure TS.10c, 5.2, 5.4, 5.8, 5.9, 5.11, 5.12, 7.2, 7.3, 9.8, 9.11, 10.4, 11.3, 11.5, 12.3, 13.5, 14.5, 15.3, Box 15.1, 16.6, CCP1.2, CCP6.2, , WGI AR6 SPM A.3.1, WGI AR6 SPM A.3.2, WGI AR6 SPM C.2.7)

B.5.2 Adverse impacts from climate hazards and resulting risks are cascading across sectors and regions (*high confidence*), propagating impacts along coasts and urban centres (*medium confidence*) and in mountain regions (*high confidence*). These hazards and cascading risks also trigger tipping points in sensitive ecosystems and in significantly and rapidly changing social-ecological systems impacted by ice melt, permafrost thaw and changing hydrology in polar regions (*high confidence*). Wildfires, in many regions, have affected ecosystems and species, people and their built assets, economic activity, and health (*medium to high confidence*). In cities and

settlements, climate impacts to key infrastructure are leading to losses and damages across water and food systems, and affect economic activity, with impacts extending beyond the area directly impacted by the climate hazard (*high confidence*). In Amazonia, and in some mountain regions, cascading impacts from climatic (e.g., heat) and non-climatic stressors (e.g., land use change) will result in irreversible and severe losses of ecosystem services and biodiversity at 2°C global warming level and beyond (*medium confidence*). Unavoidable sea level rise will bring cascading and compounding impacts resulting in losses of coastal ecosystems and ecosystem services, groundwater salinisation, flooding and damages to coastal infrastructure that cascade into risks to livelihoods, settlements, health, well-being, food and water security, and cultural values in the near to long-term (*high confidence*). (Figure SPM.3) (Figure TS.10, 2.5, 3.4, 3.5, Box 7.3, Box 8.7, Box 9.4, 11.5, Box 11.1, 12.3, 13.9, 14.6, 15.9, 16.5, 16.6, CCP1.2, CCP2.2, CCP5.2, CCP5.3, CCP6.2, CCP6.3, Box CCP6.1, Box CCP6.2, CCB EXTREMES, WGI AR6 Figure SPM.8d)

B.5.3 Weather and climate extremes are causing economic and societal impacts across national boundaries through supply-chains, markets, and natural resource flows, with increasing transboundary risks projected across the water, energy and food sectors (*high confidence*). Supply chains that rely on specialized commodities and key infrastructure can be disrupted by weather and climate extreme events. Climate change causes the redistribution of marine fish stocks, increasing risk of transboundary management conflicts among fisheries users, and negatively affecting equitable distribution of food provisioning services as fish stocks shift from lower to higher latitude regions, thereby increasing the need for climate-informed transboundary management and cooperation (*high confidence*). Precipitation and water availability changes increases the risk of planned infrastructure projects, such as hydropower in some regions, having reduced productivity for food and energy sectors including across countries that share river basins (*medium confidence*). (Figure TS.10e-f, 3.4, 3.5, 4.5, 5.8, 5.13, 6.2, 9.4, Box 9.5, 14.5, Box 14.5, Box 14.6, CCP5.3, CCB DISASTER, CCB EXTREMES, CCB INTERES, CCB MOVING PLATE)

B.5.4 Risks arise from some responses that are intended to reduce the risks of climate change, including risks from maladaptation and adverse side effects of some emissions reduction and carbon dioxide removal measures (*high confidence*). Deployment of afforestation of naturally unforested land, or poorly implemented bioenergy, with or without carbon capture and storage, can compound climate-related risks to biodiversity, water and food security, and livelihoods, especially if implemented at large scales, especially in regions with insecure land tenure (*high confidence*). (Box 2.2, 4.1, 4.7, 5.13, Table 5.18, Box 9.3, Box 13.2, CCB NATURAL, CWGB BIOECONOMY)

B.5.5 Solar radiation modification approaches, if they were to be implemented, introduce a widespread range of new risks to people and ecosystems, which are not well understood (*high confidence*). Solar radiation modification approaches have potential to offset warming and ameliorate some climate hazards, but substantial residual climate change or overcompensating change would occur at regional scales and seasonal timescales (*high confidence*). Large uncertainties and knowledge gaps are associated with the potential of solar radiation modification approaches to reduce climate change risks. Solar radiation modification would not stop atmospheric CO_2 concentrations from increasing or reduce resulting ocean acidification under continued anthropogenic emissions (*high confidence*). (CWGB SRM)

Impacts of Temporary Overshoot

B.6 If global warming transiently exceeds 1.5°C in the coming decades or later (overshoot)[17], then many human and natural systems will face additional severe risks, compared to remaining below 1.5°C (*high confidence*). Depending on the magnitude and duration of overshoot, some impacts will cause release of additional greenhouse gases (*medium confidence*) and some will be irreversible, even if global warming is reduced (*high confidence*). (Box SPM.1, Figure SPM.3) (2.5, 3.4, 12.3, 16.6, CCB DEEP, CCB SLR)

B.6.1 While model-based assessments of the impacts of overshoot pathways are limited, observations and current understanding of processes permit assessment of impacts from overshoot. Additional warming, e.g., above 1.5°C during an overshoot period this century, will result in irreversible impacts on certain ecosystems with low resilience, such as polar, mountain, and coastal ecosystems, impacted by ice-sheet, glacier melt, or by accelerating and higher committed sea level rise (*high confidence*).[18] Risks to human systems will increase, including those to infrastructure, low-lying coastal settlements, some ecosystem-based adaptation measures, and associated livelihoods (*high confidence*), cultural and spiritual values (*medium confidence*). Projected impacts are less severe with shorter duration and lower levels of overshoot (*medium confidence*). (2.5, 3.4, 12.3, 13.2, 16.5, 16.6, CCP1.2, CCP2.2, CCP5.3, CCP6.1, CCP6.2, CCB SLR, WGI AR6 SPM B.5, WGII AR6 SPM C.3, SROCC 2.3, SROCC 5.4)

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17 In this report, overshoot pathways exceed 1.5°C global warming and then return to that level, or below, after several decades.

18 Despite limited evidence specifically on the impacts of a temporary overshoot of 1.5°C, a much broader evidence base from process understanding and the impacts of higher global warming levels allows a high confidence statement on the irreversibility of some impacts that would be incurred following such an overshoot.

B.6.2 Risk of severe impacts increase with every additional increment of global warming during overshoot *(high confidence)*. In high-carbon ecosystems (currently storing 3,000 to 4,000 GtC)[39] such impacts are already observed and are projected to increase with every additional increment of global warming, such as increased wildfires, mass mortality of trees, drying of peatlands, and thawing of permafrost, weakening natural land carbon sinks and increasing releases of greenhouse gases *(medium confidence)*. The resulting contribution to a potential amplification of global warming indicates that a return to a given global warming level or below would be more challenging *(medium confidence)*. (2.4, 2.5, CCP4.2, IGI ARS SPM B.4.3, SROCC 5.4)

C: Adaptation Measures and Enabling Conditions

Adaptation, in response to current climate change, is reducing climate risks and vulnerability mostly via adjustment of existing systems. Many adaptation options exist and are used to help manage projected climate change impacts, but their implementation depends upon the capacity and effectiveness of governance and decision-making processes. These and other enabling conditions can also support climate resilient development (Section D).

Current Adaptation and Its Benefits

C.1 Progress in adaptation planning and implementation has been observed across all sectors and regions, generating multiple benefits *(very high confidence)*. However, adaptation progress is unevenly distributed with observed adaptation gaps[40] *(high confidence)*. Many initiatives prioritize immediate and near-term climate risk reduction which reduces the opportunity for transformational adaptation *(high confidence)*. (2.6, 5.14, 7.4, 10.4, 12.5, 13.11, 14.7, 16.3, 17.3, CCP5.2, CCP5.4)

C.1.1 Adaptation planning and implementation have continued to increase across all regions *(very high confidence)*. Growing public and political awareness of climate impacts and risks has resulted in at least 170 countries and many cities including adaptation in their climate policies and planning processes *(high confidence)*. Decision support tools and climate services are increasingly being used *(very high confidence)*. Pilot projects and local experiments are being implemented in different sectors *(high confidence)*. Adaptation can generate multiple additional benefits such as improving agricultural productivity, innovation, health and well-being, food security, livelihood, and biodiversity conservation as well as reduction of risks and damages *(very high confidence)*. (1.4, 2.6, 3.5, 3.6, 4.7, 4.8, 5.4, 5.6, 5.10, 6.4, 7.4, 8.5, 9.3, 9.6, 10.4, 12.5, 13.11, 15.5, 16.3, 17.2, 17.3, 17.5, CCP5.4, CCB ADAPT, CCB NATURAL)

C.1.2 Despite progress, adaptation gaps exist between current levels of adaptation and levels needed to respond to impacts and reduce climate risks *(high confidence)*. Most observed adaptation is fragmented, small in scale, incremental, sector-specific, designed to respond to current impacts or near-term risks, and focused more on planning rather than implementation *(high confidence)*. Observed adaptation is unequally distributed across regions *(high confidence)*, and gaps are partially driven by widening disparities between the estimated costs of adaptation and documented finance allocated to adaptation *(high confidence)*. The largest adaptation gaps exist among lower income population groups *(high confidence)*. At current rates of adaptation planning and implementation the adaptation gap will continue to grow *(high confidence)*. As adaptation options often have long implementation times, long-term planning and accelerated implementation, particularly in the near decade, is important to close adaptation gaps, recognising that constraints remain for some regions *(high confidence)*. (1.1, 1.4, 5.6, 8.3, Figure 8.4, 7.4, 8.5, 10.4, 11.3, 11.7, 13.11, Box 13.1, 15.2, 15.5, 16.3, 16.5, Box 16.1, Figure 16.4, Figure 16.5, 17.4, 18.2, CCP2.4, CCP5.4, CCB FINANCE, CCB SLR)

[39] At the global scale, terrestrial ecosystems currently remove more carbon from the atmosphere (3.4 ± 0.9 Gt yr⁻¹ than they emit (+1.6 ± 0.7 Gt yr⁻¹), a net sink of −1.8 ± 1.1 Gt yr⁻¹. However, recent climate change has shifted some systems to some regions from being net carbon sinks to net carbon sources.

[40] Adaptation gaps are defined as the difference between actually implemented adaptation and a societally set goal, as measured largely by preferences related to historical climate change impacts and reflecting resource limitations and competing priorities.

Future Adaptation Options and their Feasibility

C.2 **There are feasible[41] and effective[42] adaptation options which can reduce risks to people and nature. The feasibility of implementing adaptation options in the near-term differs across sectors and regions *(very high confidence)*. The effectiveness of adaptation to reduce climate risk is documented for specific contexts, sectors and regions *(high confidence)* and will decrease with increasing warming *(high confidence)*. Integrated, multi-sectoral solutions that address social inequities, differentiate responses based on climate risk and cut across systems, increase the feasibility and effectiveness of adaptation in multiple sectors *(high confidence)*. (Figure SPM.4) (Figure TS.6a, 1.4, 3.6, 4.7, 5.12, 6.3, 7.4, 11.3, 11.7, 13.2, 15.5, 17.6, CCP2.3, CCB FEASIB)**

Land, Ocean and Ecosystem Transition

C.2.1 **Adaptation to water-related risks and impacts make up the majority of all documented adaptation *(high confidence)*. For inland flooding, combinations of non-structural measures like early warning systems and structural measures like levees have reduced loss of lives *(medium confidence)*. Enhancing natural water retention such as by restoring wetlands and rivers, land use planning such as no build zones or upstream forest management, can further reduce flood risk *(medium confidence)*. On-farm water management, water storage, soil moisture conservation and irrigation are some of the most common adaptation responses and provide economic, institutional or ecological benefits and reduce vulnerability *(high confidence)*. Irrigation is effective in reducing drought risk and climate impacts in many regions and has several livelihood benefits, but needs appropriate management to avoid potential adverse outcomes, which can include accelerated depletion of groundwater and other water sources and increased soil salinization *(medium confidence)*. Large scale irrigation can also alter local to regional temperature and precipitation patterns *(high confidence)*, including both alleviating and exacerbating temperature extremes *(medium confidence)*. The effectiveness of most water-related adaptation options to reduce projected risks declines with increasing warming *(high confidence)*. (4.1, 4.6, 4.7, Box 4.3, Box 4.6, Box 4.7, Figure 4.22, Figure 4.28, Figure 4.29, Table 4.9, 9.3, 9.7, 11.3, 12.5, 13.1, 13.2, 16.3, CCP5.4)**

C.2.2 **Effective adaptation options, together with supportive public policies enhance food availability and stability and reduce climate risk for food systems while increasing their sustainability *(medium confidence)*. Effective options include cultivar improvements, agroforestry, community-based adaptation, farm and landscape diversification, and urban agriculture *(high confidence)*. Institutional feasibility, adaptation limits of crops and cost effectiveness also influence the effectiveness of the adaptation options *(limited evidence, medium agreement)*. Agroecological principles and practices, ecosystem-based management in fisheries and aquaculture, and other approaches that work with natural processes support food security, nutrition, health and well-being, livelihoods and biodiversity, sustainability and ecosystem services *(high confidence)*. These services include pest control, pollination, buffering of temperature extremes, and carbon sequestration and storage *(high confidence)*. Trade-offs and barriers associated with such approaches include costs of establishment, access to inputs and viable markets, new knowledge and management *(high confidence)* and their potential effectiveness varies by socioeconomic context, ecosystem zone, species combinations and institutional support *(medium confidence)*. Integrated, multi-sectoral solutions that address social inequities and differentiate responses based on climate risk and local situation will enhance food security and nutrition *(high confidence)*. Adaptation strategies which reduce food loss and waste or support balanced diets[43] (as described in the IPCC Special Report on Climate Change and Land) contribute to nutrition, health, biodiversity and other environmental benefits *(high confidence)*. (3.2, 4.7, 4.6, Box 4.3, 5.4, 5.5, 5.6, 5.8, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14, Box 5.10, Box 5.13, 6.3, 7.4, 10.4, 12.5, 13.5, 13.10, 14.5, CCP5.4, CCB FEASIB, CCB HEALTH, CCB MOVING PLATE, CCB NATURAL, CWGB BIOECONOMY)**

C.2.3 **Adaptation for natural forests[44] includes conservation, protection and restoration measures. In managed forests[45], adaptation options include sustainable forest management, diversifying and adjusting tree species compositions to build resilience, and managing increased risks from pests and diseases and wildfires. Restoring natural forests and drained peatlands and improving sustainability of managed forests, generally enhances the resilience of carbon stocks and sinks. Cooperation, and inclusive decision making, with local communities and Indigenous Peoples, as well as recognition of inherent rights of Indigenous Peoples, is integral to successful forest adaptation in many areas. (high confidence) (2.6, Box 2.2, 5.6, 5.13, Table 5.23, 11.4, 12.5, 13.5, Box 14.1, Box 14.2, CCP7.5, Box CCP7.1, CCB FEASIB, CCB RKDG, CCB NATURAL)**

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41 In this report, feasibility refers to the potential for a mitigation or adaptation option to be implemented. Factors influencing feasibility are context-dependent, temporally dynamic, and may vary between different groups and actors. Feasibility depends on geophysical, environmental-ecological, technological, economic, socio-cultural, and institutional factors that enable or constrain the implementation of an option. The feasibility of options may change when different options are combined and increases when enabling conditions are strengthened.

42 Effectiveness refers to the extent to which an adaptation option is anticipated or observed to reduce climate-related risk.

43 In this report, the term natural forests describes those which are subject to little or no direct human intervention, whereas the term managed forests describes those where planting or other management activities take place, including those managed for commodity production.

(a) Diverse feasible climate responses and adaptation options exist to respond to Representative Key Risks of climate change, with varying synergies with mitigation

Multidimensional feasibility and synergies with mitigation of climate responses and adaptation options relevant in the near-term, at global scale and up to 1.5°C of global warming

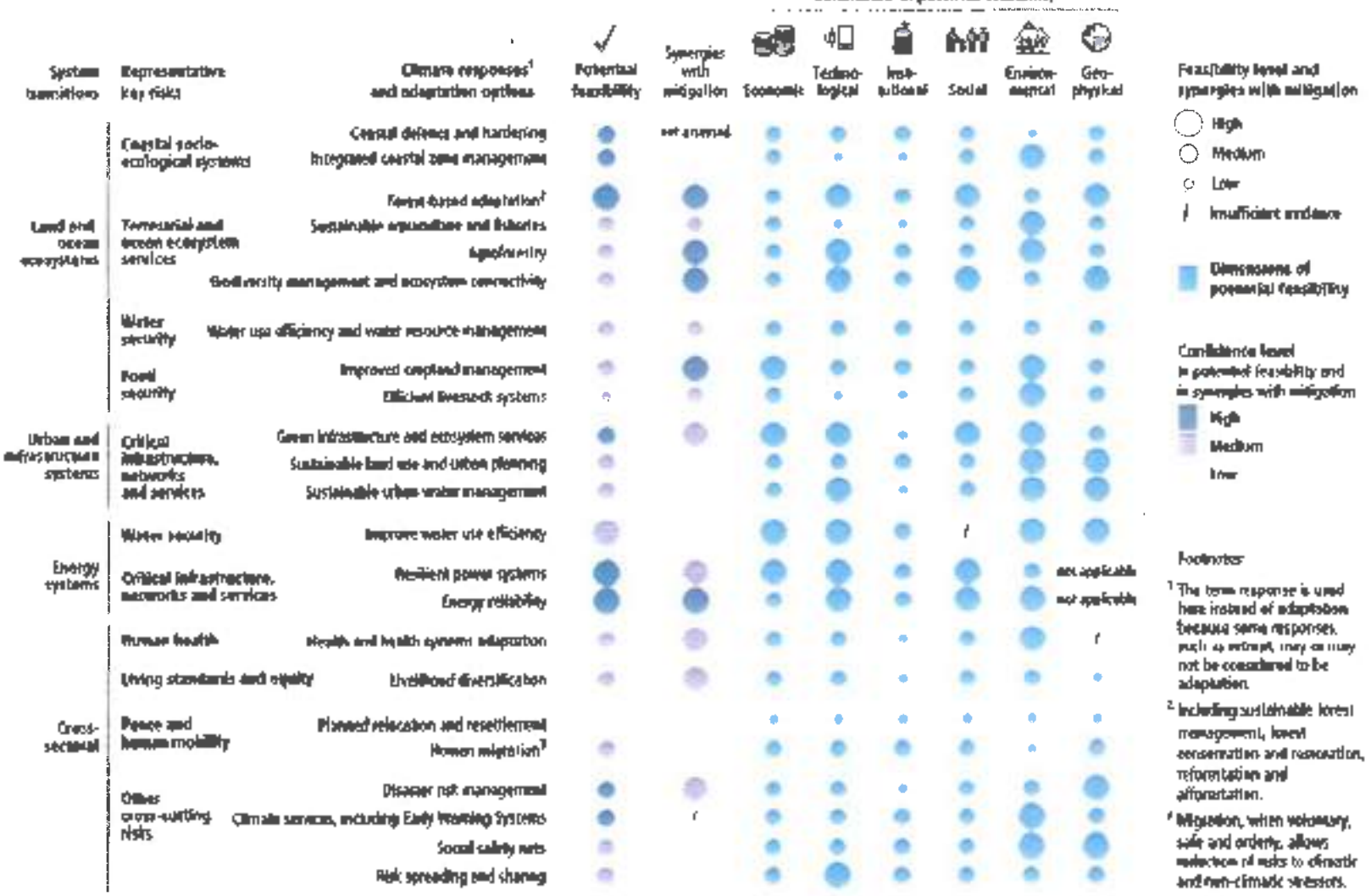
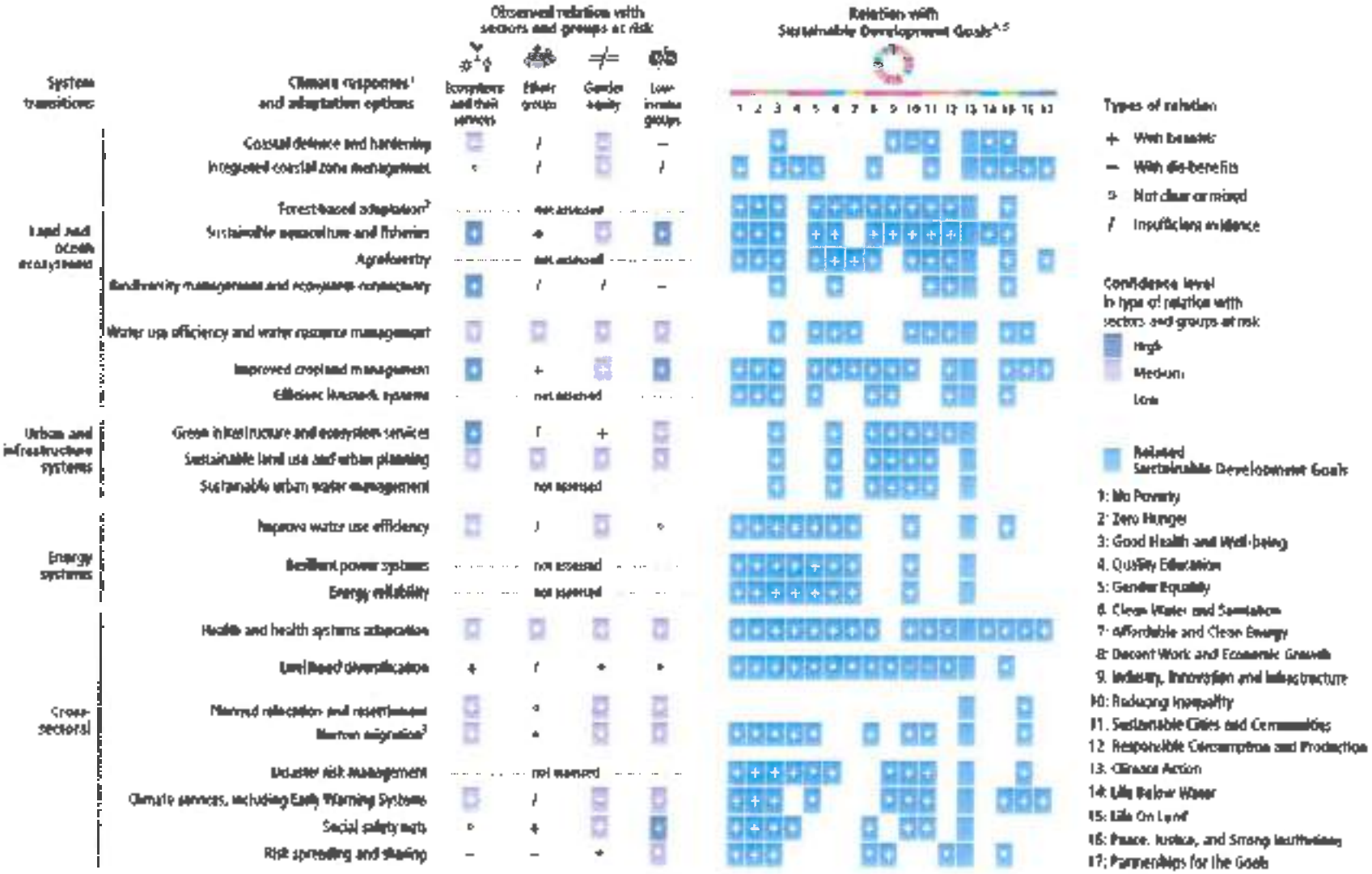


Figure SPM.8 | (a) Climate responses and adaptation options, organized by System Transitions and Representative Key Risks (RKRs), are assessed for their multidimensional feasibility at global scale, in the near-term and up to 1.5°C global warming. As literature above 1.5°C is limited, feasibility at higher levels of warming may change, which is currently not possible to assess robustly. Climate responses and adaptation options at global scale are drawn from a set of options assessed in AR6 that have robust evidence across the feasibility dimensions. This figure shows the six feasibility dimensions (economic, technological, institutional, social, environmental and geophysical) that are used to calculate the potential feasibility of climate responses and adaptation options, along with their synergies with mitigation. For potential feasibility and feasibility dimensions, the figure shows high, medium, or low feasibility. Synergies with mitigation are classified as high, medium, and low. Insufficient evidence is denoted by a dash. [CCB WGIII AR6, Table SM.CCB.6(A+B).1.1, SR1.5 4.5(SM.4.2)]

(b) Climate responses and adaptation options have benefits for ecosystems, ethnic groups, gender equity, low-income groups and the Sustainable Development Goals

Relations of sectors and groups at risk (as observed) and the SDGs (relevant in the near-term, at global scale and up to 1.5°C of global warming) with climate responses and adaptation options



Footnotes: [1] The same response is used here instead of adaptation because some responses, such as retreat, may or may not be considered to be adaptation. [2] Including sustainable forest management, forest conservation and restoration, reforestation and afforestation. [3] Migration, when voluntary, safe and orderly, allows reduction of risks to climate and non-climate stressors. [4] The Sustainable Development Goals (SDGs) are integrated and indivisible, and efforts to achieve any goal in isolation may trigger synergies or trade-offs with other SDGs. [5] Relevant in the near-term, at global scale and up to 1.5°C of global warming.

Figure SPM.4 | (b) Climate responses and adaptation options, organized by System Transitions and Representative Key Risks, are assessed at global scale for their likely ability to reduce risks for ecosystems and social groups at risk, as well as their relation with the 17 Sustainable Development Goals (SDGs). Climate responses and adaptation options are assessed for observed benefits (+) to ecosystems and their services, ethnic groups, gender equity, and low-income groups, or observed dis-benefits (-) for these systems and groups. Where there is highly diverging evidence of benefits/ dis-benefits across the scientific literature, e.g., based on differences between regions, it is shown as not clear or mixed (+). Insufficient evidence is shown by a dash. The relation with the SDGs is assessed as having benefits (+), dis-benefits (-) or not clear or mixed (+) based on the impacts of the climate response and adaptation option on each SDG. Areas not coloured indicate there is no evidence of a relation or no interaction with the respective SDG. The climate responses and adaptation options are drawn from two assessments. For compatibility of climate responses and adaptation options see Table SM17.5. [17.2, 17.5, CCB FEASIB]

C.2.4 Conservation, protection and restoration of terrestrial, freshwater, coastal and ocean ecosystems, together with targeted management to adapt to unavoidable impacts of climate change, reduces the vulnerability of biodiversity to climate change (*high confidence*). The resilience of species, biological communities and ecosystem processes increases with size of natural area, by restoration of degraded areas and by reducing non-climatic stressors (*high confidence*). To be effective, conservation and restoration actions will increasingly need to be responsive, as appropriate, to ongoing changes at various scales, and plan for future changes in ecosystem structure, community composition and species' distributions, especially as 1.5°C global warming is approached and even more so if it is exceeded (*high confidence*). Adaptation options, where circumstances allow, include facilitating the movement of species to new ecologically appropriate locations, particularly through increasing connectivity between conserved or protected areas, targeted intensive management for vulnerable species and protecting refugial areas where species can survive locally (*medium confidence*). [2.3, 2.6, Figure 2.1, Table 2.6, 3.3, 3.6, Box 3.4, 4.6, Box 4.6, Box 11.2, 12.3, 12.5, 13.4, 14.7, CCP5.4, CCB FEASIB]

C.2.5 Effective Ecosystem-based Adaptation[44] reduces a range of climate change risks to people, biodiversity and ecosystem services with multiple co-benefits (*high confidence*). Ecosystem-based Adaptation is vulnerable to climate change impacts, with effectiveness declining with increasing global warming (*high confidence*). Urban greening using trees and other vegetation can provide local cooling (*very high confidence*). Natural river systems, wetlands and upstream forest ecosystems reduce flood risk by storing water and slowing water flows, in most circumstances (*high confidence*). Coastal wetlands protect against coastal erosion and flooding associated with storms and sea level rise where sufficient space and adequate habitats are available until rates of sea level rise exceeds natural adaptive capacity to build sediment (*very high confidence*). [2.4, 2.5, 2.6, Table 2.7, 3.4, 3.5, 3.6, Figure 3.26, 4.6, Box 4.8, Box 4.7, 5.5, 5.14, Box 5.11, 6.3, 6.4, Figure 6.6, 7.4, 8.5, 8.6, 9.6, 9.8, 9.9, 10.2, 11.3, 12.5, 13.3, 13.4, 13.5, 14.5, Box 14.7, 16.3, 18.3, CCP5.4, CCB FEASIB.3, CCB HEALTH, CCB MOVING PLATE, CCB NATURAL, CWGB BIOECONOMY]

Urban, Rural and Infrastructure Transition

C.2.6 Considering climate change impacts and risks in the design and planning of urban and rural settlements and infrastructure is critical for resilience and enhancing human well-being (*high confidence*). The urgent provision of basic services, infrastructure, livelihood diversification and employment, strengthening of local and regional food systems and community-based adaptation enhance lives and livelihoods, particularly of low-income and marginalised groups (*high confidence*). Inclusive, integrated and long-term planning at local, municipal, sub-national and national scales, together with effective regulation and monitoring systems and financial and technological resources and capabilities foster urban and rural system transition (*high confidence*). Effective partnerships between governments, civil society, and private sector organizations, across scales provide infrastructure and services in ways that enhance the adaptive capacity of vulnerable people (*medium to high confidence*). [5.12, 5.13, 5.14, 6.3, 6.4, Box 6.3, Box 6.6, Table 6.6, 7.4, 12.5, 13.6, 14.5, Box 16.4, Box 17.4, CCP2.3, CCP2.4, CCP5.4, CCB FEASIB]

C.2.7 An increasing number of adaptation responses exist for urban systems, but their feasibility and effectiveness is constrained by institutional, financial, and technological access and capacity, and depends on coordinated and contextually appropriate responses across physical, natural and social infrastructure (*high confidence*). Globally, more financing is directed at physical infrastructure than natural and social infrastructure (*medium confidence*) and there is *limited* evidence of investment in the informal settlements hosting the most vulnerable urban residents (*medium to high confidence*). Ecosystem-based adaptation (e.g., urban agriculture and forestry, river restoration) has increasingly been applied in urban areas (*high confidence*). Combined ecosystem-based and structural adaptation responses are being developed, and there is growing evidence of their potential to reduce adaptation costs and contribute to flood control, sanitation, water resources management, landslide prevention and coastal protection (*medium confidence*). [3.6, Box 4.6, 5.12, 6.3, 6.4, Table 6.8, 7.4, 9.7, 9.9, 10.4, Table 10.3, 11.3, 11.7, Box 11.6, 12.5, 13.2, 13.3, 13.6, 14.5, 15.5, 17.2, Box 17.4, CCP2.3, CCP 3.2, CCP5.4, CCB FEASIB, CCB SLR, SROCC SPM]

[44] Ecosystem based Adaptation (EbA) is recognized internationally under the Convention on Biological Diversity (CBD 14/5). A related concept is nature-based solutions (NbS), which includes a broader range of approaches with safeguards, including those that contribute to adaptation and mitigation. The term 'nature-based solutions' is widely but not universally used in the scientific literature. The term is the subject of ongoing debate, with concerns that it may lead to the misunderstanding that NbS on its own can provide a global solution to climate change.

C.2.8 Sea level rise poses a distinctive and severe adaptation challenge as it implies dealing with slow onset changes and increased frequency and magnitude of extreme sea level events which will escalate in the coming decades (*high confidence*). Such adaptation challenges would occur much earlier under high rates of sea level rise, in particular if low-likelihood, high impact outcomes associated with collapsing ice sheets occur (*high confidence*). Responses[45] to ongoing sea level rise and land subsidence in low-lying coastal cities and settlements and small islands include protection, accommodation, advance and planned relocation (*high confidence*)[46]. These responses are more effective if combined and/or sequenced, planned well ahead, aligned with socio-cultural values and development priorities, and underpinned by inclusive community engagement processes (*high confidence*). {6.2, 10.4, 11.7, Box 11.6, 13.2, 14.5, 15.5, CCP2.3, CCB SLR, WGI AR6 SPM B.5, WGI AR6 SPM C.3, SROCC SPM C3.2}

C.2.9 Approximately 3.4 billion people globally live in rural areas around the world, and many are highly vulnerable to climate change. Integrating climate adaptation into social protection programs, including cash transfers and public works programmes, is highly feasible and increases resilience to climate change, especially when supported by basic services and infrastructure. Social safety nets are increasingly being reconfigured to build adaptive capacities of the most vulnerable in rural and also urban communities. Social safety nets that support climate change adaptation have strong co-benefits with development goals such as education, poverty alleviation, gender inclusion and food security. (*high confidence*) {5.14, 9.4, 9.10, 9.11, 12.5, 14.5, CCP5.4, CCB FEASIB, CCB GENDER}

Energy System Transition

C.2.10 Within energy system transitions, the most feasible adaptation options support infrastructure resilience, reliable power systems and efficient water use for existing and new energy generation systems (*very high confidence*). Energy generation diversification, including with renewable energy resources and generation that can be decentralised depending on context (e.g., wind, solar, small scale hydroelectric) and demand side management (e.g., storage, and energy efficiency improvements) can reduce vulnerabilities to climate change, especially in rural populations (*high confidence*). Adaptations for hydropower and thermo-electric power generation are effective in most regions up to 1.5°C to 2°C, with decreasing effectiveness at higher levels of warming (*medium confidence*). Climate responsive energy markets, updated design standards on energy assets according to current and projected climate change, smart-grid technologies, robust transmission systems and improved capacity to respond to supply deficits have high feasibility in the medium- to long-term, with mitigation co-benefits (*very high confidence*). {4.6, 4.7, Figure 4.28, Figure 4.29, 10.4, Table 11.8, 13.6, Figure 13.16, Figure 13.19, 15.3, CCP5.2, CCP5.4, CCB FEASIB, CWGIII BIOECONOMY}

Cross-cutting Options

C.2.11 Strengthening the climate resiliency of health systems will protect and promote human health and well-being (*high confidence*). There are multiple opportunities for targeted investments and finance to protect against exposure to climate hazards, particularly for those at highest risk. Heat Health Action Plans that include early warning and response systems are effective adaptation options for extreme heat (*high confidence*). Effective adaptation options for water-borne and food-borne diseases include improving access to potable water, reducing exposure of water and sanitation systems to flooding and extreme weather events, and improved early warning systems (*very high confidence*). For vector-borne diseases, effective adaptation options include surveillance, early warning systems, and vaccine development (*very high confidence*). Effective adaptation options for reducing mental health risks under climate change include improving surveillance, access to mental health care, and monitoring of psychosocial impacts from extreme weather events (*high confidence*). Health and well-being would benefit from integrated adaptation approaches that mainstream health into food, livelihoods, social protection, infrastructure, water and sanitation policies requiring collaboration and coordination at all scales of governance (*very high confidence*). {5.12, 6.3, 7.4, 9.10, Box 9.7, 11.3, 12.5, 13.7, 14.5, CCB COVID, CCB FEASIB, CCB ILLNESS}

C.2.12 Increasing adaptive capacities minimises the negative impacts of climate-related displacement and involuntary migration for migrants and sending and receiving areas (*high confidence*). This improves the degree of choice under which migration decisions are made, ensuring safe and orderly movements of people within and between countries (*high confidence*). Some development reduces underlying vulnerabilities associated with conflict, and adaptation contributes by reducing the impacts of climate change on climate sensitive drivers of conflict (*high confidence*). Risks to peace are reduced, for example, by supporting people in climate-sensitive economic activities (*medium confidence*) and advancing women's empowerment (*high confidence*). {7.4, Box 9.8, Box 10.2, 12.5, CCB FEASIB, CCB MIGRATE}

45 The term 'response' is used here instead of adaptation because some responses, such as retreat, may or may not be considered to be adaptation.

C.2.13 There are a range of adaptation options, such as disaster risk management, early warning systems, climate services and risk spreading and sharing that have broad applicability across sectors and provide greater benefits to other adaptation options when combined (*high confidence*). For example, climate services that are inclusive of different users and providers can improve agricultural practices, inform better water use and efficiency, and enable resilient infrastructure planning (*high confidence*). (2.6, 3.6, 4.7, 5.4, 5.5, 5.6, 5.8, 5.9, 5.12, 5.14, 9.4, 9.8, 10.4, 12.5, 13.11, CCP5.4, CCB FEASIB, CCB MOVING PLATE)

Limits to Adaptation

C.3 Soft limits to some human adaptation have been reached, but can be overcome by addressing a range of constraints, primarily financial, governance, institutional and policy constraints (*high confidence*). Hard limits to adaptation have been reached in some ecosystems (*high confidence*). With increasing global warming, losses and damages will increase and additional human and natural systems will reach adaptation limits (*high confidence*). (Figure TS.7, 1.4, 2.6, 2.5, 2.6, 3.4, 3.6, 4.7, Figure 4.30, 5.5, Table 8.6, Box 10.7, 11.7, Table 11.16, 12.5, 13.2, 13.5, 13.6, 13.10, 13.11, Figure 13.21, 14.5, 15.6, 16.4, Figure 16.8, Table 16.9, Table 16.8, CCP1.2, CCP1.3, CCP2.3, CCP3.3, CCP5.2, CCP5.4, CCP6.3, CCP7.3, CCB SLR)

C.3.1 Soft limits to some human adaptation have been reached, but can be overcome by addressing a range of constraints, which primarily consist of financial, governance, institutional and policy constraints (*high confidence*). For example, individuals and households in low-lying coastal areas in Australasia and Small Islands and smallholder farmers in Central and South America, Africa, Europe and Asia have reached soft limits (*medium confidence*). Inequity and poverty also constrain adaptation, leading to soft limits and resulting in disproportionate exposure and impacts for most vulnerable groups (*high confidence*). Lack of climate literacy[46] at all levels and limited availability of information and data pose further constraints to adaptation planning and implementation (*medium confidence*). (1.4, 4.7, 5.4, 8.4, Table 8.6, 9.1, 9.4, 9.5, 9.8, 11.7, 12.5 13.5, 15.3, 15.5, 15.6, 16.4, Box 16.1, Figure 16.8, CCP5.2, CCP5.4, CCP6.3)

C.3.2 Financial constraints are important determinants of soft limits to adaptation across sectors and all regions (*high confidence*). Although global tracked climate finance has shown an upward trend since AR5, current global financial flows for adaptation, including from public and private finance sources, are insufficient for and constrain implementation of adaptation options especially in developing countries (*high confidence*). The overwhelming majority of global tracked climate finance was targeted to mitigation while a small proportion was targeted to adaptation (*very high confidence*). Adaptation finance has come predominantly from public sources (*very high confidence*). Adverse climate impacts can reduce the availability of financial resources by incurring losses and damages and through impeding national economic growth, thereby further increasing financial constraints for adaptation, particularly for developing and least developed countries (*medium confidence*). (Figure TS.7, 1.4, 2.6, 3.6, 4.7, Figure 4.30, 5.14, 7.4, 8.4, Table 8.6, 9.4, 9.9, 9.11, 10.5, 12.5, 13.3, 13.11, Box 14.4, 15.6, 16.2, 16.4, Figure 16.8, Table 16.4, 17.4, 18.1, CCP2.4, CCP5.4, CCP6.3, CCB FINANCE)

C.3.3 Many natural systems are near the hard limits of their natural adaptation capacity and additional systems will reach limits with increasing global warming (*high confidence*). Ecosystems already reaching or surpassing hard adaptation limits include some warm-water coral reefs, some coastal wetlands, some rainforests, and some polar and mountain ecosystems (*high confidence*). Above 1.5°C global warming level, some Ecosystem-based Adaptation measures will lose their effectiveness in providing benefits to people as these ecosystems will reach hard adaptation limits (*high confidence*). (Figure SPM.4) (1.4, 2.4, 2.6, 3.4, 3.6, 9.6, Box 13.2, 13.4, 14.5, 15.5, 16.4, 16.6, 17.2, CCP1.2, CCP5.2, CCP6.3, CCP7.3, CCB SLR)

C.3.4 In human systems, some coastal settlements face soft adaptation limits due to technical and financial difficulties of implementing coastal protection (*high confidence*). Above 1.5°C global warming level, limited freshwater resources pose potential hard limits for Small Islands and for regions dependent on glacier and snow-melt (*medium confidence*). By 2°C global warming level, soft limits are projected for multiple staple crops in many growing areas, particularly in tropical regions (*high confidence*). By 3°C global warming level, soft limits are projected for some water management measures for many regions, with hard limits projected for parts of Europe (*medium confidence*). Transitioning from incremental to transformational adaptation can help overcome soft adaptation limits (*high confidence*). (1.4, 4.7, 5.4, 5.8, 7.2, 7.3, 8.4, Table 8.6, 9.6, 10.4, 12.5, 13.2, 13.6, 16.4, 17.2, CCP1.3, Box CCP1.1, CCP2.3, CCP3.3, CCP4.4, CCP5.3, CCB SLR)

C.3.5 Adaptation does not prevent all losses and damages, even with effective adaptation and before reaching soft and hard limits. Losses and damages are unequally distributed across systems, regions and sectors and are not comprehensively addressed by current financial, governance and institutional arrangements, particularly in vulnerable developing countries. With increasing global warming, losses and damages increase and become increasingly difficult to avoid, while strongly concentrated among the poorest vulnerable populations. (*high confidence*) (1.4, 2.6, 3.4, 3.6, 6.3, Figure 6.4, 8.4, 13.2, 13.7, 13.10, 17.2, CCP2.3, CCP4.4, CCB LOSS, CCB SLR, CWGB ECONOMIC)

46 Climate literacy encompasses being aware of climate change, its anthropogenic causes and implications.

Avoiding Maladaptation

C.4 There is increased evidence of maladaptation[47] across many sectors and regions since the AR5. Maladaptive responses to climate change can create *lock-ins* of vulnerability, exposure and risks that are difficult and expensive to change and exacerbate existing inequalities. Maladaptation can be avoided by flexible, multi-sectoral, inclusive and long-term planning and implementation of adaptation actions with benefits to many sectors and systems. *(high confidence)* {1.3, 1.4, 2.6, Box 2.2, 3.2, 3.6, 4.6, 4.7, Box 4.3, Box 4.5, Figure 4.29, 5.6, 5.13, 8.2, 8.3, 8.4, 8.6, 9.6, 9.7, 9.8, 9.9, 9.10, 9.11, Box 9.5, Box 9.6, Box 9.9, Box 11.6, 13.11, 13.3, 13.4, 13.5, 14.5, 15.5, 15.6, 16.5, 17.2, 17.3, 17.4, 17.5, 17.6, CCP2.3, CCP2.3, CCP5.4, CCB DEEP, CCB NATURAL, CCB SLR, CWGB BIOECONOMY}

C.4.1 Actions that focus on sectors and risks in isolation and on short-term gains often lead to maladaptation if long-term impacts of the adaptation option and long-term adaptation commitments are not taken into account *(high confidence)*. The implementation of these maladaptive actions can result in infrastructure and institutions that are inflexible and/or expensive to change *(high confidence)*. For example, seawalls effectively reduce impacts to people and assets in the short-term but can also result in lock-ins and increase exposure to climate risks in the long-term unless they are integrated into a long-term adaptive plan *(high confidence)*. Adaptation integrated with development reduces lock-ins and creates opportunities (e.g., infrastructure upgrading) *(medium confidence)*. {1.4, 3.4, 3.6, 10.4, 11.7, Box 11.6, 13.2, 17.2, 17.5, 17.6, CCP 2.3, CCB DEEP, CCB SLR}

C.4.2 Biodiversity and ecosystem resilience to climate change are decreased by maladaptive actions, which also constrain ecosystem services. Examples of these maladaptive actions for ecosystems include fire suppression in naturally fire-adapted ecosystems or hard defences against flooding. These actions reduce space for natural processes and represent a severe form of maladaptation for the ecosystems they degrade, replace or fragment, thereby reducing their resilience to climate change and the ability to provide ecosystem services for adaptation. Considering biodiversity and autonomous adaptation in long-term planning processes reduces the risk of maladaptation. *(high confidence)* {2.4, 2.6, Table 2.7, 3.4, 3.6, 4.7, 5.6, 5.13, Table 5.21, Table 5.23, Box 9.1.2, 13.2, Box 13.2, 17.2, 17.5, CCP5.4}

C.4.3 Maladaptation especially affects marginalised and vulnerable groups adversely (e.g., Indigenous Peoples, ethnic minorities, low-income households, informal settlements), reinforcing and entrenching existing inequities. Adaptation planning and implementation that do not consider adverse outcomes for different groups can lead to maladaptation, increasing exposure to risks, marginalising people from certain socioeconomic or livelihood groups, and exacerbating inequity. Inclusive planning initiatives informed by cultural values, Indigenous knowledge, local knowledge, and scientific knowledge can help prevent maladaptation. *(high confidence)* (Figure SPM.4) {2.6, 3.6, 4.3, 4.6, 4.8, 5.12, 5.13, 5.14, 6.1, Box 7.1, 8.4, 11.4, 12.5, Box 13.2, 14.4, Box 14.1, 17.2, 17.5, 18.2, 17.2, CCP2.4}

C.4.4 To minimize maladaptation, multi-sectoral, multi-actor and inclusive planning with flexible pathways encourages low-regret[47] and timely actions that keep options open, ensure benefits in multiple sectors and systems and indicate the available solution space for adapting to long-term climate change *(very high confidence)*. Maladaptation is also minimized by planning that accounts for the time it takes to adapt *(high confidence)*, the uncertainty about the rate and magnitude of climate risk *(medium confidence)* and a wide range of potentially adverse consequences of adaptation actions *(high confidence)*. {1.4, 3.6, 5.12, 5.13, 5.14, 11.6, 11.7, 17.3, 17.6, CCP2.3, CCP2.4, CCP5.4, CCB DEEP, CCB SLR}

Enabling Conditions

C.5 Enabling conditions are key for implementing, accelerating and sustaining adaptation in human systems and ecosystems. These include political commitment and follow-through, institutional frameworks, policies and instruments with clear goals and priorities, enhanced knowledge on impacts and solutions, mobilization of and access to adequate financial resources, monitoring and evaluation, and inclusive governance processes. *(high confidence)* {1.4, 2.4, 3.6, 4.8, 6.4, 7.4, 8.5, 9.4, 10.5, 11.4, 11.7, 12.5, 13.11, 14.7, 15.6, 17.4, 18.4, CCP2.4, CCP5.4, CCB FINANCE, CCB MDIG}

C.5.1 Political commitment and follow-through across all levels of government accelerate the implementation of adaptation actions *(high confidence)*. Implementing actions can require large upfront investments of human, financial and technological resources *(high confidence)*, whilst some benefits could only become visible in the next decade or beyond *(medium confidence)*. Accelerating commitment and follow-through is promoted by rising public awareness, building business cases for adaptation, accountability and transparency mechanisms, monitoring and evaluation of adaptation progress, social movements, and climate-related litigation in some regions *(medium confidence)*. {3.6, 4.8, 5.8, 6.4, 8.5, 9.4, 11.7, 12.5, 13.11, 17.4, 17.5, 18.4, CCP2.4, CCB COMD}

47 *From AR5, an option that would generate net social welfare or benefits under current climate change and a range of future climate change scenarios, and represent one example of adaptation strategies.*

C.5.2 Institutional frameworks, policies and instruments that set clear adaptation goals and define responsibilities and commitments and that are coordinated amongst actors and governance levels, strengthen and sustain adaptation actions (*very high confidence*). Sustained adaptation actions are strengthened by mainstreaming adaptation into institutional budget and policy planning cycles, statutory planning, monitoring and evaluation frameworks and into recovery efforts from disaster events (*high confidence*). Instruments that incorporate adaptation such as policy and legal frameworks, behavioural incentives, and economic instruments that address market failures, such as climate risk disclosure, inclusive and deliberative processes strengthen adaptation actions by public and private actors (*medium confidence*). (1.4, 3.6, 4.8, 5.14, 6.3, 8.4, 7.4, 9.4, 10.4, 11.7, Box 11.6, Table 11.17, 13.10, 13.11, 14.7, 15.6, 17.3, 17.4, 17.5, 17.6, 18.4, CCP2.4, CCP5.4, CCP6.3, CCB DEEP)

C.5.3 Enhancing knowledge on risks, impacts, and their consequences, and available adaptation options promotes societal and policy responses (*high confidence*). A wide range of top-down, bottom-up and co-produced processes and sources can deepen climate knowledge and sharing, including capacity building at all scales, educational and information programmes, using the arts, participatory modelling and climate services, Indigenous knowledge and local knowledge and citizen science (*high confidence*). These measures can facilitate awareness, heighten risk perception and influence behaviours (*high confidence*). (1.3, 3.6, 4.8, 5.9, 5.14, 6.4, Table 6.8, 7.4, 9.4, 10.5, 11.1, 11.7, 12.5, 13.9, 13.11, 14.3, 15.6, 15.6, 17.4, 18.4, CCP2.4.1, CCB BEING)

C.5.4 With adaptation finance needs estimated to be higher than those presented in AR5, enhanced mobilization of and access to financial resources are essential for implementation of adaptation and to reduce adaptation gaps (*high confidence*). Building capacity and removing some barriers to accessing finance is fundamental to accelerate adaptation, especially for vulnerable groups, regions and sectors (*high confidence*). Public and private finance instruments include inter alia grants, guarantee, equity, concessional debt, market debt, and internal budget allocation as well as savings in households and insurance. Public finance is an important enabler of adaptation (*high confidence*). Public mechanisms and finance can leverage private sector finance for adaptation by addressing real and perceived regulatory, cost and market barriers, for example via public-private partnerships (*high confidence*). Financial and technological resources enable effective and ongoing implementation of adaptation, especially when supported by institutions with a strong understanding of adaptation needs and capacity (*high confidence*). (4.8, 5.14, 6.4, Table 6.10, 7.4, 9.4, Table 11.17, 12.5, 13.11, 15.6, 17.4, 18.4, Box 18.9, CCP5.4, CCB FINANCE)

C.5.5 Monitoring and evaluation (M&E) of adaptation are critical for tracking progress and enabling effective adaptation (*high confidence*). M&E implementation is currently limited (*high confidence*) but has increased since AR5 at local and national levels. Although most of the monitoring of adaptation is focused towards planning and implementation, the monitoring of outcomes is critical for tracking the effectiveness and progress of adaptation (*high confidence*). M&E facilitates learning on successful and effective adaptation measures, and signals when and where additional action may be needed. M&E systems are most effective when supported by capacities and resources and embedded in enabling governance systems (*high confidence*). (1.4, 2.6, 6.4, 7.4, 11.7, 11.8, 13.2, 13.11, 17.5, 18.4, CCP2.4, CCB DEEP, CCB ILLNESS, CCB NATURAL, CCB PROGRESS)

C.5.6 Inclusive governance that prioritises equity and justice in adaptation planning and implementation leads to more effective and sustainable adaptation outcomes (*high confidence*). Vulnerabilities and climate risks are often reduced through carefully designed and implemented laws, policies, processes, and interventions that address context specific inequities such as based on gender, ethnicity, disability, age, location and income (*high confidence*). These approaches, which include multi-stakeholder co-learning platforms, transboundary collaborations, community-based adaptation and participatory scenario planning, focus on capacity-building, and meaningful participation of the most vulnerable and marginalised groups, and their access to key resources to adapt (*high confidence*). (1.4, 2.6, 3.6, 4.8, 5.4, 5.8, 5.9, 5.13, 6.4, 7.4, 8.5, 11.8, 12.5, 13.11, 14.7, 15.5, 15.7, 17.3, 17.5, 18.4, CCP2.4, CCP5.4, CCP6.4, CCB GENDER, CCB HEALTH, CCB BEING)

D: Climate Resilient Development

Climate resilient development integrates adaptation measures and their enabling conditions (Section C) with mitigation to advance sustainable development for all. Climate resilient development involves questions of equity and system transitions in land, ocean and ecosystems; urban and infrastructure; energy; industry; and society and includes adaptations for human, ecosystem and planetary health. Pursuing climate resilient development focuses on both where people and ecosystems are co-located as well as the protection and maintenance of ecosystem function at the planetary scale. Pathways for advancing climate resilient development are development trajectories that successfully integrate mitigation and adaptation actions to advance sustainable development. Climate resilient development pathways may be temporarily coincident with any RCP and SSP scenario used throughout AR6, but do not follow any particular scenario in all places and over all time.

Conditions for Climate Resilient Development

D.1 Evidence of observed impacts, projected risks, levels and trends in vulnerability, and adaptation limits, demonstrate that worldwide climate resilient development action is more urgent than previously assessed in AR5. Comprehensive, effective, and inclusive responses can harness synergies and reduce trade-offs between adaptation and mitigation to advance sustainable development. (*very high confidence*) (2.6, 3.4, 3.6, 4.2, 4.6, 7.2, 7.4, 8.3, 8.4, 9.3, 10.6, 13.3, 13.8, 13.10, 14.7, 17.3, 18.3, Box 18.1, Figure 18.1, Table 18.5)

D.1.1 There is a rapidly narrowing window of opportunity to enable climate resilient development. Multiple climate resilient development pathways are still possible by which communities, the private sector, governments, nations and the world can pursue climate resilient development – each involving and resulting from different societal choices influenced by different contexts and opportunities and constraints on system transitions. Climate resilient development pathways are progressively constrained by every increment of warming, in particular beyond 1.5°C, social and economic inequalities, the balance between adaptation and mitigation varying by national, regional and local circumstances and geographies, according to capabilities including resources, vulnerability, culture and values, past development choices leading to past emissions and future warming scenarios, bounding the climate resilient development pathways remaining, and the ways in which development trajectories are shaped by equity, and social and climate justice, (*very high confidence*) (Figure TS.14d, 2.6, 4.7, 4.8, 5.14, 6.4, 7.4, 8.3, 9.4, 9.3, 9.4, 9.5, 10.6, 11.8, 12.5, 13.10, 14.7, 15.3, 18.5, CCP2.3, CCP3.4, CCP4.4, CCP5.3, CCP5.4, Table CCP5.2, CCP6.3, CCP7.5)

D.1.2 Opportunities for climate resilient development are not equitably distributed around the world (*very high confidence*). Climate impacts and risks exacerbate vulnerability and social and economic inequities and consequently increase persistent and acute development challenges, especially in developing regions and sub-regions, and in particularly exposed sites, including coasts, small islands, deserts, mountains and polar regions. This in turn undermines efforts to achieve sustainable development, particularly for vulnerable and marginalized communities (*very high confidence*). (2.5, 4.4, 4.7, 6.3, Box 6.4, Figure 6.5, 9.4, Table 18.5, CCP2.2, CCP3.2, CCP3.3, CCP5.4, CCP6.2, CCB HEALTH, CWGB [URBAN])

D.1.3 Embedding effective and equitable adaptation and mitigation in development planning can reduce vulnerability, conserve and restore ecosystems, and enable climate resilient development. This is especially challenging in localities with persistent development gaps and limited resources (*high confidence*). Dynamic trade-offs and competing priorities exist between mitigation, adaptation, and development. Integrated and inclusive system-oriented solutions based on equity and social and climate justice reduce risks and enable climate resilient development (*high confidence*). (1.4, 2.6, Box 2.2, 3.4, 4.7, 4.8, Box 4.5, Box 4.8, 5.13, 7.4, 8.5, 9.4, Box 9.3, 10.6, 12.5, 12.6, 13.3, 13.4, 13.10, 13.11, 14.7, 18.4, CCB DEEP, CCP2, CCP5.4, CCB HEALTH, SRCCL)

Enabling Climate Resilient Development

D.2 Climate resilient development is enabled when governments, civil society and the private sector make inclusive development choices, that prioritize risk reduction, equity and justice, and when decision-making processes, finance and actions are integrated across governance levels, sectors and timeframes (*very high confidence*). Climate resilient development is facilitated by international cooperation and by governments at all levels working with communities, civil society, educational bodies, scientific and other institutions, media, investors and businesses; and by developing partnerships with traditionally marginalized groups, including women, youth, Indigenous Peoples, local communities and ethnic minorities (*high confidence*). These partnerships are most effective when supported by enabling political leadership, institutions, resources, including finance, as well as climate services, information and decision support tools (*high confidence*). (Figure SPM.5) (1.3, 1.4, 1.5, 2.7, 3.6, 4.8, 5.14, 6.4, 7.4, 8.5, 8.6, 9.4, 10.6, 11.8, 12.5, 13.11, 14.7, 15.6, 15.7, 17.4, 17.6, 18.4, 18.5, CCP2.4, CCP3.4, CCP4.4, CCP5.4, CCP6.4, CCP7.6, CCB DEEP, CCB GENDER, CCB HEALTH, CCB MIDG, CCB NATURAL, CCB SLR)

D.2.1 Climate resilient development is advanced when actors work in equitable, just and enabling ways to reconcile divergent interests, values and worldviews, toward equitable and just outcomes (*high confidence*). These practices build on diverse knowledges about climate risk and chosen development pathways account for local, regional and global climate impacts, risks, barriers and opportunities (*high confidence*). Structural vulnerabilities to climate change can be reduced through carefully designed and implemented legal, policy, and process interventions from the local to global that address inequities based on gender, ethnicity, disability, age, location and income (*very high confidence*). This includes rights-based approaches that focus on capacity-building, meaningful participation of the most vulnerable groups, and their access to key resources, including financing, to reduce risk and adapt (*high confidence*). Evidence shows that climate resilient development processes links scientific, Indigenous, local, practitioner and other forms of knowledge, and are more effective and sustainable because they are locally appropriate and lead to more legitimate, relevant and effective actions (*high confidence*).

There is a rapidly narrowing window of opportunity to enable climate resilient development

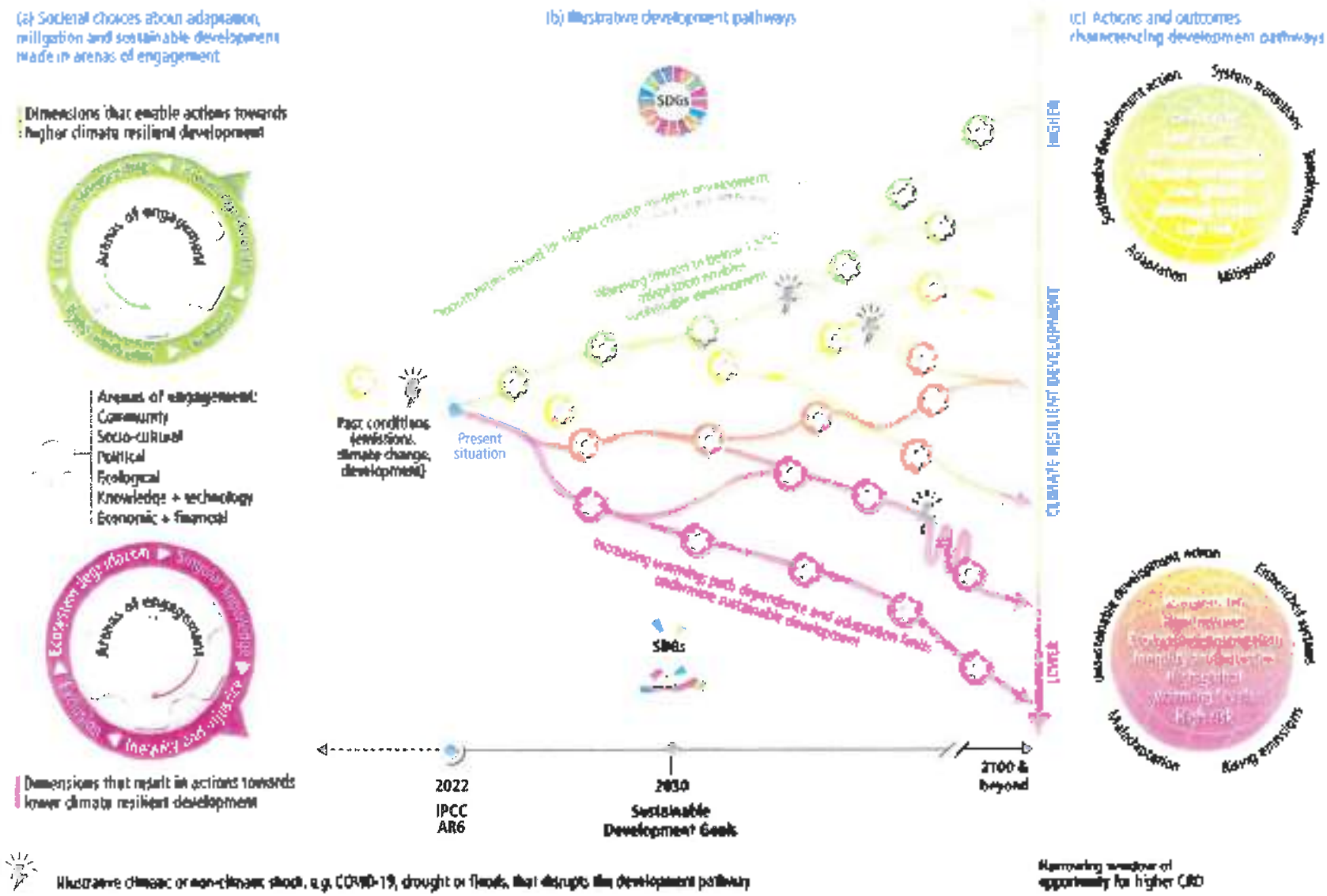


Figure SPM.5 | Climate resilient development (CRD) is the process of implementing greenhouse gas mitigation and adaptation measures to support sustainable development. This figure builds on Figure SPM.1 in AR5 WGII (depicting climate resilient pathways) by describing how CRD pathways are the result of cumulative societal choices and actions within multiple arenas.

Panel (a) Societal choices towards higher CRD (green cog) or lower CRD (red cog) result from interacting decisions and actions by diverse governance, private sector and civil society actors, in the context of climate risks, adaptation limits and development gaps. These actions engage with adaptation, mitigation and development actions in political, economic and financial, ecological, socio-cultural, knowledge and technology, and community arenas from local to international levels. Opportunities for climate resilient development are not equitably distributed around the world.

Panel (b) Cumulatively, societal choices, which are made continuously, shift global development pathways towards higher (green) or lower (red) climate resilient development. Past conditions (past emissions, climate change and development) have already eliminated some development pathways towards higher CRD (dashed green line).

Panel (c) Higher CRD is characterized by outcomes that advance sustainable development for all. Climate resilient development is progressively harder to achieve with global warming levels beyond 1.5°C. Inadequate progress towards the Sustainable Development Goals (SDGs) by 2030 reduces climate resilient development prospects. There is a narrowing window of opportunity to shift pathways towards more climate resilient development futures as reflected by the adaptation limits and increasing close to them, constraining the remaining carbon budgets. (Figure SPM.2, Figure SPM.3) (Figure TS.14b, 2.5, 3.6, 7.2, 7.3, 7.4, 8.3, 8.4, 8.5, 14.4, 16.5, 17.3, 17.4, 17.6, 18.1, 18.2, 18.3, 18.4, Box 18.1, Figure 18.1, Figure 18.2, Figure 18.3, CCB COVID, CCB GENDER, CCB HEALTH, CCB MDIG, CCB SLR, WGI AR6 Table SPM.1, WGI AR6 Table SPM.2, SR1.5 Figure SPM.1)

Pathways towards climate resilient development overcome jurisdictional and organizational barriers, and are founded on societal choices that accelerate and deepen key system transitions (*very high confidence*). Planning processes and decision analysis tools can help identify 'low regrets' options[48] that enable mitigation and adaptation in the face of change, complexity, deep uncertainty and divergent views (*medium confidence*). (1.3, 1.4, 1.5, 2.7, 3.6, 4.8, 5.14, 6.4, 7.4, 8.5, 8.6, Box 9.7, 9.4, Box 9.2, 10.6, 11.8, 12.5, 13.11, 14.7, 15.6, 15.7, 17.2–17.6, 18.2–18.4, CCP2.3–2.4, CCP3.4, CCP4.4, CCP5.4, CCP6.4, CCP7.6, CCB DEEP, CCB HEALTH, CCB MDIG, CCB NATURAL, CCB SLR)

D.2.2 Inclusive governance contributes to more effective and enduring adaptation outcomes and enables climate resilient development (*high confidence*). Inclusive processes strengthen the ability of governments and other stakeholders to jointly consider factors such as the rate and magnitude of change and uncertainties, associated impacts, and timescales of different climate resilient development pathways given past development choices leading to past emissions and scenarios of future global warming (*high confidence*). Associated societal choices are made continuously through interactions in arenas of engagement from local to international levels. The quality and outcome of these interactions helps determine whether development pathways shift towards or away from climate resilient development (*medium confidence*). (Figure SPM.5) (2.7, 3.6, 4.8, 5.14, 6.4, 7.4, 8.5, 8.6, 9.4, 10.6, 11.8, 12.5, 13.11, 14.7, 15.6, 15.7, 17.2–17.6, 18.2, 18.4, CCP2.3–2.4, CCP3.4, CCP4.4, CCP5.4, CCP6.4, CCP7.6, CCB GENDER, CCB HEALTH, CCB MDIG)

D.2.3 Governance for climate resilient development is most effective when supported by formal and informal institutions and practices that are well-aligned across scales, sectors, policy domains and timeframes. Governance efforts that advance climate resilient development account for the dynamic, uncertain and context-specific nature of climate-related risk, and its interconnections with non-climate risks. Institutions[48] that enable climate resilient development are flexible and responsive to emergent risks and facilitate sustained and timely action. Governance for climate resilient development is enabled by adequate and appropriate human and technological resources, information, capacities and finance. (*high confidence*) (2.7, 3.6, 4.8, 5.14, 6.3, 6.4, 7.4, 8.5, 8.6, 9.4, 10.6, 11.8, 12.5, 13.11, 14.7, 15.6, 15.7, 17.2–17.6, 18.2, 18.4, CCP2.3–2.4, CCP3.4, CCP4.4, CCP5.4, CCP6.4, CCP7.6, CCB DEEP, CCB GENDER, CCB HEALTH, CCB MDIG, CCB NATURAL, CCB SLR)

Climate Resilient Development for Natural and Human Systems

D.3 Interactions between changing urban form, exposure and vulnerability can create climate change-induced risks and losses for cities and settlements. However, the global trend of urbanisation also offers a critical opportunity in the near-term, to advance climate resilient development (*high confidence*). Integrated, inclusive planning and investment in everyday decision-making about urban infrastructure, including social, ecological and grey/physical infrastructures, can significantly increase the adaptive capacity of urban and rural settlements. Equitable outcomes contributes to multiple benefits for health and well-being and ecosystem services, including for Indigenous Peoples, marginalized and vulnerable communities (*high confidence*). Climate resilient development in urban areas also supports adaptive capacity in more rural places through rebalancing peri-urban supply chains of goods and services and financial flows (*medium confidence*). Coastal cities and settlements play an especially important role in advancing climate resilient development (*high confidence*). (6.2, 6.3, Table 6.6, 7.4, 8.6, Box 9.8, 18.3, CCP2.1, CCP2.2, CCP6.2, CWG1 URBAN)

48 Institutions: Rules, norms and customs that guide, constrain or enable human behaviours and practices. Institutions can be formally established, for instance through laws and regulations, or informally established, for instance by traditions or customs. Institutions may spur, hinder, strengthen, weaken or distort the emergence, adoption, and implementation of climate action and climate governance.

D.3.1 Taking integrated action for climate resilience to avoid climate risk requires urgent decision making for the new built environment and retrofitting existing urban design, infrastructure and land use. Based on socioeconomic circumstances, adaptation and sustainable development actions will provide multiple benefits including for health and well-being, particularly when supported by national governments, non-governmental organisations and international agencies that work across sectors in partnerships with local communities. Equitable partnerships between local and municipal governments, the private sector, Indigenous Peoples, local communities, and civil society can, including through international cooperation, advance climate resilient development by addressing structural inequalities, insufficient financial resources, cross-city risks and the integration of Indigenous knowledge and local knowledge *(high confidence)* [6.2, 6.3, 6.4, Table 6.6, 7.4, 8.5, 9.4, 10.5, 12.5, 17.4, Table 17.8, 18.2, Box 18.1, CCP2.4, CCB FINANCE, CCB GENDER, CCB INDIG, CWGB URBAN]

D.3.2 Rapid global urbanisation offers opportunities for climate resilient development in diverse contexts from rural and informal settlements to large metropolitan areas *(high confidence)*. Dominant models of energy intensive and market-led urbanisation, insufficient and misaligned finance and a predominant focus on grey infrastructure in the absence of integration with ecological and social approaches, risks missing opportunities for adaptation and locking in maladaptation *(high confidence)*. Poor land use planning and siloed approaches to health, ecological and social planning also exacerbate vulnerability in already marginalised communities *(medium confidence)*. Urban climate resilient development is observed to be more effective if it is responsive to regional and local land use development and adaptation gaps, and addresses the underlying drivers of vulnerability *(high confidence)*. The greatest gains in well-being can be achieved by prioritizing finance to reduce climate risk for low-income and marginalized residents including people living in informal settlements *(high confidence)*. [5.14, 6.1, 6.2, 6.3, 6.4, 6.5, Figure 6.5, Table 6.6, 7.4, 8.5, 8.6, 9.8, 9.9, 10.4, Table 17.8, 18.2, CCP2.2, CCP5.4, CCB HEALTH, CWGB URBAN]

D.3.3 Urban systems are critical, interconnected sites for enabling climate resilient development, especially at the coast. Coastal cities and settlements play a key role in moving toward higher climate resilient development given firstly, almost 11% of the global population – 896 million people – lived within the Low Elevation Coastal Zone[49] in 2020, potentially increasing to beyond 1 billion people by 2050, and these people, and associated development and coastal ecosystems, face escalating climate compounded risks, including sea level rise. Secondly, these coastal cities and settlements make key contributions to climate resilient development through their vital role in national economies and inland communities, global trade supply chains, cultural exchange, and centres of innovation. *(high confidence)* [6.1, 6.2, 6.4, Table 6.6, Box 15.2, SMCCP Table 2.1, CCP2.2, CCP2.4, CCB SLR, XWGB URBAN, SROCC Chapter 4]

D.4 Safeguarding biodiversity and ecosystems is fundamental to climate resilient development, in light of the threats climate change poses to them and their roles in adaptation and mitigation *(very high confidence)*. Recent analyses, drawing on a range of lines of evidence, suggest that maintaining the resilience of biodiversity and ecosystem services at a global scale depends on effective and equitable conservation of approximately 30% to 50% of Earth's land, freshwater and ocean areas, including currently near-natural ecosystems *(high confidence)*. [2.4, 2.5, 2.6, 3.4, 3.5, 3.6, Box 3.4, 12.5, 13.3, 13.4, 13.5, 13.10, CCB INDIG, CCB NATURAL]

D.4.1 Building the resilience of biodiversity and supporting ecosystem integrity[50] can maintain benefits for people, including livelihoods, human health and well-being and the provision of food, fibre and water, as well as contributing to disaster risk reduction and climate change adaptation and mitigation. [2.2, 2.5, 2.6, Table 2.6, Table 2.7, 3.5, 3.6, 5.4, 5.13, 5.14, Box 5.11, 12.5, CCP5.4, CCB COVID, CCB GENDER, CCB ILLNESS, CCB INDIG, CCB MIGRATE, CCB NATURAL]

D.4.2 Protecting and restoring ecosystems is essential for maintaining and enhancing the resilience of the biosphere *(very high confidence)*. Degradation and loss of ecosystems is also a cause of greenhouse gas emissions and is at increasing risk of being exacerbated by climate change impacts, including droughts and wildfire *(high confidence)*. Climate resilient development avoids adaptation and mitigation measures that damage ecosystems *(high confidence)*. Documented examples of adverse impacts of land-based measures intended as mitigation, when poorly implemented, include afforestation of grasslands, savannas and peatlands, and risks from bioenergy crops at large scale to water supply, food security and biodiversity *(high confidence)*. [2.4, 2.5, Box 2.2, 3.4, 3.5, Box 3.4, Box 9.3, CCP7.3, CCB NATURAL, CWGB BIOECONOMY]

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49 LECZ: coastal areas below 10 m of elevation above sea level that are hydrologically connected to the sea.

50 Ecosystem integrity refers to the ability of ecosystems to maintain key ecological processes, recover from disturbance, and adapt to new conditions.

D.4.3 Biodiversity and ecosystem services have limited capacity to adapt to increasing global warming levels, which will make climate resilient development progressively harder to achieve beyond 1.5°C warming (*very high confidence*). Consequences of current and future global warming for climate resilient development include reduced effectiveness of Ecosystem-based Adaptation and approaches to climate change mitigation based on ecosystems and amplifying feedbacks to the climate system (*high confidence*). (Figure TS.14d, 2.4, 2.5, 2.6, 3.4, Box 3.4, 3.5, 3.6, Table 5.2, 12.5, 13.2, 13.3, 13.10, 14.5, 14.5, Box 14.3, 15.3, 17.3, 17.6, CCP5.3, CCP5.4, CCB EXTREMES, CCB ILLNESS, CCB NATURAL, CCB SLR, SR1.5, SROCC, SROCC)

Achieving Climate Resilient Development

D.5 It is unequivocal that climate change has already disrupted human and natural systems. Past and current development trends (past emission, development and climate change) have not advanced global climate resilient development (*very high confidence*). Societal choices and actions implemented in the next decade determine the extent to which medium- and long-term pathways will deliver higher or lower climate resilient development (*high confidence*). Importantly climate resilient development prospects are increasingly limited if current greenhouse gas emissions do not rapidly decline, especially if 1.5°C global warming is exceeded in the near-term (*high confidence*). These prospects are constrained by past development, emissions and climate change, and enabled by inclusive governance, adequate and appropriate human and technological resources, information, capacities and finance (*high confidence*). (Figure TS.14d, 1.2, 1.4, 1.5, 2.6, 2.7, 3.6, 4.7, 4.8, 5.14, 6.4, 7.4, 8.3, 8.5, 8.6, 9.3, 9.4, 9.5, 10.6, 11.8, 12.5, 13.10, 13.11, 14.7, 15.3, 15.6, 15.7, 16.2, 16.4, 16.5, 16.6, 17.2–17.6, 18.2–18.5, CCP2.3–2.4, CCP3.4, CCP4.4, CCP5.3, CCP5.4, Table CCP5.2, CCP6.3, CCP6.4, CCP7.5, CCP7.6, CCB DEEP, CCB HEALTH, CCB INEQ, CCB NATURAL, CCB SLR)

D.5.1 Climate resilient development is already challenging at current global warming levels (*high confidence*). The prospects for climate resilient development will be further limited if global warming levels exceeds 1.5°C (*high confidence*) and not be possible in some regions and sub-regions if the global warming level exceeds 2°C (*medium confidence*). Climate resilient development is most constrained in regions/subregions in which climate impacts and risks are already advanced, including low-lying coastal cities and settlements, small islands, deserts, mountains and polar regions (*high confidence*). Regions and subregions with high levels of poverty, water, food and energy insecurity, vulnerable urban environments, degraded ecosystems and rural environments, and/or few enabling conditions, face many non-climate challenges that inhibit climate resilient development which are further exacerbated by climate change (*high confidence*). (Figure TS.14d, 1.2, Box 6.6, 9.3, 9.4, 9.5, 10.6, 11.8, 12.5, 13.10, 14.7, 15.3, CCP2.3, CCP3.4, CCP4.4, CCP5.3, Table CCP5.2, CCP6.3, CCP7.5)

D.5.2 Inclusive governance, investment aligned with climate resilient development, access to appropriate technology and rapidly scaled-up finance, and capacity building of governments at all levels, the private sector and civil society enable climate resilient development. Experience shows that climate resilient development processes are timely, anticipatory, integrative, flexible and action focused. Common goals and social learning build adaptive capacity for climate resilient development. When implementing adaptation and mitigation together, and taking trade-offs into account, multiple benefits and synergies for human well-being as well as ecosystem and planetary health can be realised. Prospects for climate resilient development are increased by inclusive processes involving local knowledge and Indigenous Knowledge as well as processes that coordinate across risks and institutions. Climate resilient development is enabled by increased international cooperation including mobilising and enhancing access to finance, particularly for vulnerable regions, sectors and groups. (*high confidence*) (Figure SPM.5) (2.7, 3.6, 4.8, 5.14, 6.4, 7.4, 8.5, 8.6, 9.4, 10.6, 11.8, 12.5, 13.11, 14.7, 15.6, 15.7, 17.2–17.6, 18.2–18.5, CCP2.3–2.4, CCP3.4, CCP4.4, CCP5.4, CCP6.4, CCP7.6, CCB DEEP, CCB HEALTH, CCB INEQ, CCB NATURAL, CCB SLR)

D.5.3 The cumulative scientific evidence is unequivocal: Climate change is a threat to human well-being and planetary health. Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all (*very high confidence*) (1.2, 1.4, 1.5, 16.2, Table SM16.24, 16.4, 16.5, 16.6, 17.3, 17.5, 17.6, 18.3, 18.4, 18.5, CCB DEEP, CWGB URBAN, WGI AR6 SPM, SROCC SPM, SRCCL SPM)

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GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DSARE/PASA
accepted reason. Activities associated with the Project could further pressure this species by physically harming individual seals, and by disrupting the seals' food supply. 84. The Pisces Report states that Cape fur seals are unlikely to be found in the project area, citing map that shows generalized foraging areas that extend nearly exactly to the edge of the reconnaissance area.[90] However, the report also states, "[s]eals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles (~220 km) offshore,"[91] meaning a large part of the reconnaissance area is well within the foraging range of Cape fur seals. Moreover, the Based on the questionable assumption that Cape fur seals are unlikely to occur within the reconnaissance area, the Pisces Report authors deemed their sensitivity to the proposed seismic operations to be "LOW," in spite of the finding that "The potential impact of physiological injury to seals as a result of seismic noise is deemed to be of HIGH intensity."[92] Whales and dolphins 85. There is genuine conservation concern for beaked whales that are particularly sensitive to anthropogenic noise, including seismic surveys. It has been demonstrated that even minor, non-lethal disturbances, resulting in changes in behaviour such as displacement from preferred habitats, could impact a population.[93] 86. The phenomenon of energy-cost (from stress and avoidance behaviour) is of particular concern for some of the species expected to be encountered in the survey area in question, particularly the humpback whales and southern right whales who are at risk of the	were more associated with operational dynamics of the Namibian fleets and their licensing conditions that had reduced their effort (as South African vessels were not permitted to fish in Namibian waters). Cumulative impacts are assessed in Section 9 of the BA report. For both technical and commercial reasons, it is unlikely that concurrent seismic surveys will be undertaken in the same area during the same survey window. However, the cumulative impacts associated with multiple surveys was assessed and detailed in Section 9.3.5 of the BAR. Section 9.3.5 of the BA Report states that "three seismic surveys of regional extent, undertaken simultaneously, could be expected to result in an impact of medium negative significance on the large pelagic longline sector, both with and without the application of mitigation measures. This relates to the large pelagic long-line sector only, and only in the event that all three surveys are undertaken simultaneously. It should be noted that the seismic industry typically avoids simultaneous surveys occurring in close proximity to each other as this has the potential to degrade the quality of the recorded survey data. Other cumulative impacts are all expected to be low after mitigation is applied – therefore overall cumulative impacts are considered low post-mitigation. It should also be noted that of the three potential surveys cited by the Appellants, the GX Technologies survey should be disregarded as the company went into liquidation in 2022. The appellants' contention that up to 30% of the revenue generated by the impacted fisheries would be lost during the 70 day period is unsubstantiated and vague for the following reasons:	

[90] Pisces Report at 69 (Fig. 37).
[91] *Id.* at 111.
[92] *Id.*
[93] Harris Report

AG 2.25

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
airgun noise affecting their behaviour or interfering with the communication between mother and calf. Any impact on their energy reserves could impact on their condition (weight-loss and physiological condition) and affect survival of the animals during a vulnerable time (especially for lactating mothers and their calves) on their long migration to feeding grounds in Antarctica.[94] **Fish** 87. The BAR downplays the impacts of seismic surveys on fish and the fisheries they support, particularly in the case of the large pelagic longline fishery and the tuna pole-line fishery. While the BAR assesses the exclusion of fishing vessels due to temporary safety zones during seismic surveys, it fails to adequately assess the actual impacts of seismic activities on the target fish species themselves, both in the short and long-term. During the seismic survey, fishing vessels would be required to maintain a safe operational distance from the survey vessel and streamer array, which may extend up to 6 nautical miles. The FBAR assessed the impact of potential exclusion for each commercial sector based on the affected area of fishing ground and the amount of catch reported within the Reconnaissance Permit area. Given the location of the Reconnaissance Permit application area, two high-value fisheries are directly impacted: the large pelagic longline fishery (targeting tuna, swordfish and shark) and the tuna pole-line fishery. 88. The FBAR concluded that the Project's activities will result in exclusion to fishing grounds for at least the large pelagic longline fishery. The FBAR states that "[t]here is a high probability that the large pelagic longline sector (targeting tuna, swordfish and shark) will experience loss of access to fishing ground over the duration of the	◦ The four-month window is proposed to coincide with the period of lowest activities for the fisheries that operate in the potentially affected sectors; ◦ It should further be noted that the survey will not be undertaken over the entire tuna fisheries area or the whole application area at the same time and will thus not lead to a complete shutdown of the fishing activities in the pelagic longline sector during the 70 day period of the survey; and ◦ The mitigation measures included in Section 9.3.2 of the BAR provide for avoidance of the peak fishing periods and, furthermore, for the establishment of clear communication channels to be established with the other users of the survey area and to ensure that the disturbance within this sector is reduced to the absolute minimum. The impact on the affected fishing sectors was assessed to be of low significance and short duration and it could thus not be stated that "The FBAR fails to consider the long-term behavioural or migration impacts that seismic activity could have on the pelagic longline fishery, which include several species of tuna." Impacts of cumulative sound exposure on marine mammals are evaluated using disturbance and injury threshold, defined as temporary threshold shifts (TTS) and permanent threshold shifts (PTS) (Southall et al. 2019). The audibility of a noise pertains only to the perception or detection of a sound above background levels of ambient noise. The thresholds established by Southall et al. (2019) are internationally regarded as standard references for environmental impact assessment of underwater noise. Although the modelling report doesn't specifically reference the CBA areas, the purpose of the modelling was to model the likely sound transmission and contours. The outputs of the model were then	

[94] Harris Report

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"A7.1"

PROPOSED 3D SEISMIC SURVEY IN THE ORANGE BASIN OFF THE WEST COAST OF SOUTH AFRICA

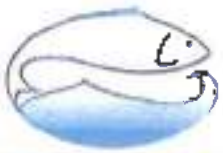
Biodiversity and Ecosystem Services Assessment

Prepared for:

TGS

TGS Geophysical Company (UK) Ltd

September 2022



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NOTE

The information contained herein was the most up-to-date at the time of writing. The author cannot be held accountable for the omission of any publications that became available or changes to features such as EBSAs and CBA that occurred subsequent to finalisation and submission of the report.

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EXECUTIVE SUMMARY

TGS Geophysical Company (UK) Ltd proposes to undertake 3D seismic acquisition in the Orange Basin off the West Coast of South Africa. The survey will comprise the acquisition of up to ~57 400 km² of 3D seismic data over a period of ~70 days, during the best available window of opportunity in either 2023 or 2024, subject to granting of the Reconnaissance Permit and vessel availability.

The Reconnaissance Permit Area, which is approximately 57 400 km² in size, is located in water depths ranging from ~1 500 m to nearly 4 000 m off the South African West Coast between Alexander Bay and Cape Columbine. The seabed sediments comprise sandy muds. Although influenced by the Benguela Current the Reconnaissance Permit area is located on the western extent of the coastal upwelling cells. Winds come primarily from the southeast, whereas virtually all swells throughout the year come from the S and SSW direction. The bulk of the seawater in the study area is South Atlantic Central Water characterised by low oxygen concentrations, especially at depth. Surface waters in the Reconnaissance Permit Application area will primarily be nutrient poor and clear, being beyond the influence of coastal upwelling, with seasonal nutrient peaks expected on the eastern edge of the Reconnaissance Permit Area during periods of upwelling.

The proposed 3D survey area falls into the Southeast Atlantic Deep Ocean Ecoregions. Although there is a lack of knowledge of the community structure and diversity of benthic macrofauna off the shelf edge, the South Atlantic bathyal and abyssal unconsolidated habitat types have been rated as 'Least Threatened', reflecting the great extent of these habitats in the South African Exclusive Economic Zone (EEZ). Only sections along the shelf edge and in the Cape Canyon are rated as 'Vulnerable' and 'Endangered'. Geological features of note in and adjacent to the proposed survey area are Child's Bank situated at about 31°S and Tripp Seamount situated at about 29°40'S. Two canyons, the Cape Canyon and Cape Valley also occur to the south of the Reconnaissance Permit Area. Features such as banks and seamounts often host deep-water corals and boast an enrichment of bottom-associated communities relative to the otherwise low-profile, homogenous seabed habitats.

Due to its offshore location, plankton abundance is expected to be low, with the major fish spawning and migration routes occurring inshore on the shelf. The dominant fish in the area would include the migratory large pelagic species such as tunas, billfish and pelagic sharks. Seabirds will be dominated by the pelagic species such as albatross, petrels and shearwaters. Migrating turtles in the area would include the leatherback and loggerhead turtles. Marine mammals likely to occur offshore include a variety of baleen whales including humpbacks, Antarctic minke, fin and sei whales. Toothed whales will include sperm and killer whales, as well as a variety of beaked whales and dolphins. There are six offshore Marine Protected Areas (MPAs) in the general project area but none fall within the Reconnaissance Permit Area. The proposed 3D survey area lies well offshore of these MPAs. There is some overlap of the Reconnaissance Permit Area with the Orange Seamount and Canyon Complex Ecologically and Biologically Significant Areas (EBSAs). Critical biodiversity areas (CBAs) within the Reconnaissance Permit area include both CBA1: natural and CBA2: natural areas, with a small section of CBA2: restore being located in the north.

Potential impacts to the marine fauna as a result of the proposed 3D seismic acquisition include:

- Physiological injury and/or mortality;
- Behavioural avoidance;
- Reduced reproductive success/spawning;
- Masking of environmental sounds and communication;
- Collision of turtles/marine mammals with the survey and support vessels or entanglement in towed acoustic apparatus; and
- Indirect impacts on piscivorous predators due to seismic effects on prey species.

The highest sensitivities in response to the proposed 3D surveys are:

- Humpback whales, which migrate through the area between June and November (inclusive);
- Sperm whales, beaked whales and other odontocetes that frequent offshore waters;
- Large migratory pelagic fish and shark species that show seasonal association with Child's Bank and Tripp Seamount;
- Leatherback turtles which frequent offshore waters in low numbers and aggregate around seamounts to feed on jellyfish; and
- Various pelagic Albatross, Petrel, Storm Petrel and Shearwater species.

The impacts before and after mitigation on marine habitats and communities associated with seismic noise are summarised below:

Impact	Significance (before mitigation)	Significance (after mitigation)
Plankton and ichthyoplankton	Medium	Very Low
Marine invertebrates	Negligible	Negligible
Pelagic Fish	Medium	Low
Diving Seabirds	Low	Very Low
Turtles	Medium	Low
Seals	Low	Very Low
Whales and dolphins		
Baleen whale	Medium	Low
Toothed whales and dolphins	Medium	Low

Other impacts before and after mitigation on marine habitats and communities associated with the proposed project are summarised below:

Impact	Significance (before mitigation)	Significance (after mitigation)
Non-seismic noise - helicopter	Low	Low
Non-seismic noise - vessel	Very Low	Very Low
Vessel lighting	Very Low	Very Low
Hull fouling and ballast water discharge	Very Low	Negligible
Waste Discharges to sea	Very Low	Very Low
Ship strikes and entanglement in gear	Low	Low
Accidental loss of equipment	Very Low	Very Low
Operational spills and vessel collision	Medium	Low

The mitigation measures proposed for seismic surveys are as provided below for each phase of a seismic survey operation:

No.	Mitigation measure	Classification
1. Survey Planning		
1.1	Plan seismic surveys to avoid sensitive areas and periods for some marine fauna: • Movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (June/July and late October/November), and their aggregation on the summer feeding grounds between St Helena Bay and Dassen Island from late October to late December and ensure that migration paths are not blocked by seismic operations. If possible the survey should be undertaken from North to South to avoid these feeding aggregations.	Avoid
1.2	Plan survey, as far as possible, so that the first commencement of airgun firing in a new area (including gun tests) are undertaken during daylight hours.	Abate on site
1.3	Prohibit airgun use (including airgun tests) outside of the Reconnaissance Permit Area.	Avoid
1.4	Although a seismic vessel and its gear may pass through a declared Marine Protected Area, acoustic sources (airguns) must not be operational during this transit.	Avoid
1.5	A 5 km buffer zone where no airgun operation is permitted is recommended around all MPAs	Avoid
2. Key Equipment		
2.1	**Passive Acoustic Monitoring (PAM)**	
2.1.1	Ensure the seismic vessel is fitted with Passive Acoustic Monitoring (PAM) technology, which detects some animals through their vocalisations.	Abate on site
2.1.2	As the survey area would largely be in waters deeper than 1 000 m where sperm whales and other deep-diving odontocetes are likely to be encountered, implement the use of PAM 24-hr a day when the airgun is in operation.	Abate on site
2.1.3	Ensure that the PAM hydrophone streamer is towed in such a way that the interference of vessel noise is minimised.	Abate on site
2.1.4	Ensure the PAM streamer is fitted with at least four hydrophones, of which two are HF and two LF, to allow directional detection of cetaceans.	Abate on site

No.	Mitigation measure	Classification
2.1.5	Ensure spare PAM hydrophone streamers (e.g. 4 heavy tow cables and 6 hydrophone cables) are readily available in the event that PAM breaks down, in order to ensure timeous redeployment.	Abate on site
2.2	Acoustic Source	
2.2.1	Define and enforce the use of the lowest practicable airgun volume for production, and design arrays to maximise downward propagation, minimise horizontal propagation and minimise high frequencies in airgun pulses.	Abate on site
2.2.2	Ensure a display screen for the acoustic source operations is provided to the marine observers. All information relating to the activation of the acoustic source and the power output levels must be readily available to support the observers in real time via the display screen and to ensure that operational capacity is not exceeded.	Abate on site
2.2.3	Ensure the ramp-up noise volumes do not exceed the production volume.	Abate on site
2.3	Streamers	
2.3.1	Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'.	Abate on site
2.3.2	Ensure that solid streamers rather than fluid-filled streamers are used to avoid leaks.	Avoid
3. Key Personnel		
3.1	• Make provision for the placing of a qualified MMOs on board the seismic vessel. As a minimum, one must be on watch during daylight hours for the pre-shoot observations and when the acoustic source is active. • The duties of the MMO would be to: – Provide effective regular briefings to crew members, and establish clear lines of communication and procedures for onboard operations; – Record airgun activities, including sound levels, "soft-start" procedures and pre-firing regimes; – Observe and record responses of marine fauna to seismic shooting from optimum vantage points, including seabird, large pelagic fish (e.g. shoaling tuna, sunfish, sharks), turtle, seal and cetacean incidence and behaviour and any mortality or injuries of marine fauna as a result of the seismic survey. Data captured should include species identification, position (latitude/longitude), distance/bearing from the vessel, swimming speed and direction (if applicable) and any obvious changes in behaviour (e.g. startle responses or changes in surfacing/diving frequencies, breathing patterns) as a result of the seismic activities. Both the identification and the behaviour of the animals must be recorded accurately along with current seismic sound levels. Any attraction of predatory seabirds, large pelagic fish or cetaceans (by mass disorientation or stunning of fish as a result of seismic survey activities) and incidents of feeding behaviour among the hydrophone streamers should also be recorded; – Record sightings of any injured or dead marine mammals, large pelagic fish (e.g. sharks), seabirds and sea turtles, regardless of whether the injury or death was caused by the seismic vessel itself. If the injury or death was caused by a collision with the seismic vessel, the date and location (latitude/longitude) of the strike, and the species identification or a description of the animal should be recorded and included as part of the daily report;	Abate on site

No.	Mitigation	Classification
	– Record meteorological conditions at the beginning and end of the observation period, and whenever the weather conditions change significantly; – Request the delay of start-up or temporary termination of the seismic survey or adjusting of seismic shooting, as appropriate. It is important that MMO decisions on the termination of firing are made confidently and expediently, and following dialogue between the observers on duty at the time. A log of all termination decisions must be kept (for inclusion in both daily and "close-out" reports); – Use a recording spreadsheet (e.g. JNCC, 2017) in order to record all the above observations and decisions; and – Prepare daily reports of all observations, to be forwarded to the necessary authorities as required, in order to ensure compliance with the mitigation measures.	
3.2	• Make provision for placing of a qualified PAM operator on board the seismic vessel. As a minimum, one must be on 'watch' during the pre-shoot observations and when the acoustic source is active. • The duties of the PAM operator would be to: – Provide effective regular briefings to crew members, and establish clear lines of communication and procedures for onboard operations; – Ensure that the hydrophone cable is optimally placed, deployed and tested for acoustic detections of marine mammals; – Confirm that there is no marine mammal activity within 500 m of the airgun array prior to commencing with the "soft-start" procedures; – Record species identification, position (latitude/longitude), distance and bearing from the vessel and acoustic source, where possible; – Record general environmental conditions; – Record airgun activities, including sound levels, "soft-start" procedures and pre-firing regimes; and – Request the delay of start-up and temporary termination of the seismic survey, as appropriate.	Abate on site
3.3.	Ensure MMOs and PAM operators are briefed on the area-specific sensitivities and on the seismic survey planning (including roles and responsibilities, and lines of communication).	Abate on site
4. Airgun Testing		
4.1	Maintain a pre-shoot watch of 60-minutes before any instances of airgun testing. If only a single lowest power airgun is tested, the pre-shoot watch period can be reduced to 30 minutes.	Avoid / Abate on site
4.2	Implement a "soft-start" procedure if testing multiple airguns. • The "soft-start" should be carried out over a time period proportional to the number of guns being tested and not exceed 20 minutes; airguns should be tested in order of increasing volume; • If testing all airguns at the same time, a 20 minute "soft-start" is required; • If testing a single lowest power airgun a "soft-start" is not required.	Avoid / Abate on site

No.	Mitigation Measure	Implementation
5.1	Implement a dedicated MMO and PAM pre-shoot watch of at least 60 minutes (to accommodate deep-diving species in water depths greater than 200 m).	Avoid / Abate on site
5.2	Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source if: • during daylight hours it is confirmed: - visually by the MMO during the pre-shoot watch (60 minutes) that there are no penguins or feeding aggregations of diving seabirds, shoaling large pelagic fish, turtles, seals or cetaceans within 500 m of the seismic source, and - by PAM technology that there are no vocalising cetaceans detected in the 500 m mitigation zone. • during times of poor visibility or darkness it is confirmed by PAM technology that no vocalising cetaceans are present in the 500 m mitigation zone during the pre-shoot watch (60 minutes).	Avoid / Abate on site
5.3	Delay "soft-starts" if penguins or feeding aggregations of diving seabirds, shoaling large pelagic fish, turtles, seals or cetaceans are observed within the mitigation zone. • A "soft-start" should not begin until 30 minutes after cetaceans depart the 500 m mitigation zone or 30 minutes after they are last seen or acoustically detected by PAM in the mitigation zone. • In the case of penguins, diving seabirds, shoaling large pelagic fish and turtles, delay the "soft-start" until animals are outside the 500 m mitigation zone. • In the case of fur seals, which may occur commonly around the vessel, delay "soft-starts" for at least 10 minutes until it has been confirmed that the mitigation zone is clear of all seal activity. However, if after a period of 10 mins seals are still observed within 500 m of the airgun, the normal "soft-start" procedure should be allowed to commence for at least a 20-minute duration. Seal activity should be carefully monitored during "soft-starts" to determine if they display any obvious negative responses to the airgun and gear or if there are any signs of injury or mortality as a direct result of the seismic activities.	Avoid / Abate on site
5.4	As noted above for planning, when arriving at the survey area for the first time, survey activities should, as far as possible, only commence during daylight hours with good visibility. However, if this is not possible due to prolonged periods of poor visibility (e.g. thick fog) or unforeseen technical issue which results in a night-time start, the initial acoustic source activation (including gun tests) may only be undertaken if the normal 60-minute PAM pre-watch and "soft-start" procedures have been followed.	Avoid / Abate on site
5.5	Schedule "soft-starts" so as to minimise, as far as possible, the interval between reaching full power operation and commencing a survey line. The period between the end of the soft start and commencing with a survey line must not exceed 20 minutes. If it does exceed 20 minutes, refer to breaks in firing below.	Abate on site

No.	Mitigation measure	Classification
6. Line Turns		
6.1	If line changes are expected to take longer than 40 minutes: • Terminate airgun firing at the end of the survey line and implement a pre-shoot search (60 minutes) and "soft-start" procedure (20 minutes) when approaching the next survey line. • If line turn is shorter than 80 minutes (i.e. shorter than a 60-minute pre-shoot watch and 20-minute "soft-start" combined), the pre-shoot watch can commence before the end of the previous survey line.	Abate on site
6.2	If line changes are expected to take less than 40 minutes, airgun firing can continue during the line change if: • The power is reduced to 180 cubic inches (or as close as is practically feasible) at standard pressure. Airgun volumes of less than 180 cubic inches can continue to fire at their operational volume and pressure; • The Shot Point Interval (SPI) is increased to provide a longer duration between shots, with the SPI not to exceed 5 minutes; and • The power is increased and the SPI is decreased in uniform stages during the final 10 minutes of the line change (or geophone repositioning), prior to data collection re-commencing (i.e. a form of mini soft start). • Normal MMO and PAM observations continue during this period when reduced power airgun is firing.	Abate on site
7. Shut-Downs		
7.1	Terminate seismic shooting on: • observation and/or detection of penguins or feeding aggregations of diving seabirds, turtles, slow swimming large pelagic fish (including whale sharks, basking sharks, manta rays) or cetaceans within the 500 m mitigation zone. • observation of any obvious mortality or injuries to cetaceans, turtles, seals or mass mortalities of squid and fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO to be as a direct result of the survey.	Abate on site
7.2	Depending the species, specific mitigation will be implemented to continue the survey operations, as specified below: • For specific species such as turtles, penguins, diving seabirds and slow swimming large pelagic fish (including whale sharks, basking sharks, manta rays), terminate shooting until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required). • For cetaceans, terminate shooting until such time as there has been a 30 minute delay from the time the animal was last sighted within the mitigation zone before the commencement of the normal soft start procedure.	Abate on site

No.	Mitigation measure	Classification
8. Breaks in Airgun Firing		
8.1	If after breaks in firing, the airgun can be restarted within 5 minutes, no soft-start is required and firing can recommence at the same power level provided no marine mammals have been observed or detected in the mitigation zone during the break-down period.	Abate on site
8.2	For all breaks in firing of longer than 5 minutes, but less than 20 minutes, implement a "soft-start" of similar duration, assuming there is continuous observation by the MMO and PAM operator during the break.	Abate on site
8.3	For all breaks in firing of 20 minutes or longer, implement a 60-minute pre-shoot watch and 20-minute "soft-start" procedure prior to the survey operation continuing.	Abate on site
8.4	For planned breaks, ensure that there is good communication between the seismic contractor and MMOs and PAM operators in order for all parties to be aware of these breaks and that early commencement of pre-watch periods can be implemented to limit delays.	Abate on site
9. PAM Malfunctions		
9.1	If the PAM system malfunctions or becomes damaged during night-time operations or periods of low visibility, continue operations for 30 minutes without PAM if no marine mammals were detected by PAM in the mitigation zones in the previous 2 hours, while the PAM operator diagnoses the issue. If after 30 minutes the diagnosis indicates that the PAM gear must be repaired to solve the problem, reduce power to 190 cubic inches. Firing of the reduced power gun may continue for 30 minutes while PAM is being repaired, the last 10-minute of which is a 10-minute ramp-up to full power (mini "soft-start"). If the PAM repair will take longer than 60 minutes, stop surveying until such time as a functional PAM system can be redeployed and tested.	Abate on site
9.2	If the PAM system breaks down during daylight hours, continue operations for 30 minutes without PAM, while the PAM operator diagnoses the issue. If the diagnosis indicates that the PAM gear must be repaired to solve the problem, operations may continue for an additional 2 hours without PAM monitoring as long as: • No marine mammals were detected by PAM in the mitigation zones in the previous 2 hours; • Two MMOs maintain watch at all times during operations when PAM is not operational; • The time and location in which operations began and stop without an active PAM system is recorded.	Abate on site

Vessel and Aircraft Operations

No.	Mitigation measure	Classification
1	Pre-plan flight paths to ensure that no flying occurs over seal colonies and seabird nesting areas.	Avoid / abate on site
2	Avoid extensive low-altitude coastal flights by ensuring that the flight path is perpendicular to the coast, as far as possible.	Avoid/ abate on site
3	Brief all pilots on the ecological risks associated with flying at a low level along the coast or above marine mammals.	Avoid
4	The lighting on the survey and support vessels should be reduced to a minimum compatible with safe operations wherever and wherever possible. Light sources should, if possible and consistent with safe working practices, be positioned in places where emissions to the surrounding environment can be minimised.	Reduce at Source

No.	Mitigation measure	Classification
5	Keep abornensated, but otherwise unharmed, seabirds in dark containers (e.g. cardboard box) for subsequent release during daylight hours. Ringed/banded birds should be reported to the appropriate ringing/banding scheme (details are provided on the ring).	Repair or Restore
6	Avoid the unnecessary discharge of ballast water.	Reduce at source
7	Use filtration procedures during loading in order to avoid the uptake of potentially harmful aquatic organisms, pathogens and sediment that may contain such organisms.	Avoid/reduce at source
8	Ensure that routine cleaning of ballast tanks to remove sediments is carried out, where practicable, in mid-ocean or under controlled arrangements in port or dry dock, in accordance with the provisions of the ship's Ballast Water Management Plan.	Avoid/reduce at source
9	Ensure all equipment (e.g. arrays, streamers, tail buoys etc) that has been used in other regions is thoroughly cleaned prior to deployment.	Avoid/Reduce at Source
10	Implement a waste management system that addresses all wastes generated at the various sites, shore-based and marine. This should include: – Separation of wastes at source; – Recycling and re-use of wastes where possible; – Treatment of wastes at source (maceration of food wastes, compaction, incineration, treatment of sewage and oily water separation).	Avoid/Reduce at Source
11	Implement leak detection and repair programmes for valves, flanges, fittings, seals, etc.	Avoid/Reduce at Source
12	Use a low-toxicity biodegradable detergent for the cleaning of all deck spillages.	Reduce at Source
13	The vessel operators should keep a constant watch for marine mammals and turtles in the path of the vessel.	Avoid
14	Keep watch for marine mammals behind the vessel when tension is lost on the towed equipment and either retrieve or regain tension on towed gear as rapidly as possible.	Avoid
15	Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'.	Avoid
16	Ensure vessel transit speed between the survey area and port is a maximum of 12 knots (22 km/hr), except in the MPA; where it is reduced further to 10 knots (18 km/hr).	Avoid/reduce at source
17	Ensuring that loads are lifted using the correct lifting procedure and within the maximum lifting capacity of crane system.	Avoid
18	Minimise the lifting path between vessels.	Avoid
19	Undertake frequent checks to ensure items and equipment are stored and secured safely on board each vessel.	Avoid
20	In the event that equipment is lost during the operational stage, assess safety and metocean conditions before performing any retrieval operations. Establishing a hazards database listing the type of gear left on the seabed and/or in the Reconnaissance Permit Area with the dates of abandonment/loss and locations, and where applicable, the dates of retrieval.	Repair/restore
21	Use low toxicity dispersants cautiously and only with the permission of the Department of Forestry, Fisheries and Environment (DFFE).	Abate on and off site

No.	Mitigation measure	Classification
22	As far as possible, and whenever the sea state permits, attempt to control and contain the spill at sea with suitable recovery techniques to reduce the spatial and temporal impact of the spill.	Abate on site
23	Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station.	Restore
24	Ensure offshore bunkering is not undertake in the following circumstances: – Wind force and sea state conditions of ≥6 on the Beaufort Wind Scale; – During any workboat or mobilisation boat operations; – During helicopter operations; – During the transfer of in-sea equipment; and – At night or times of low visibility.	Avoid / Reduce at source

ACRONYMS, ABBREVIATIONS and UNITS

2D	Two-dimensional
3D	Three-dimensional
ALARP	as low as reasonably practicable
BAR	Basic Assessment Report
BAT	Best Available Techniques
BCC	Benguela Current Commission
BCLME	Benguela Current Large Marine Ecosystem
BOD	Biological Oxygen Demand
CBD	Convention of Biological Diversity
CCA	CCA Environmental (Pty) Ltd
cm	centimetres
cm/s	centimetres per second
CITES	Convention on International Trade in Endangered Species
CMS	Convention on Migratory Species
CMS	Centre for Marine Studies
CSIR	Council for Scientific and Industrial Research
dB	decibell
DEFRA	UK Department for Environment, Food & Rural Affairs
DFFE	Department of Forestry, Fisheries and Environment
EBSAs	Ecologically or Biologically Significant Areas
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services (Pty) Ltd
EMP	Environmental Management Programme
EOO	Extent of Occurrence
ENSO	El Niño Southern Oscillation
EPA	Environmental Protection Agency
ERA	Environmental Risk Analysis
ERP	Emergency Response Plan
FAO	Food and Agricultural Organisation
g/m^2	grams per square metre
g C/m^2/day	grams Carbon per square metre per day
h	hour
H_2S	hydrogen sulphide
HAB	Harmful Algal Bloom
kHz	Herz
IBA	Important Bird Area
IFC	International Finance Corporation
IMO	International Maritime Organisation
IUCN	International Union for the Conservation of Nature
IWC	International Whaling Commission
JNCC	Joint Nature Conservation Committee
kHz	kiloHerz

km	kilometre
km^2	square kilometre
km/h	kilometres per hour
kts	knots
m	metres
m^2	square metres
m^3	cubic metre
mm	millimetres
m/s	metres per second
mg/l	milligrams per litre
MBES	Multi Beam Echo Sounder
MMO	Marine Mammal Observer
MPA	Marine Protected Area
MPRDA	Minerals and Petroleum Development Act
N	north
NBHF	narrow band, high frequency
NDP	Namibian Dolphin Project
NMFS	National Marine Fisheries Services
NNW	north-northwest
NW	north-west
PAM	Passive Acoustic Monitoring
PASA	Petroleum Association of South Africa
PIM	Particulate Inorganic Matter
Pk SPL	Peak Sound Pressure Level
POM	Particulate Organic Matter
ppm	parts per million
PRDW	Prestedge Retief Dresner Wijnberg Coastal Engineers
PTS	Permananet Threshold Shift
psi	pound-force per square inch
RMS SPL	root-mean-square sound pressure levels
RMU	Regional Management Unit
ROV	Remotely Operated Vehicle
S	south
SACW	South Atlantic Central Water
SAEON	South African Environmental Observation Network
SANBI	South African National Biodiversity Institute
SEL	Sound Exposure Level
SFRI	Sea Fisheries Research Institute, Department of Environmental Affairs
SOPEP	Shipboard Oil Pollution Emergency Plan
SPRFMA	South Pacific Regional Fisheries Management Authority
SSW	South-southwest
SW	south-west
T	ton(s)
TBT	tributyltin
TSPM	Total Suspended Particulate Matter
TTS	Temporary Threshold Shift

VMEs	Vulnerable Marine Ecosystems
VOS	Voluntary Observing Ships
WBMs	Water-based muds
WWF	World Wildlife Fund
µg	micrograms
µm	micrometre
µg/l	micrograms per litre
µPa	micro Pascal
°C	degrees Centigrade
%	percent
‰	parts per thousand
~	approximately
<	less than
>	greater than
"	inch

EXPERTISE AND DECLARATION OF INDEPENDENCE

This report was prepared by Dr Andrea Pulfrich of Pisces Environmental Services (Pty) Ltd. Andrea has a PhD in Fisheries Biology from the Institute for Marine Science at the Christian-Albrechts University, Kiel, Germany.

As Director of Pisces since 1998, Andrea has considerable experience in undertaking specialist environmental impact assessments, baseline and monitoring studies, and Environmental Management Programmes relating to marine diamond mining and dredging, hydrocarbon exploration and thermal/hypersaline effluents. She is a registered Environmental Assessment Practitioner and member of the South African Council for Natural Scientific Professions (Pr.Sci.Nat. No: 400327/06), South African Institute of Ecologists and Environmental Scientists, and International Association of Impact Assessment (South Africa).

This specialist report was compiled for EIMS (Pty) Ltd for their use in preparing a Basic Assessment Report and Environmental Management Programme Report (EMPr) for proposed 3D seismic acquisition in the Orange Basin off the West Coast of South Africa.

I do hereby declare that Pisces Environmental Services (Pty) Ltd is financially and otherwise independent of TGS Geophysical Company (UK) Ltd, and has no vested interests in the proposed project or the study area.

Andrea Pulfrich

Dr Andrea Pulfrich

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1 GENERAL INTRODUCTION

Hydrocarbon deposits occur in reservoirs in sedimentary rock layers. Being lighter than water they accumulate in traps where the sedimentary layers are arched or tilted by folding or faulting of the geological layers. Marine seismic surveys are the primary tool for locating such deposits and are thus an indispensable component of offshore oil or gas exploration.

Seismic survey programmes comprise data acquisition in either two-dimensional (2D) and/or three dimensional (3D) scales, depending on information requirements. 2D surveys are typically applied to obtain regional data from widely spaced survey grids and provide a vertical slice through the seafloor geology along the survey track-line. Infill surveys on closer grids subsequently provide more detail over specific areas of interest. In contrast, 3D seismic surveys are conducted on a very tight survey grid, and provide a cube image of the seafloor geology along each survey track-line. Such surveys are typically applied to promising petroleum prospects to assist in fault line interpretation.

The nature of the sound impulses utilised during seismic surveys have resulted in concern over their potential impact on marine fauna, particularly marine mammals, seabirds and fish (McCauley et al. 2000). Consequently, it has been proposed that environmental management already be applied at the exploration stage of the life cycle of a hydrocarbon field project (Duff et al. 1997, in Salter & Ford 2001).

For this investigation TGS Geophysical Company (UK) Ltd (TGS) is planning to undertake 3D seismic acquisition in the Orange Basin off the West Coast of South Africa. The area of interest is located on the edge of the South African Exclusive Economic Zone (EEZ). Although the Reconnaissance Permit Area extends over a number of licence blocks between the South-African - Namibian border and Cape Columbine, the proposed 3D acquisition area is confined to the Deep Water Orange Basin Block. Water depths in the Reconnaissance Permit area range from -500 m to nearly 4 000 m. Environmental Impact Management Services (Pty) Ltd (EIMS) has been appointed byTGS to compile the Basic Assessment Report and Environmental Management Programme (EMP) for the proposed 3D seismic acquisition. EIMS in turn has approached Pisces Environmental Services (Pty) Ltd to provide a specialist report on potential impacts of the proposed seismic operations on biodiversity and ecosystem services in the area.

1.1 Scope of Work

This specialist report was compiled as a desktop study on behalf of TGS, for their use in preparing an EMP as part of a Basic Assessment Report for the proposed 3D seismic survey in the Orange Basin, offshore of the West Coast of South Africa.

The terms of reference specifically for the Biodiversity and Ecosystem Services Assessment are:

- Provide a general description of the marine ecosystem goods and services in the Benguela System along the South African West Coast, based on current available literature;
- Provide a qualitative and/or quantitative description of the Biodiversity and Ecosystem Services values occurring at the site, including their current condition, trends and uses.
- Describe the offshore habitats that are likely to be affected by seismic activities.
- Identify acoustically sensitive marine species (receptors).

- Confirm the presence and/or status of priority biodiversity features, habitats and species in the impact area, and contextualise the assessment within local, regional and national conservation priorities.
- Describe the significance of seasonality and natural cycles/variability of key marine fauna.
- Highlight the implications of gaps in information, uncertainty and/or risks in terms of irreversibility of impacts, irreplaceable loss of resource, etc.
- Assess whether there are any secondary, indirect, induced and/or cumulative impacts.
- Identify, describe and assess the significance of potential impacts of the proposed seismic survey on Biodiversity and Ecosystem Services.
- Systematically apply the Mitigation Hierarchy for avoidance and reduction of any negative impacts across all phases of the seismic survey.
- When making recommendations, specify and identify all mitigation with reference to the options in the Mitigation Hierarchy.

1.2 Approach to the Study

All identified marine and coastal impacts are summarised, categorised and ranked in an appropriate impact assessment table, to be incorporated in the overall EIA.

1.3 Assumptions, Limitations and Information Gaps

As determined by the terms of reference, this study has adopted a 'desktop' approach. Consequently, the description of the natural baseline environment in the study area is based on a review and collation of existing information and data from the scientific literature, internal reports and the Marine Mammal Observer (MMO) Reports. The sources consulted are listed in the Reference chapter.

The assumptions made in this specialist assessment are:

- The study is based on the project description made available to the specialist at the time of the commencement of the study.
- Some important conclusions regarding the extent of the zones of impact of seismic sound and associated assessments on marine fauna are based on the results of the Underwater Acoustic Modelling Study (SLR 2022).
- Potential changes in the marine environment such as sea-level rise and/or increases in the severity and frequency of storms related to climate change are not included in the terms of reference and therefore not dealt with in this report.

All identified marine impacts are summarised, categorised and ranked in appropriate impact assessment tables, to be incorporated in the overall EIA Report.

Information gaps include:

- details of the benthic macrofaunal communities beyond the shelf break;
- details on demersal fish communities beyond the shelf break;

- information specific to the marine communities of seamounts (Tripp Seamount, Child's Bank) and submarine canyons (Cape Canyon and Cape Point Canyon); and
- current information on the distribution, population sizes and trends of most cetacean species occurring in South African waters and the project area in particular.

Keeping these information gaps in mind, the assessment of impacts has adopted a strongly precautionary approach.

1.4 Assessment Procedure

The assessment convention used by Environmental Impact Management Services (Pty) Ltd (EIMS), who are undertaking the Reconnaissance Permit Application and compiling the Basic Assessment Report for TGS, was used to determine significance ratings in the assessment (see Appendix 1).

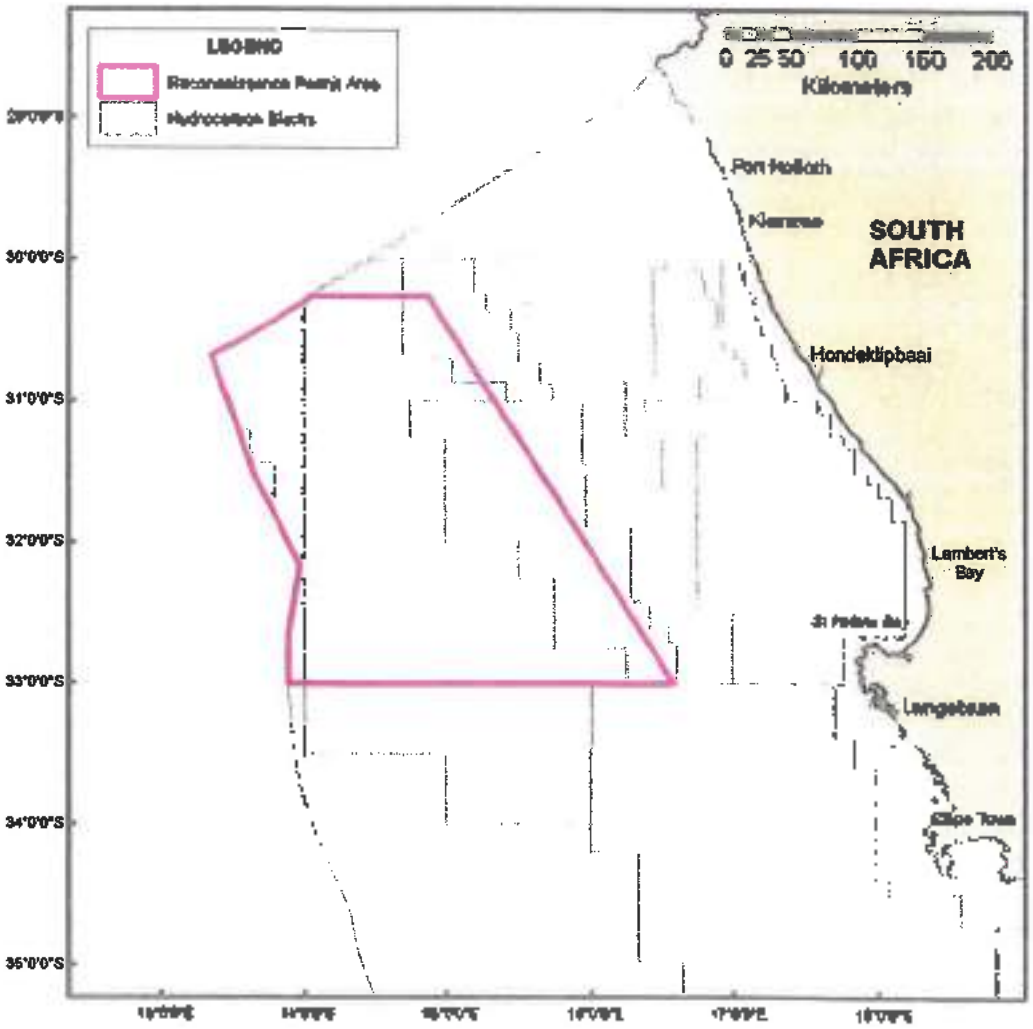

Figure 1: Map of the proposed Reconnaissance Permit Area (red polygon) in relation to hydrocarbon blocks off the West Coast (grey polygons).

2 DESCRIPTION OF THE PROPOSED PROJECT

TGS Geophysical Company (UK) Ltd is planning to conduct a seismic campaign over in the Orange Basin during the best available window of opportunity in either 2023 or 2024, subject to granting of the Reconnaissance PermR and vessel availability. The Reconnaissance Permit Area is approximately 57 400 km² in extent. Water depths in the Reconnaissance Permit Area range from ~500 m to nearly 4 000 m. The area is situated roughly between the Orange River mouth and Cape Columbine, approximately 120 km offshore at its closest points. The total 3D survey duration would be in the order of up to 70 days.

The anticipated acoustic source (airgun) and hydrophone array would consist of 24 active guns with operating pressures of 2 000 pound-force per square inch (psi), situated some 50 m behind the vessel at a depth of 7 - 8 m below the surface. The 3D survey will involve multiple streamers (up to 12 streamers spaced 100 m apart) up to 12 000 m long, towed at a depth of approximately 8 m.

The seismic vessel would steam a series of predefined transects describing the survey grid, the headings of which would be fixed and reciprocal. During surveying the seismic vessel would travel at a speed of between four and six knots and the sound sources would be "fired" by the airgun array. As the seismic vessel would be restricted in manoeuvrability (a turn radius of approximately 5 km is expected), other vessels should remain clear of it. A support vessel usually assists in the operation of keeping other vessels at a safe distance.

Each triggering of a sound pulse is termed a seismic shot, and these are fired at intervals of 6 - 20 seconds (depending on water depth and other environmental characteristics) (Barger & Hamblen 1980). Each seismic shot is usually only between 5 and 30 milliseconds in duration, and despite peak levels within each shot being high, the total energy delivered into the water is low.

Airguns have most of their energy in the 5-300 Hz frequency range, with the optimal frequency required for deep penetration seismic work being 50-80 Hz.

Sound levels from individual airguns use today in the seismic industry range from 200 to 232 dB re 1 µPa at 1 m, for small to large individual guns, respectively. For airgun arrays, sound levels range from 235 dB re 1 µPa at 1 m for a small array (500 cubic inches) to 260 dB re 1 µPa at 1 m for large arrays (7 900 cubic inches) (Bröcker 2019). The majority of the produced energy is below 250 Hz, with 90% of the energy between 70 to 140 Hz, although pulses do contain some higher frequencies up to 16 kHz (Bröcker 2019). It must be noted, however, that the sound level specifications for airgun arrays refer to sound levels in the vertical direction directly beneath the airgun array, generally near its centre, with nominal sound levels in the horizontal direction being ~10-20 dB lower (Caldwell & Dragoset 2000; Dragoset 2000).

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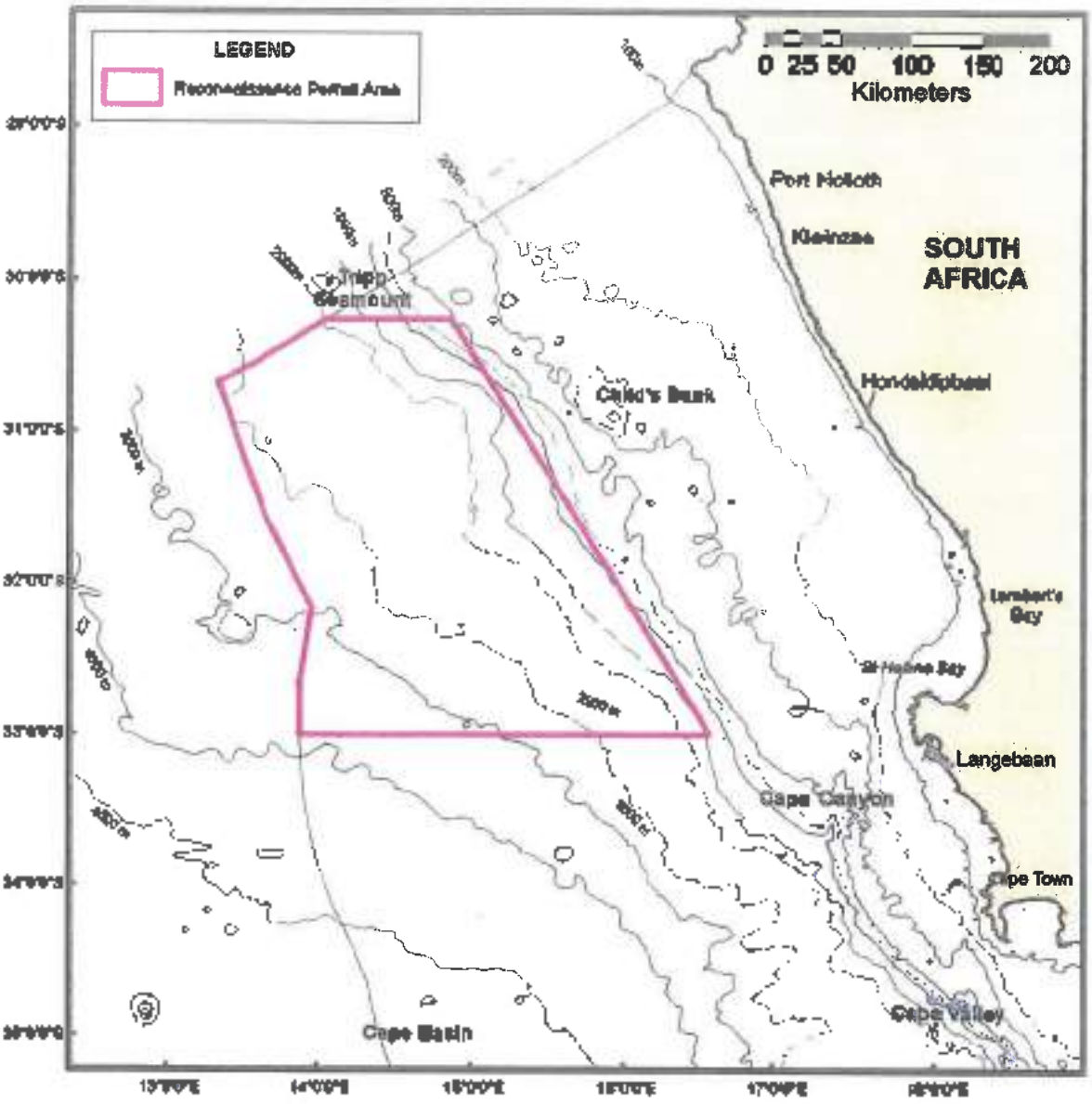

Figure 2: Map indicating location of the Reconnaissance Permit Area in relation to bathymetric features off the West Coast. Places mentioned in the text are also indicated.

3 DESCRIPTION OF THE BASELINE MARINE ENVIRONMENT

The descriptions of the physical and biological environments along the South African West Coast focus primarily on the study area between the Orange River mouth and Cape Point. The description of the marine environment includes the various biophysical receptors that may be affected both directly and indirectly by the project activities. The area of direct influence would include those receptors located within or immediately adjacent to the area of interest for seismic acquisition within the Orange Basin, which may be affected by seismic noise, whereas the area of indirect influence will vary in extent depending on the type of receptor potentially affected by more far-reaching impacts. The summaries presented below are based on information gleaned from Lane & Carter (1999), Morant (2006), and Penney *et al.* (2007), supplemented with more recent information available in peer-reviewed publications and internal reports. Natasha Karenyi of the University of Cape Town contributed to a previous version of the description of benthic macrofaunal communities. Dr Simon Elwen of the Namibian Dolphin Project and Mammal Research Institute (University of Pretoria) provided input into a previous version of the section on marine mammals.

3.1 Geophysical Characteristics

3.1.1 Bathymetry

The continental shelf along the West Coast is generally wide and deep, although large variations in both depth and width occur. The shelf maintains a general NNW trend, widening north of Cape Columbine and reaching its widest off the Orange River (180 km) (see Figure 2). The nature of the shelf break varies off the South African West Coast. Between Cape Columbine and the Orange River, there is usually a double shelf break, with the distinct inner and outer slopes, separated by a gently sloping ledge. The immediate inshore[1] area consists mainly of a narrow (about 8 km wide) rugged rocky zone and slopes steeply seawards to a depth of around 80 m. The middle (-50 to -150 m) and outer shelf (-150 to -350 m) normally lacks relief and slopes gently seawards reaching the shelf edge at a depth of between -350 to -500 m (Sink *et al.* 2019). The three shelf zones characterising the West Coast are recognised following both abiotic (de Wet 2013) and biotic (Karenyi *et al.* 2016) patterns.

Banks on the continental shelf include the Orange Bank (Shelf or Cone), a shallow (160 - 190 m) zone that reaches maximal widths (180 km) offshore of the Orange River, and Child's Bank, situated ~350 km offshore at about 31°S, and within the northern portion of the project target area. Child's Bank is a major feature on the West Coast margin and is the only known submarine bank within South Africa's Exclusive Economic Zone (EEZ), rising from a depth of 350 - 400 m water to less than -200 m at its shallowest point. It is a rounded, flat topped, sandy plateau, which lies at the edge of the continental shelf. The bank has a gentle northern, eastern and southern margin but a steep, slump-generated outer face (Birch & Rogers 1973; Dingle *et al.* 1983; de Wet 2013). At its southwestern edge, the continental slope drops down steeply from -350 to -1 500 m over a distance of less than 60 km (de Wet 2013) creating precipitous cliffs at least 150 m high (Birch & Rogers 1973). The bank consists of resistant, horizontal beds of Pliocene sediments, similar to that of the Orange Banks, and

[1] As per the 2019 National Biodiversity Assessment inshore is defined as the area influenced by wave energy and light, with the fair weather wave base at a depth ranging between -30 to -50 m used to determine the outer limits of this zone in South Africa. Offshore areas are those that extend beyond this zone.

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represents another perched erosional outlier formed by Post-Pliocene erosion (Dingle 1973; Siesser *et al.* 1974). The top of this feature, has been estimated to cover some 1 450 km^2 (Sink *et al.* 2012).

Tripp Seamount, a geological feature ~25 km to the north of the Reconnaissance Permit area, rises from the seabed at ~1 000 m to a depth of 150 m. It is a roughly circular feature with a flat apex that drops steeply on all sides.

Further underwater features in the vicinity of the Reconnaissance Permit Area include the Cape Canyon and Cape Point Valley, which lie ~95 km and ~250 km to the southeast of the southern boundary of the Reconnaissance Permit Area (Simpson & Forder 1968; Dingle 1986; Wigley 2004; Wigley & Compton 2006). The Cape Canyon was discovered in the 1960s. The canyon head forms a well-developed trench on the continental shelf, 100 m deep and 4 km wide (Wigley 2004; Wigley & Compton 2006). South of Cape Columbine the canyon becomes progressively narrower and deeper. Adjacent to Cape Town in a water depth of 1 500 m, the canyon has a local relief in the order of 500-800 m (Simpson & Forder 1968; Dingle *et al.* 1987). The Cape Canyon has a longitudinal extent of at least 200 km and can be traced to a water depth of at least 3 600 m (Dingle 1970), where the topography of the distal end is rugged and complex (Dingle *et al.* 1987). Sediments in the canyon are predominately unconsolidated sands and muds. The canyon serves as an upwelling feature funnelling cold, nutrient-rich South Atlantic Central Water up the canyon slope providing highly productive surface waters which in turn power feeding grounds for cetaceans and seabirds (Filander *et al.* 2018; www.environment.gov.za/ dearesearchteamreturnfromdeepseaexpedition).

The Cape Point Valley, which lies about 70 km south of the Cape Peninsula, is another large canyon breaching the shelf. This canyon has sustained the highest fishing effort and catches in the South African demersal trawl fishery for almost a century (www.marineprotectedareas.org.za/canyons).

Using high-resolution bathymetry collected between 315 - 3 125 m depth, Palan (2017) identified numerous new and previously undocumented submarine canyon systems, most of which are less extensive than the Cape Canyon and Cape Point Valley and do not incise the shelf (Figure 3). Canyon morphology was highly variable and included linear, sinuous, hooked and shelf-indenting types. Large fluid seep/pockmark fields of varying morphologies were similarly revealed situated in close proximity to the sinuous, hooked and shelf-indenting canyon types thereby providing the first evidence of seafloor fluid venting and escape features from the South African margin. These pockmarks represent the terminus of stratigraphic fluid migration from an Aptian gas reservoir, evidenced in the form of blowout pipes and brightened reflectors. This area lies well to the southeast of the Reconnaissance Permit Area.

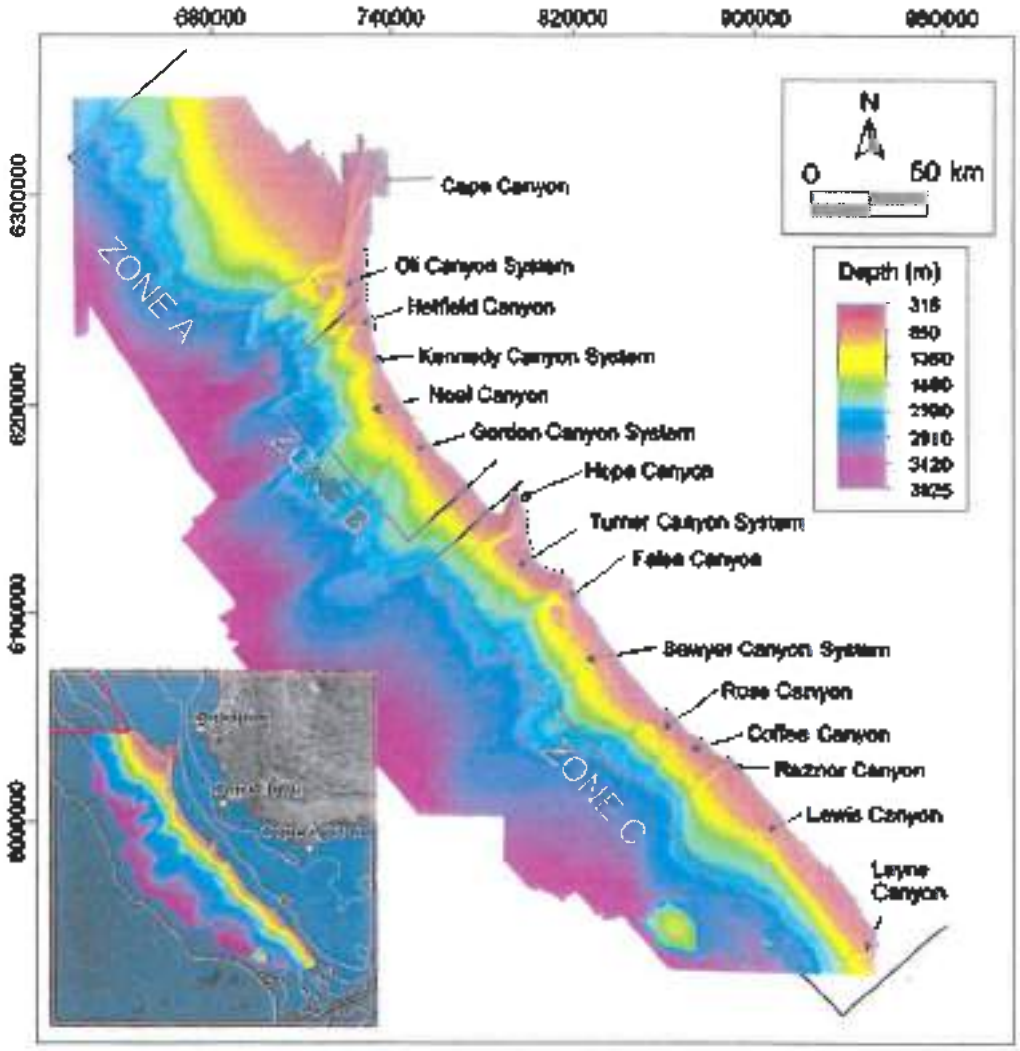

Figure 3: Submarine canyon domains of the southwestern Cape continental margin identified by Paton (2017). Insert shows the locality of the study area (red polygon) in relation to the canyons.

3.1.2 Coastal and Inner-shelf Geology and Seabed Geomorphology

Figure 4 illustrates the distribution of seabed surface sediment types off the South African north-western coast. The inner shelf is underlain by Precambrian bedrock (Pre-Mesozoic basement), whilst the middle and outer shelf areas are composed of Cretaceous and Tertiary sediments (Dingle 1973; Dingle *et al.* 1987; Birch *et al.* 1976; Rogers 1977; Rogers & Bremner 1991). As a result of erosion on the continental shelf, the unconsolidated sediment cover is generally thin, often less than 1 m. Sediments are finer seawards, changing from sand on the inner and outer shelves to muddy sand and sandy mud in deeper water. However, this general pattern has been modified considerably by biological deposition (large areas of shelf sediments contain high levels of calcium carbonate) and localised river input. An ~500-km long mud belt (up to 40 km wide, and of 15 m average thickness) is situated over the inner shelf between the Orange River and St Helena Bay (Birch *et al.* 1976). Further offshore and within the Reconnaissance Permit Area, sediment is dominated by muds and

sandy muds. The continental slope, seaward of the shelf break, has a smooth seafloor, underlain by calcareous ooze.

Present day sedimentation is limited to input from the Orange River. This sediment is generally transported northward. Most of the sediment in the area is therefore considered to be relict deposits by now ephemeral rivers active during wetter climates in the past. The Orange River, when in flood, still contributes largely to the mud belt as suspended sediment is carried southward by poleward flow. In this context, the absence of large sediment bodies on the inner shelf reflects on the paucity of terrigenous sediment being introduced by the few rivers that presently drain the South African West Coast coastal plain.

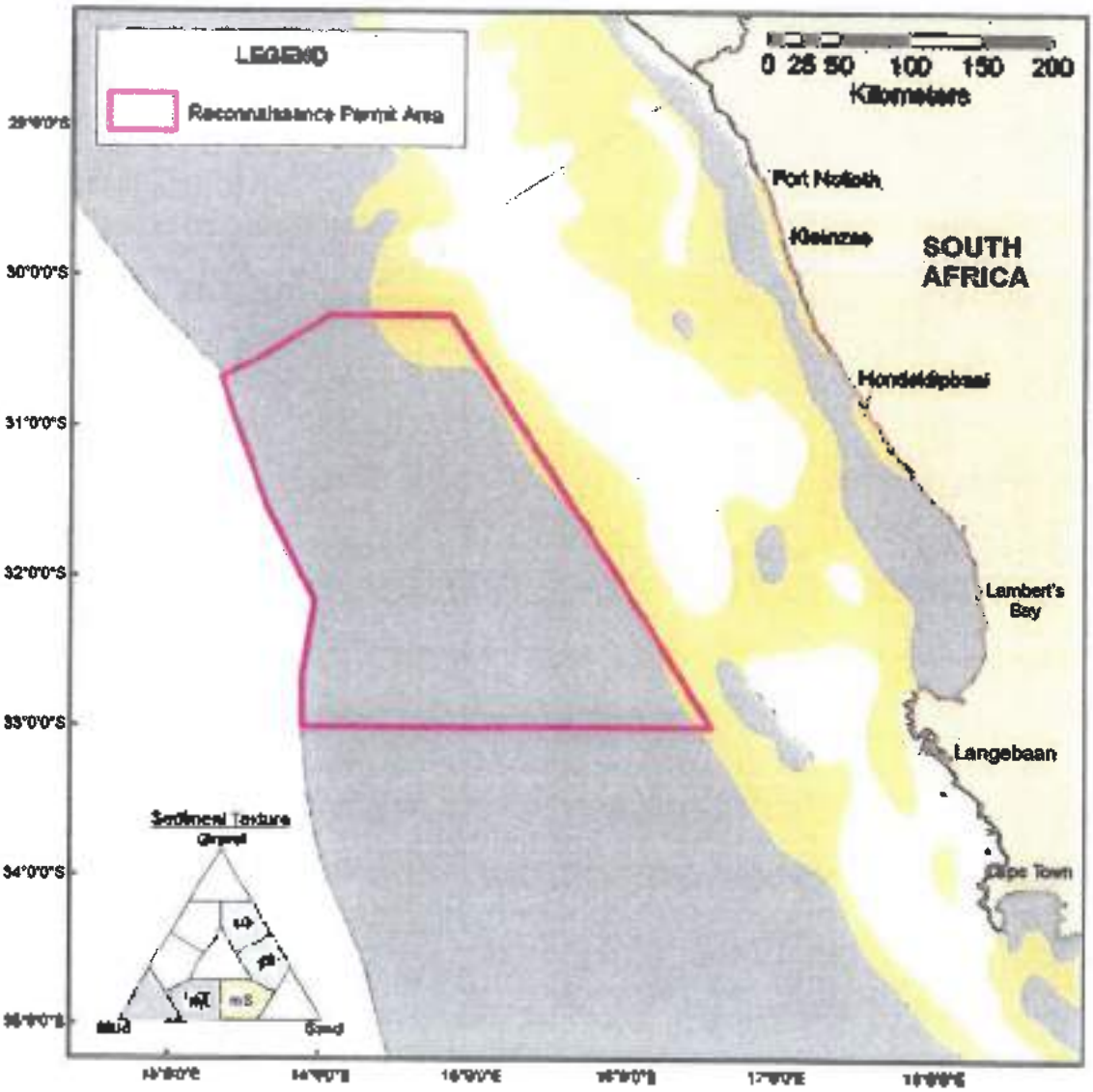

Figure 4: The Reconnaissance Permit Area in relation to sediment distribution on the continental shelf of the South African West Coast (Adapted from Rogers 1977). Based on information in Holness *et al.* (2014) and Sink *et al.* (2019), the mud/sandy mud sediments have been extended to the edge of the EEZ beyond that shown in Rogers (1977).

The benthic habitat types of the West Coast were classified and mapped in detail through the 2011 National Biodiversity Assessment (NBA) (Sink *et al.* 2012a). These were refined in the 2018 NBA (Sink *et al.* 2019) to provide substratum types (Figure 5).

In the Reconnaissance Permit Area the water depth ranges from -500 m to nearly 4 000 m. The Southeast Atlantic Unclassified Slopes and Southeast Atlantic Unclassified Abyss substrata dominate across the area. The shelf inshore of the Reconnaissance Permit Area boasts a diversity of substrata (Sink *et al.* 2019).

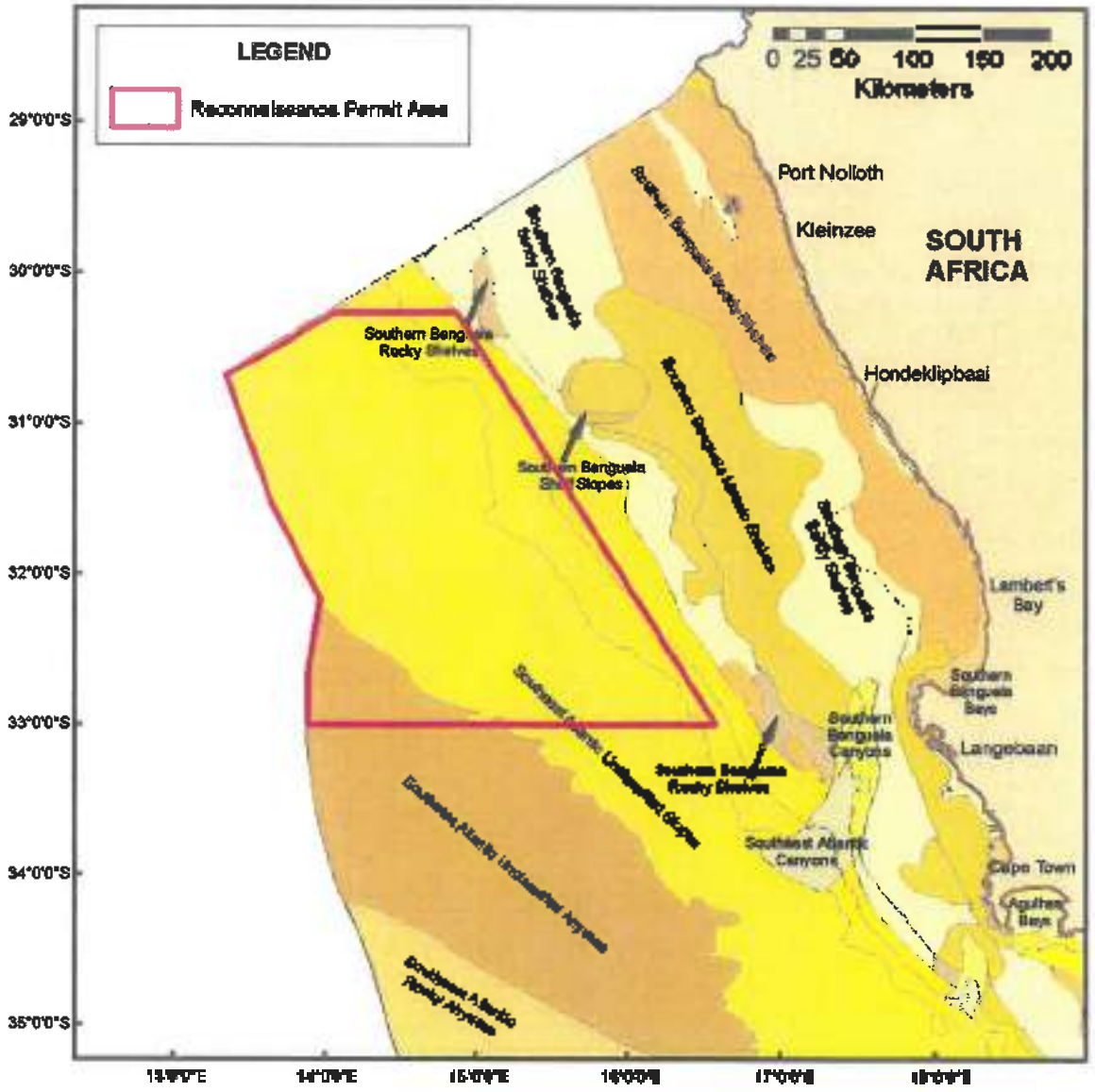

Figure 5: The Reconnaissance Permit Area in relation to the distribution of seabed substratum types along the West Coast (adapted from Sink *et al.* 2019).

3.2 Biophysical Characteristics

3.2.1 Wind Patterns

Winds are one of the main physical drivers of the nearshore Benguela region, both on an oceanic scale, generating the heavy and consistent south-westerly swells that impact this coast, and locally, contributing to the northward-flowing longshore currents, and being the prime mover of sediments in the terrestrial environment. Consequently, physical processes are characterised by the average seasonal wind patterns, and substantial episodic changes in these wind patterns have strong effects on the entire Benguela region.

The prevailing winds in the Benguela region are controlled by the South Atlantic subtropical anticyclone, the eastward moving mid-latitude cyclones south of southern Africa, and the seasonal atmospheric pressure field over the subcontinent. The south Atlantic anticyclone is a perennial feature that forms part of a discontinuous belt of high-pressure systems which encircle the subtropical southern hemisphere. This undergoes seasonal variations, being strongest in the austral summer, when it also attains its southernmost extension, lying south west and south of the subcontinent. In winter, the south Atlantic anticyclone weakens and migrates north-westwards.

These seasonal changes result in substantial differences between the typical summer and winter wind patterns in the region, as the southern hemisphere anti-cyclonic high-pressures system, and the associated series of cold fronts, moves northwards in winter, and southwards in summer. The strongest winds occur in summer (October to March), during which winds blow 98% of the time (PRDW 2013), with a total of 226 gales (winds exceeding 18 m/s or 35 kts) being recorded over the period (CSIR 2006). Virtually all winds in summer come from the south to south-southeast (Figure 6). These southerlies occur over 40% of the time, averaging 20 - 30 kts and reaching speeds in excess of 60 kts, bringing cool, moist air into the coastal region and driving the massive offshore movements of surface water, and the resultant strong upwelling of nutrient-rich bottom waters, which characterise this region in summer. The winds also play an important role in the loss of sediment from beaches. These strong equatorwards winds are interrupted by the passing of coastal lows with which are associated periods of calm or north or northwest wind conditions. These northerlies occur throughout the year, but are more frequent in winter.

Winter remains dominated by southerly to south-easterly winds, but the closer proximity of the winter cold-front systems results in a significant south-westerly to north-westerly component (Figure 6). This 'reversal' from the summer condition results in cessation of upwelling, movement of warmer mid-Atlantic water shorewards and breakdown of the strong thermoclines which typically develop in summer. There are also more calms in winter, occurring about 3% of the time, and wind speeds generally do not reach the maximum speeds of summer. However, the westerly winds blow in synchrony with the prevailing south-westerly swell direction, resulting in heavier swell conditions in winter.

During autumn and winter, catabatic, or easterly 'berg' winds can also occur. These powerful offshore winds can exceed 50 km/h, producing sandstorms that considerably reduce visibility at sea and on land. Although they occur intermittently for about a week at a time, they have a strong effect on the coastal temperatures, which often exceed 30°C during 'berg' wind periods (Shannon & O'Toole 1998). The winds also play a significant role in sediment input into the coastal marine environment with transport of the sediments up to 150 km offshore.

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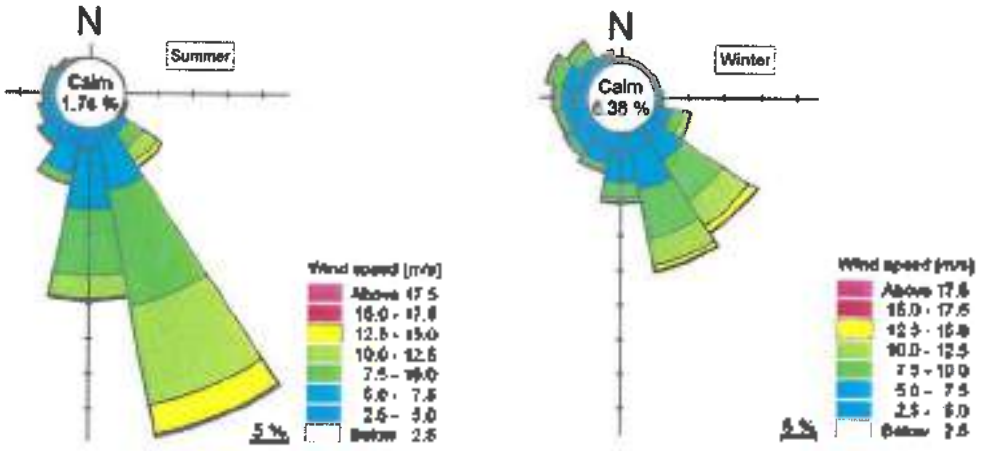

Figure 6: Wind Speed vs. Wind Direction for NCEP hind cast data at location 15°E, 31°S (From PRDW 2013).

3.2.2 Large-Scale Circulation and Coastal Currents

The southern African West Coast is strongly influenced by the Benguela Current. Current velocities in continental shelf areas generally range between 10-30 cm/s (Boyd & Oberholster 1994), although localised flows in excess of 50 cm/s occur associated with eddies (PRDW 2013). On its western side, flow is more transient and characterised by large eddies shed from the retroflection of the Agulhas Current. This results in considerable variation in current speed and direction over the domain (PRDW 2013). In the south the Benguela current has a width of 200 km, widening rapidly northwards to 750 km. The surface flows are predominantly wind-forced, barotropic and fluctuate between poleward and equatorward flow (Shillington *et al.* 1990; Nelson & Hutchings 1983) (Figure 7b). Fluctuation periods of these flows are 3 - 10 days, although the long-term mean current residual is in an approximate northwest (alongshore) direction. Current speeds decrease with depth, while directions rotate from predominantly north-westerly at the surface to south-easterly near the seabed. Near bottom shelf flow is mainly poleward with low velocities of typically <5 cm/s (Nelson 1989; PRDW 2013). The poleward flow becomes more consistent in the southern Benguela.

The major feature of the Benguela Current is coastal upwelling and the consequent high nutrient supply to surface waters leads to high biological production and large fish stocks. The prevailing longshore, equatorward winds move nearshore surface water northwards and offshore. To balance the displaced water, cold, deeper water wells up inshore. Although the rate and intensity of upwelling fluctuates with seasonal variations in wind patterns, the most intense upwelling tends to occur where the shelf is narrowest and the wind strongest. There are three upwelling centres in the southern Benguela, namely the Namaqua (30°S), Cape Columbine (33°S) and Cape Point (34°S) upwelling cells (Taunton-Clark 1985) (Figure 7a). Upwelling in these cells is seasonal, with maximum upwelling occurring between September and March. Both the Reconnaissance Permit area and the proposed 3D survey area are located offshore of these upwelling events.

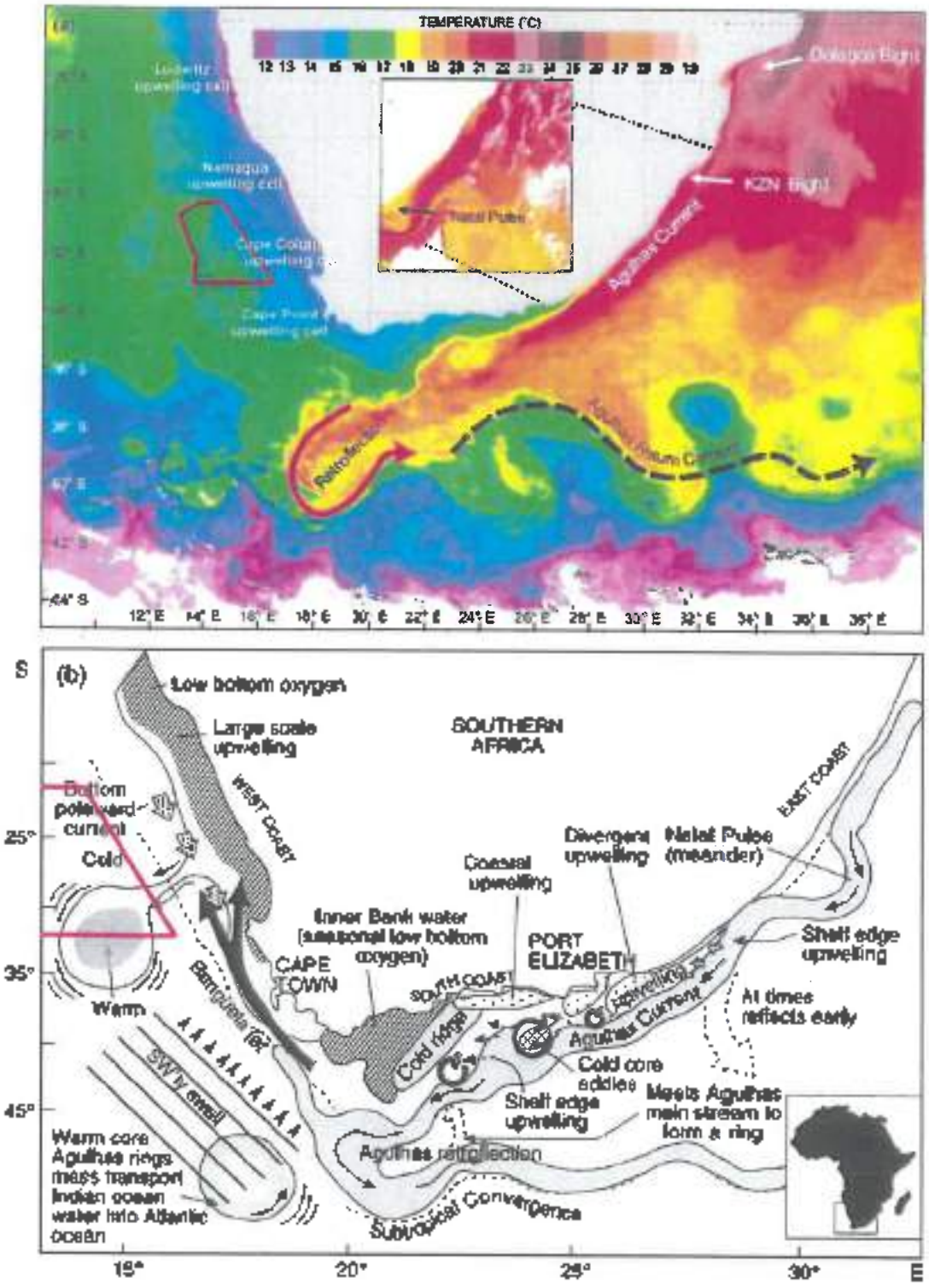

Figure 7: (a) Satellite sea-surface temperature image showing the predominance of the warm Agulhas Current along the South African south coast and the colder upwelled water on the west coast (adapted from Roberts *et al.* 2010), and (b) physical processes and features associated with the Southwest Coast (adapted from Roberts 2005) in relation to the Reconnaissance Permit Area (red polygon).

Where the Agulhas Current passes the southern tip of the Agulhas Bank (Agulhas Retroflection area), it may shed a filament of warm surface water that moves north-westward along the shelf edge towards Cape Point, and Agulhas Rings, which similarly move north-westwards into the South Atlantic Ocean (Figure 7). These rings may extend to the seafloor and west of Cape Town may split, disperse or join with other rings. During the process of ring formation, intrusions of cold subantarctic water moves into the South Atlantic. The contrast in warm (nutrient-poor) and cold (nutrient-rich) water is thought to be reflected in the presence of cetaceans and large migratory pelagic fish species (Best 2007). The Reconnaissance Permit Area lies offshore of 15°E on the outer edge of these features.

3.2.3 Waves and Tides

Most of the west coast of southern Africa is classified as exposed, experiencing strong wave action, rating between 13-17 on the 20 point exposure scale (McLachlan 1980). Much of the coastline is therefore impacted by heavy south-westerly swells generated in the roaring forties, as well as significant sea waves generated locally by the prevailing moderate to strong southerly winds characteristic of the region (Figure 8). The peak wave energy periods fall in the range 9,7 - 15,5 seconds.

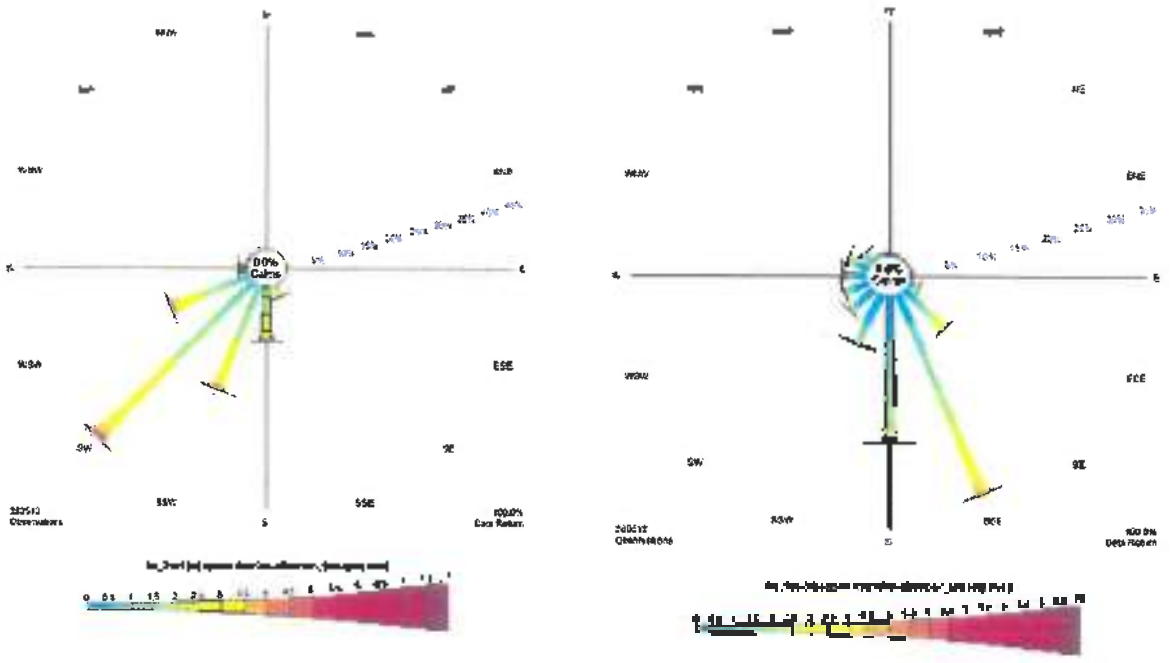

Figure 8: Annual roseplots of significant wave height partitions of swell (left) and wind-sea (right) for GROW1012 hind cast data at location 15°E, 31°S.

The wave regime along the southern African west coast shows only moderate seasonal variation in direction, with virtually all swells throughout the year coming from the S and SSW direction. Winter swells are strongly dominated by those from the S and SSW, which occur almost 80% of the time, and typically exceed 2 m in height, averaging about 3 m, and often attaining over 5 m. With wind speeds

capable of reaching 100 km/h during heavy winter south-westerly storms, winter swell heights can exceed 10 m.

In comparison, summer swells tend to be smaller on average, typically around 2 m, not reaching the maximum swell heights of winter. There is also a slightly more pronounced southerly swell component in summer. These southerly swells tend to be wind-induced, with shorter wave periods (~8 seconds), and are generally steeper than swell waves (CSIR 1996). These wind-induced southerly waves are relatively local and, although less powerful, tend to work together with the strong southerly winds of summer to cause the northward-flowing nearshore surface currents, and result in substantial nearshore sediment mobilisation, and northwards transport, by the combined action of currents, wind and waves.

In common with the rest of the southern African coast, tides are semi-diurnal, with a total range of some 1.5 m at spring tide, but only 0.6 m during neap tide periods.

3.2.4 Water

South Atlantic Central Water (SACW) comprises the bulk of the seawater in the study area, either in its pure form in the deeper regions, or mixed with previously upwelled water of the same origin on the continental shelf (Nelson & Hutchings 1983). Salinities range between 34.5‰ and 35.5‰ (Shannon 1985).

Seawater temperatures on the continental shelf of the southern Benguela typically vary between 6°C and 16°C. Well-developed thermal fronts exist, demarcating the seaward boundary of the upwelled water. Upwelling filaments are characteristic of these offshore thermal fronts, occurring as surface streamers of cold water, typically 50 km wide and extending beyond the normal offshore extent of the upwelling cell. Such fronts typically have a lifespan of a few days to a few weeks, with the filamentous mixing area extending up to 625 km offshore. South and east of Cape Agulhas, the Agulhas retroflection area is a global "hot spot" in terms of temperature variability and water movements.

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations, especially on the bottom. SACW itself has depressed oxygen concentrations (~80% saturation value), but lower oxygen concentrations (<40% saturation) frequently occur (Bailey *et al.* 1985; Chapman & Shannon 1985).

Nutrient concentrations of upwelled water of the Benguela system attain 20 µM nitrate-nitrogen, 1.5 µM phosphate and 15-20 µM silicate, indicating nutrient enrichment (Chapman & Shannon 1985). This is mediated by nutrient regeneration from biogenic material in the sediments (Bailey *et al.* 1985). Modification of these peak concentrations depends upon phytoplankton uptake, which varies according to phytoplankton biomass and production rate. The range of nutrient concentrations can thus be large but, in general, concentrations are high.

3.2.5 Upwelling & Plankton Production

The cold, upwelled water is rich in inorganic nutrients, the major contributors being various forms of nitrates, phosphates and silicates (Chapman & Shannon 1985). During upwelling the comparatively nutrient-poor surface waters are displaced by enriched deep water, supporting substantial seasonal primary phytoplankton production. This, in turn, serves as the basis for a rich food chain up through

zooplankton, pelagic baitfish (anchovy, pilchard, round-herring and others), to predatory fish (hake and snoek), mammals (primarily seals and dolphins) and seabirds (jackass penguins, cormorants, pelicans, terns and others). High phytoplankton productivity in the upper layers again depletes the nutrients in these surface waters. This results in a wind-related cycle of plankton production, mortality, sinking of plankton detritus and eventual nutrient re-enrichment occurring below the thermocline as the phytoplankton decays. The eastern boundary of the Reconnaissance Permit Area is located on the western edge of these upwelling events and although waters are expected to be comparatively warm and nutrient poor, seasonal upwelling inshore of the Reconnaissance Permit Area can be expected (see Figure 7). The proposed 3D survey area is located well offshore of these upwelling events.

3.2.6 Organic Inputs

The Benguela upwelling region is an area of particularly high natural productivity, with extremely high seasonal production of phytoplankton and zooplankton. These plankton blooms in turn serve as the basis for a rich food chain up through pelagic baitfish (anchovy, pilchard, round-herring and others), to predatory fish (snoek), mammals (primarily seals and dolphins) and seabirds (jackass penguins, cormorants, pelicans, terns and others). All of these species are subject to natural mortality, and a proportion of the annual production of all these trophic levels, particularly the plankton communities, die naturally and sink to the seabed.

Balanced multispecies ecosystem models have estimated that during the 1990s the Benguela region supported biomasses of 76,9 tons/km^2 of phytoplankton and 31.5 tons/km^2 of zooplankton alone (Shannon *et al.* 2003). Thirty six percent of the phytoplankton and 5% of the zooplankton are estimated to be lost to the seabed annually. This natural annual input of millions of tons of organic material onto the seabed off the southern African West Coast has a substantial effect on the ecosystems of the Benguela region. It provides most of the food requirements of the particulate and filter-feeding benthic communities that inhabit the sandy-muds of this area, and results in the high organic content of the muds in the region. As most of the organic detritus is not directly consumed, it enters the seabed decomposition cycle, resulting in subsequent depletion of oxygen in deeper waters.

An associated phenomenon ubiquitous to the Benguela system are red tides (dinoflagellate and/or ciliate blooms) (see Shannon & Pillar 1985; Pitcher 1998). Also referred to as Harmful Algal Blooms (HABs), these red tides can reach very large proportions, extending over several square kilometres of ocean. Toxic dinoflagellate species can cause extensive mortalities of fish and shellfish through direct poisoning, while degradation of organic-rich material derived from both toxic and non-toxic blooms results in oxygen depletion of subsurface water. Being associated primarily with upwelling cells, HABs may occur in inshore of the Reconnaissance Permit Area, but would not be expected in the proposed 3D survey area.

3.2.7 Low Oxygen Events

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations with <40% saturation occurring frequently (e.g. Visser 1969; Bailey *et al.* 1985). The low oxygen concentrations are attributed to nutrient remineralisation in the bottom waters of the system (Chapman & Shannon 1985). The absolute rate of this is dependent upon the net organic material

build-up in the sediments, with the carbon rich mud deposits playing an important role. As the mud on the shelf is distributed in discrete patches (see Figure 4), there are corresponding preferential areas for the formation of oxygen-poor water. The two main areas of low-oxygen water formation in the southern Benguela region are in the Orange River Bight and St Helena Bay (Chapman & Shannon 1985; Bailey 1991; Shannon & O'Toole 1998; Bailey 1999; Fossing *et al.* 2000). The spatial distribution of oxygen-poor water in each of the areas is subject to short- and medium-term variability in the volume of hypoxic water that develops. De Decker (1970) showed that the occurrence of low oxygen water off Lambert's Bay is seasonal, with highest development in summer/autumn. Bailey & Chapman (1991), on the other hand, demonstrated that in the St Helena Bay area daily variability exists as a result of downward flux of oxygen through thermoclines and short-term variations in upwelling intensity. Subsequent upwelling processes can move this low-oxygen water up onto the inner shelf, and into nearshore waters, often with devastating effects on marine communities.

Periodic low oxygen events in the nearshore region can have catastrophic effects on the marine communities leading to large-scale stranding of rock lobsters, and mass mortalities of marine biota and fish (Newman & Pollock 1974; Matthews & Pitcher 1996; Pitcher 1998; Cockcroft *et al.* 2000). The development of anoxic conditions as a result of the decomposition of huge amounts of organic matter generated by phytoplankton blooms is the main cause for these mortalities and walkouts. The most recent walkout occurred in early March 2022 at Elands Bay, when some 500 tons of rocklobster were reported stranded on the beach. The blooms develop over a period of unusually calm wind conditions when sea surface temperatures where high. Algal blooms usually occur during summer-autumn (February to April) but can also develop in winter during the 'berg' wind periods, when similar warm windless conditions occur for extended periods.

3.2.8 Turbidity

Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulate matter. Total Suspended Particulate Matter (TSPM) can be divided into Particulate Organic Matter (POM) and Particulate Inorganic Matter (PIM), the ratios between them varying considerably. The POM usually consists of detritus, bacteria, phytoplankton and zooplankton, and serves as a source of food for filter-feeders. Seasonal microphyte production associated with upwelling events will play an important role in determining the concentrations of POM in coastal waters. PIM, on the other hand, is primarily of geological origin consisting of fine sands, silts and clays. Off Namaqualand, the PIM loading in nearshore waters is strongly related to natural inputs from the Orange River or from 'berg' wind events. Although highly variable, annual discharge rates of sediments by the Orange River is estimated to vary from 8 - 26 million tons/yr (Rogers 1979). 'Berg' wind events can potentially contribute the same order of magnitude of sediment input as the annual estimated input of sediment by the Orange River (Shannon & Anderson 1982; Zoutendyk 1992, 1995; Shannon & O'Toole 1998; Lane & Carter 1999). For example, a 'berg' wind event in May 1979 described by Shannon and Anderson (1982) was estimated to have transported in the order of 50 million tons of sand out to sea, affecting an area of 20 000 km^2.

Concentrations of suspended particulate matter in shallow coastal waters can vary both spatially and temporally, typically ranging from a few mg/ℓ to several tens of mg/ℓ (Bricel & Maloud 1984; Berg & Newell 1986; Fegley *et al.* 1992). Field measurements of TSPM and PIM concentrations in the Benguela current system have indicated that outside of major flood events, background concentrations of coastal and continental shelf suspended sediments are generally <12 mg/ℓ, showing significant long-

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shore variation (Zoutendyk 1995). Considerably higher concentrations of PIM have, however, been reported from southern African West Coast waters under stronger wave conditions associated with high tides and storms, or under flood conditions. In the vicinity of the Orange River mouth, where river outflow strongly influences the turbidity of coastal waters, measured concentrations ranged from 14.3 mg/ℓ at Alexander Bay just south of the mouth (Zoutendyk 1995) to peak values of 7 400 mg/ℓ immediately upstream of the river mouth during the 1988 Orange River flood (Bremner *et al.* 1990).

The major source of turbidity in the swell-influenced nearshore areas off the West Coast is the redistribution of fine inner shelf sediments by long-period Southern Ocean swells. The current velocities typical of the Benguela (10-30 cm/s) are capable of resuspending and transporting considerable quantities of sediment equatorwards. Under relatively calm wind conditions, however, much of the suspended fraction (silt and clay) that remains in suspension for longer periods becomes entrained in the slow poleward undercurrent (Shillington *et al.* 1990; Rogers & Bremner 1991).

Superimposed on the suspended fine fraction, is the northward littoral drift of coarser bedload sediments, parallel to the coastline. This northward, nearshore transport is generated by the predominantly south-westerly swell and wind-induced waves. Longshore sediment transport varies considerably in the shore-perpendicular dimension, being substantially higher in the surf-zone than at depth, due to high turbulence and convective flows associated with breaking waves, which suspend and mobilise sediment (Smith & Mocke 2002).

On the inner and middle continental shelf, the ambient currents are insufficient to transport coarse sediments typical of those depths, and re-suspension and shoreward movement of these by wave-induced currents occur primarily under storm conditions (see also Drake *et al.* 1985; Ward 1985). Data from a Waverider buoy at Port Nolloth have indicated that 2-m waves are capable of re-suspending medium sands (200 µm diameter) at -10 m depth, whilst 6-m waves achieve this at -42 m depth. Low-amplitude, long-period waves will, however, penetrate even deeper. Most of the sediment shallower than 90 m can therefore be subject to re-suspension and transport by heavy swells (Lane & Carter 1999).

Offshore of the continental shelf, the oceanic waters are typically clear as they are beyond the influence of aeolian and riverine inputs. The waters in the Reconnaissance Permit Area are thus expected to be comparatively clear.

3.3 The Biological Environment

Biogeographically, the study area falls into the cold temperate Namaqua Bioregion, which extends from Sylvia Hill, north of Lüderitz in Namibia to Cape Columbine (Emanuel *et al.* 1992; Lombard *et al.* 2004). The Reconnaissance Permit Area falls into the Southeast Atlantic Deep Ocean Ecoregion (Sink *et al.* 2019) (Figure 9). The coastal, wind-induced upwelling characterising the western Cape coastline, is the principle physical process which shapes the marine ecology of the southern Benguela region. The Benguela system is characterised by the presence of cold surface water, high biological productivity, and highly variable physical, chemical and biological conditions.

The Southeast Atlantic Oceanic Ecoregion extends from the shelf edge of the Southern Benguela onto the slope and into the abyssal plain of the Cape Basin, which comprises a relatively monotonous plain, interrupted by sporadic seamounts. This deep ocean region extends into Namibia and is bounded in the north by the prominent Walvis Ridge. In the south it is separated from the Southwest Indian Deep

Ocean by the Agulhas Ridge, a transverse ridge that forms part of the Agulhas Falklands Fracture Zone and acts as a divide between the Cape Basin and the Agulhas Basin. The biodiversity patterns in the deep ocean ecosystems are not well understood (Sink *et al.* 2019).

Communities within marine habitats are largely ubiquitous throughout the southern African West Coast region, being particular only to substrate type or depth zone. These biological communities consist of many hundreds of species, often displaying considerable temporal and spatial variability (even at small scales). The offshore marine ecosystems comprise a limited range of habitats, namely unconsolidated seabed sediments, deepwater reefs and the water column. The biological communities 'typical' of these habitats are described briefly below, focussing both on dominant, commercially important and conspicuous species, as well as potentially threatened or sensitive species, which may be affected by the proposed exploration activities.

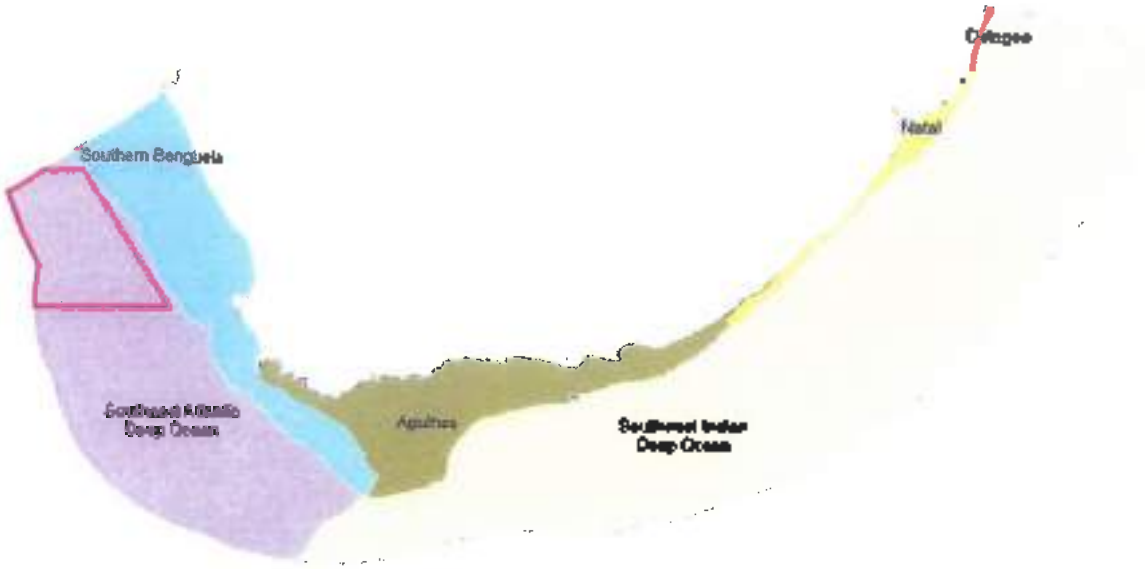

Figure 9: The Reconnaissance Permit Area (red polygon) in relation to the inshore and offshore ecoregions of the South African coast (adapted from Sink *et al.* 2019).

3.3.1 Demersal Communities

3.3.1.1 Benthic Invertebrate Macrofauna

The seabed communities in the Reconnaissance Permit Area lie within the Namaqua sub-photic and continental slope biozones, which extend from a 30 m depth to the shelf edge, and beyond to the lower deepsea slope, respectively. The benthic habitats of South Africa were mapped as part of the 2018 National Biodiversity Assessment (Sink *et al.* 2019) to develop assessments of the ecosystem threat status and ecosystem protection level. The benthic ecosystem types were subsequently mapped (Figure 10) and assigned an ecosystem threat status based on their level of protection (Figure 11). The Reconnaissance Permit Area is characterised by a limited variety of ecosystem types covering the mid- and lower shelves, the Southeast Atlantic continental slope and the Cape Basin Abyss.

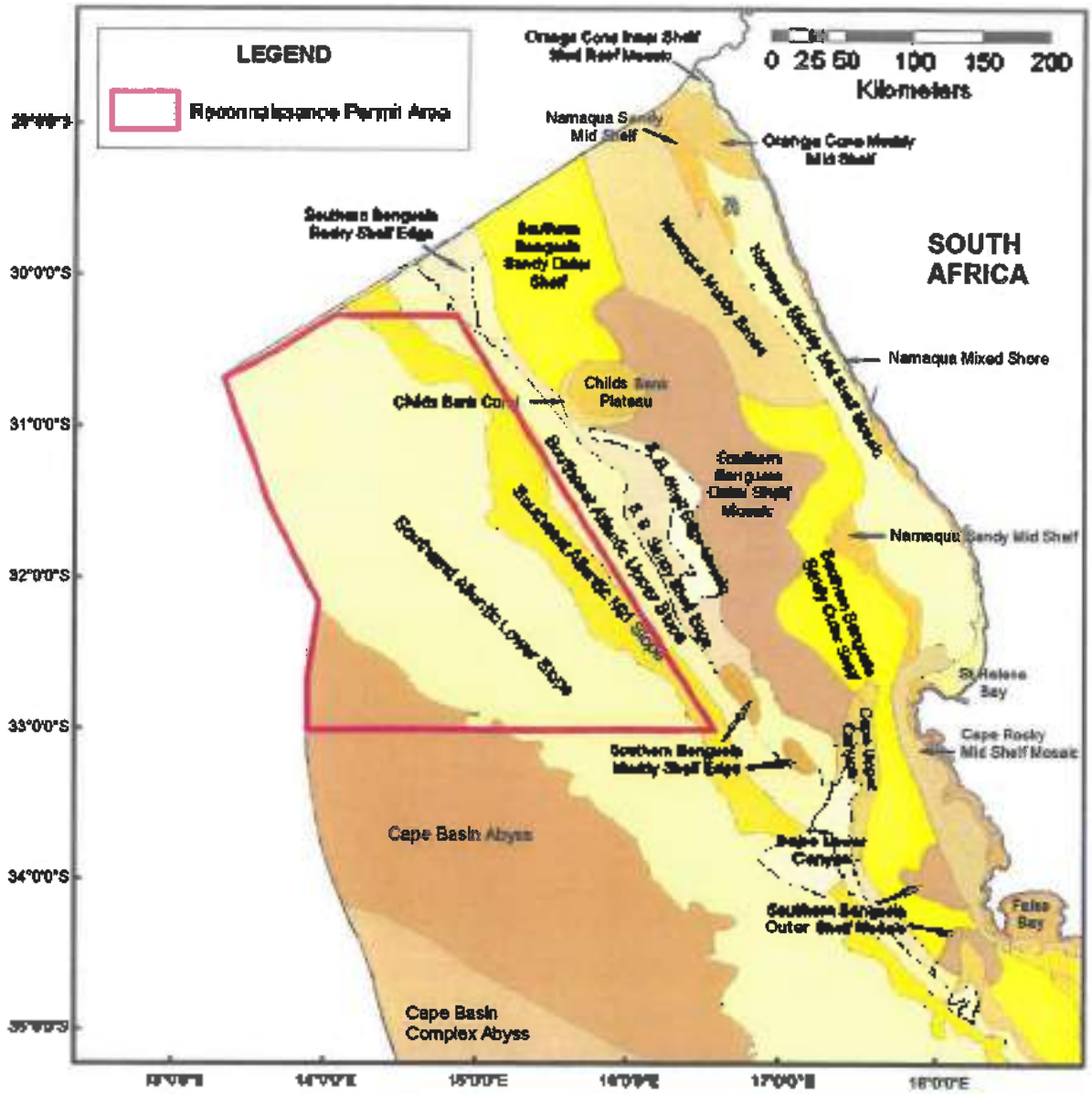

Figure 10: The Reconnaissance Permit Area (red polygon) in relation to the distribution of ecosystem types along the West Coast (adapted from Sink *et al.* 2019). Only those ecosystem types within the immediate vicinity of the Reconnaissance Permit Area are labelled.

The benthic biota of unconsolidated marine sediments constitute invertebrates that live on (epifauna) or burrow within (infauna) the sediments, and are generally divided into macrofauna (animals >1 mm) and meiofauna (<1 mm). Numerous studies have been conducted on southern African West Coast continental shelf benthos, mostly focused on mining, pollution or demersal trawling impacts (Christie & Moldan 1977; Moldan 1978; Jackson & McGibbon 1991; Field *et al.* 1996; Field & Parkins 1997; Parkins & Field 1998; Pulfrich & Penney 1999; Goosen *et al.* 2000; Savage *et al.* 2001; Steffani & Pulfrich 2004; 2007; Steffani 2007a; 2007b; Atkinson 2009; Steffani 2009a, 2009b, 2010a, 2010b, 2010c; Atkinson *et al.* 2011; Steffani 2012a, 2012b, 2014; Karenyi 2014; Steffani *et al.* 2015; Biccard & Clark 2016; Biccard *et al.* 2016; Duna *et al.* 2016; Karenyi *et al.* 2016; Biccard *et al.* 2017, 2018; Giwhala *et al.* 2018; Biccard *et al.* 2019; Giwhala *et al.* 2019). These studies, however, concentrated

on the continental shelf and nearshore regions, and consequently the benthic fauna of the outer shelf and continental slope (beyond ~450 m depth) are very poorly known. This is primarily due to limited opportunities for sampling as well as the lack of access to Remote Operated Vehicles (ROVs) for visual sampling of hard substrata.

To date very few areas on the continental slope off the West Coast have been biologically surveyed (Sink *et al.* 2019; Harris *et al.* 2022). Although sediment distribution studies (Rogers & Bremner 1991) suggest that the outer shelf is characterised by unconsolidated sediments (see Figure 4), recent surveys conducted between 180 m and 480 m depth offshore of the Northern Cape coast revealed high proportions of hard ground rather than unconsolidated sediment, although this requires further verification (Karenyi unpublished data).

To date there have been no studies examining connectivity between slope, plateau or abyssal ecosystems in South Africa and there is thus limited knowledge on the benthic biodiversity of all three of these broad ecosystem groups in South African waters (Sink *et al.* 2019). There is no quantitative data describing bathyal ecosystems in South Africa and hence limited understanding of ecosystem functioning and sensitivity (Anderson & Hulley 2000; Harris *et al.* 2022). Due to the lack of information on benthic macrofaunal communities beyond the shelf break, no description can be provided for the offshore portions of the Reconnaissance Permit Area. However, as these communities would receive the sound in the far field only, no detrimental effects to the communities or to individual benthic species are expected. The description below for areas on the continental shelf, offshore of the Northern Cape coast is drawn from recent surveys by Karenyi (2014), Duna *et al.* (2016), Mostert *et al.* (2016), and Gwhala *et al.* (2018, 2019).

Three macro-infauna communities have been identified on the inner- (0-30 m depth) and mid-shelf (30-150 m depth, Karenyi *et al.* 2016). Polychaetes, crustaceans and molluscs make up the largest proportion of individuals, biomass and species on the west coast. The inner-shelf community, which is affected by wave action, is characterised by various mobile gastropod and polychaete predators and sedentary polychaetes and isopods. The mid-shelf community inhabits the mudbelt and is characterised by mud prawns. A second mid-shelf community occurring in sandy sediments, is characterised by various deposit-feeding polychaetes. The distribution of species within these communities are inherently patchy reflecting the high natural spatial and temporal variability associated with macro-infauna of unconsolidated sediments (e.g. Kenny *et al.* 1998; Kendall & Widdicombe 1999; van Dalfsen *et al.* 2000; Zajac *et al.* 2000; Parry *et al.* 2003), with evidence of mass mortalities and substantial recruitments recorded on the South African West Coast (Steffani & Pulfrich 2004).

Despite the current lack of knowledge of the community structure and endemicity of South African macro-infauna off the edge of the continental shelf, the marine component of the 2018 National Biodiversity Assessment (Sink *et al.* 2019), rated the South Atlantic bathyal and abyssal unconsolidated habitat types that characterise depths beyond 500 m, as being of 'Least concern' (Figure 11), with only those communities occurring along the shelf edge (~500 m) being considered 'Vulnerable'. This primarily reflects the great extent of these habitats in the South African Exclusive Economic Zone (EEZ).

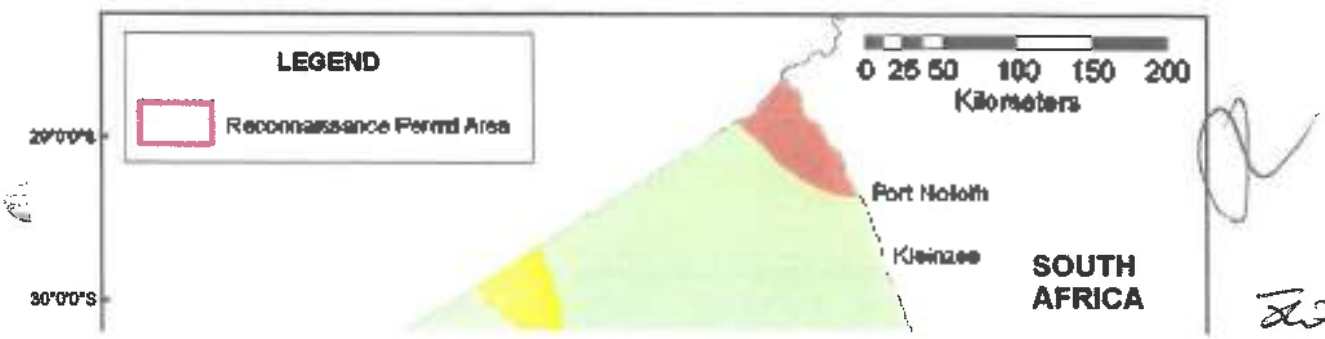

Figure 11: The Reconnaissance Permit Area (red polygon) in relation to the ecosystem threat status for coastal and offshore benthic and pelagic habitat types on the South African West Coast (adapted from Sink *et al.* 2019).

Karenyi *et al.* (2016) found that off Namaqualand, species richness generally increased from the inner-shelf across the mid-shelf and is influenced by sediment type. The highest total abundance and species diversity was measured in sandy sediments of the mid-shelf. Biomass is highest in the inshore (± 50 g/m^2 wet weight) and decreases across the mid-shelf averaging around 30 g/m^2 wet weight. This is contrary to Christie (1974) who found that biomass was greatest in the mudbelt at 80 m depth off Lamberts Bay, where the sediment characteristics and the impact of environmental stressors (such as low oxygen events) are likely to differ from those off the northern Namaqualand coast.

Benthic communities are structured by the complex interplay of a large array of environmental factors. Water depth and sediment grain size are considered the two major factors that determine benthic community structure and distribution on the South African west coast (Christie 1974, 1976; Steffani & Pulfrich 2004a, 2004b; 2007; Steffani 2007a; 2007b) and elsewhere in the world (e.g. Gray 1981; Ellingsen 2002; Bergen *et al.* 2001; Post *et al.* 2006). However, studies have shown that shear

bed stress - a measure of the impact of current velocity on sediment - oxygen concentration (Post *et al.* 2006; Currie *et al.* 2009; Zettler *et al.* 2009, 2013), productivity (Escaravage *et al.* 2009), organic carbon and seafloor temperature (Day *et al.* 1971) may also strongly influence the structure of benthic communities. There are clearly other natural processes operating in the deep water shelf areas of the West Coast that can over-ride the suitability of sediments in determining benthic community structure, and it is likely that periodic intrusion of low oxygen water masses is a major cause of this variability (Monteiro & van der Plas 2006; Pulfrich *et al.* 2006). In areas of frequent oxygen deficiency, benthic communities will be characterised either by species able to survive chronic low oxygen conditions, or colonising and fast-growing species able to rapidly recruit into areas that have suffered oxygen depletion. The combination of local, episodic hydrodynamic conditions and patchy settlement of larvae will tend to generate the observed small-scale variability in benthic community structure.

The invertebrate macrofauna are important in the marine benthic environment as they influence major ecological processes (e.g. remineralisation and flux of organic matter deposited on the sea floor, pollutant metabolism, sediment stability) and serve as important food source for commercially valuable fish species and other higher order consumers. As a result of their comparatively limited mobility and permanence over seasons, these animals provide an indication of historical environmental conditions and provide useful indices with which to measure environmental impacts (Gray 1974; Warwick 1993; Salas *et al.* 2006).

Also associated with soft-bottom substrates are demersal communities that comprise epifauna and bottom-dwelling vertebrate species, many of which are dependent on the invertebrate benthic macrofauna as a food source. According to Lange (2012) the continental shelf on the West Coast between depths of 100 m and 250 m, contained a single epifaunal community characterised by the hermit crabs *Sympagurus dimorphus* and *Parapagurus pilosimanus*, the prawn *Funchalia woodwardi* and the sea urchin *Brissaster capensis*. Atkinson (2009) also reported numerous species of urchins and burrowing anemones beyond 300 m depth off the West Coast.

Information on the benthic fauna of the lower continental slope and abyss (beyond 1 800 m depth) is largely lacking due to limited opportunities for sampling. However, deep water benthic sampling was undertaken (Benthic Solutions Ltd 2019) as part of the Environmental Baseline Survey for Total E&P Namibia's Block 2913B just to the north of the Reconnaissance Permit Area. This provided valuable information on the benthic infaunal communities of the lower continental slope. As conditions in such deep water habitats tend to be more uniform (low temperatures and low oxygen concentrations characterising the SACW that comprises the bulk of the water in the area), similar communities may be expected in the Reconnaissance Permit Area.

The macrofauna in Block 2913B were generally impoverished but fairly consistent, which is typical for deep water sediments. The 105 species recorded, were dominated by polychaetes, which accounted for 64.1% of the total individuals. Molluscs were represented by 11 species (19.6% of total individuals), whilst 20 species of crustaceans were recorded (contributing to only 9.8% of total individuals). Echinoderms were represented by only 3 species (5.8% of total individuals), whilst all other groups (Actiniaria, Nemertea, Nematoda, Ascidiacea and Priapulida) accounted for the remaining 5.9% of individuals. The deposit-feeding polychaete *Spiophanes* sp. was the most abundant species recorded. This small bristleworm can either be a passive suspension feeder or a surface deposit feeder, living off sediment particles, planktonic organisms and meiobenthic organisms. The bivalve mollusc *Microgloma mirabilina* was the second most common species, with the polychaete tentatively identified as a *Leiocapitellide* being the third most abundant. With the exception of the carnivorous

polychaete *Glycera capitata*, most species were suspension or deposit feeders typical of soft unconsolidated sediments.

Examples of the macroinvertebrate infauna of the Block 2913B area are illustrated in Figure 12. A wide diversity of macroinvertebrates has been recorded inshore of the 1 000 m depth contour, and the reader is referred to the comprehensive field guide compiled by Atkinson & Sink (2018).

The 2018 National Biodiversity Assessment for the marine environment (Sink *et al.* 2019) points out that very few national IUCN Red List assessments have been conducted for marine invertebrate species to date owing to inadequate taxonomic knowledge, limited distribution data, a lack of systematic surveys and limited capacity to advance species red listing for these groups.

3.3.1.2 Deep-water coral communities

There has been increasing interest in deep-water corals in recent years because of their likely sensitivity to disturbance and their long generation times. These benthic filter-feeders generally occur at depths in below 150 m with some species being recorded from as deep as 3 000 m. Some species form reefs while others are smaller and remain solitary. Corals add structural complexity to otherwise uniform seabed habitats thereby creating areas of high biological diversity (Breeze *et al.* 1997; Macissac *et al.* 2001). Deep water corals establish themselves below the thermocline where there is a continuous and regular supply of concentrated particulate organic matter, caused by the flow of a relatively strong current over special topographical formations which cause eddies to form. Nutrient seepage from the substratum might also promote a location for settlement (Rowland *et al.* 2002). In the productive Benguela region, substantial areas on and off the edge of the shelf should thus potentially be capable of supporting rich, cold water, benthic, filter-feeding communities, and various species of scleractine and stylastrine corals have been reported from depths beyond -200 m in the Orange Basin.

Such communities would also be expected with topographic features such as seamounts located adjacent to the northern and western boundary of the Reconnaissance Permit Area (see Figure 2). Nonetheless, our understanding of the invertebrate fauna of the sub-photic zone is relatively poor (Gibbons *et al.* 1999) and the conservation status of the majority of invertebrates in this bioregion is not known.

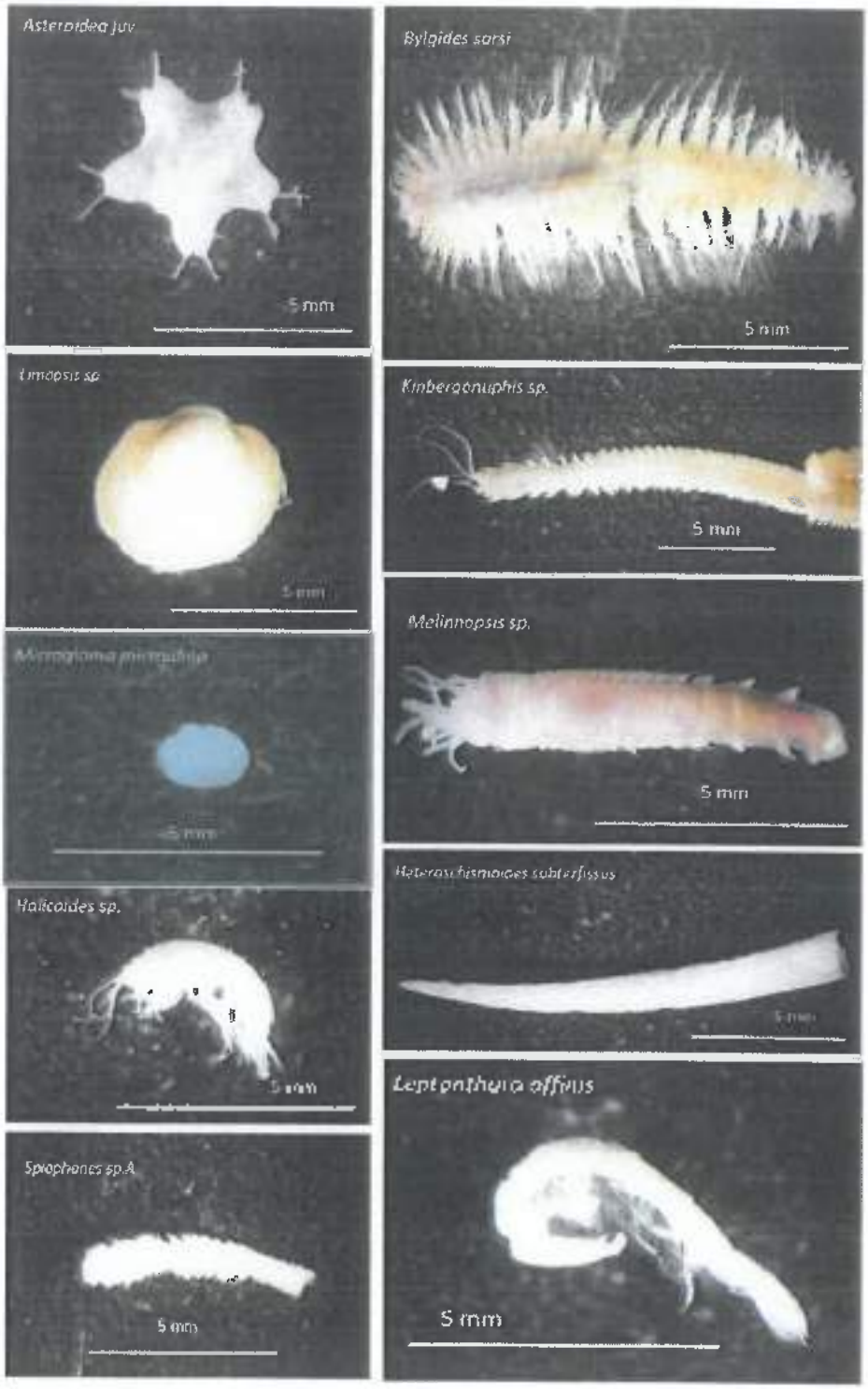

Figure 12: Examples of macroinvertebrates recorded in Block 2913B to the north of the Reconnaissance Permit Area (Source Benthic Solutions Ltd 2019).

3.3.1.3 Demersal Fish Species

Demersal fish are those species that live and feed on or near the seabed. As many as 110 species of bony and cartilaginous fish have been identified in the demersal communities on the continental shelf of the West Coast (Roel 1987). Details on demersal fish communities beyond the shelf break and in the Reconnaissance Permit Area are, however, lacking (see Harris *et al.* 2022). Changes in fish communities occur both latitudinally (Shine 2006, 2008; Yemane *et al.* 2015) and with increasing depth (Roel 1987; Smale *et al.* 1993; Macpherson & Gordoa 1992; Bianchi *et al.* 2001; Atkinson 2009; Yemane *et al.* 2015), with the most substantial change in species composition occurring in the shelf break region between 300 m and 400 m depth (Roel 1987; Atkinson 2009). The shelf community (<380 m) is dominated by the Cape hake *M. capensis*, and includes jacopever *Helicolenus dactylopterus*, Izak catshark *Holohalaelurus regani*, soupfin shark *Galeorhinus galeus* and whitespotted houndshark *Mustelus palumbes*. The more diverse deeper water community is dominated by the deepwater hake *Merluccius paradoxus*, monkfish *Lophius vomerinus*, kingklip *Genypterus capensis*, bronze whiptail *Lucigadus ori* and hairy conger *Bassanago albescens* and various squalid shark species. There is some degree of species overlap between the depth zones.

Roel (1987) showed seasonal variations in the distribution ranges shelf communities, with species such as the pelagic goby *Sufflogobius bibarbatus*, and West Coast sole *Austroglossus microlepis* occurring in shallow water north of Cape Point during summer only. The deep-sea community was found to be homogenous both spatially and temporally. In a more recent study, however, Atkinson (2009) identified two long-term community shifts in demersal fish communities: the first (early to mid-1990s) being associated with an overall increase in density of many species, whilst many species decreased in density during the second shift (mid-2000s). These community shifts correspond temporally with regime shifts detected in environmental forcing variables (Sea Surface Temperatures and upwelling anomalies) (Howard *et al.* 2007) and with the eastward shifts observed in small pelagic fish species and rock lobster populations (Coetzee *et al.* 2008, Cockcroft *et al.* 2008).

The diversity and distribution of demersal cartilagenous fishes on the West Coast is discussed by Compagno et al. (1991). The species that may occur in the general project area and on the continental shelf inshore thereof, and their approximate depth range, are listed in Table 1. Details on demersal cartilaginous species beyond the shelf break and in the Reconnaissance Permit Area are lacking, however.

There is limited information about bathyal fish communities in South Africa. South Africa defines its bathyal zone as extending from 500 m to 3 500 m, recognising an upper slope (500-1 000 m), mid slope (1 000-1 800 m) and lower slope (1 800-3 500 m). Typical upper slope fishes (200-2 000 m) include rattails (Macrouridae), greeneyes (*Chlorophthalmus* species), notacanthids, halosaurs, chimaeras, skates, bythitids such as *Cataetyx* spp. and moridS (deepsea cods) (Smith & Heemstra 2003). Rattails, bythitids, liparidids (snail fishes) and notacanthids (*Polyacanthonotus* species and halosaurs) are characteristic of the lower bathyal (see also Iwamoto & Anderson 1994; Jones 2014).

Table 1: Demersal cartilaginous species found on the continental shelf along the West Coast, with approximate depth range at which the species occurs (Compagno *et al.* 1991) and their IUCN conservation status. The National Assessment is provided in parentheses where available.

Common Name	Scientific name	Depth Range (m)	IUCN Conservation Status
Frilled shark	*Chlamydoselachus anguineus*	200-1 000	LC
Six gill cowshark	*Hexanchus griseus*	150-600	NT
Gulper shark	*Centrophorus granulosus*	480	EN
Leafscale gulper shark	*Centrophorus squamosus*	370-800	EN
Bramble shark	*Echinorhinus brucus*	55-285	EN
Black dogfish	*Centroscyllium fabricii*	>700	LC
Portuguese shark	*Centroscymnus coelolepis*	>700	NT
Longnose velvet dogfish	*Centroscymnus crepidater*	400-700	NT
Birdbeak dogfish	*Deania calcea*	400-800	NT
Arrowhead dogfish	*Deania profundorum*	200-500	NT
Longsnout dogfish	*Deania quadrispinosa*	200-650	VU
Sculpted lanternshark	*Etmopterus brachyurus*	450-900	DD
Brown lanternshark	*Etmopterus compagnoi*	450-925	LC
Giant lanternshark	*Etmopterus granulosus*	>700	LC
Smooth lanternshark	*Etmopterus pusillus*	400-500	LC
Spotted spiny dogfish	*Squalus acanthias*	100-400	VU
Shortnose spiny dogfish	*Squalus megalops*	75-460	LC
Shortspine spiny dogfish	*Squalus mitsukurii*	150-600	EN
Sixgill sawshark	*Pliotrema warreni*	60-500	LC
Goblin shark	*Mitsukurina owstoni*	270-960	LC
Smalleye catshark	*Apristurus microps*	700-1 000	LC
Saldanha catshark	*Apristurus saldanha*	450-765	LC
"grey/black wonder" catsharks	*Apristurus spp.*	670-1 005	LC
Tiger catshark	*Halaelurus natalensis*	50-100	VU
Izak catshark	*Holohalaelurus regani*	100-500	LC
Yellowspotted catshark	*Scyliorhinus capensis*	150-500	NT
Soupfin shark/Vaalhaai	*Galeorhinus galeus*	<10-300	[illegible]
Houndshark	*Mustelus mustelus*	<100	EN (DD)
Whitespotted houndshark	*Mustelus palumbes*	>350	LC
Little guitarfish	*Rhinobatos annulatus*	>100	VU (LC)
Atlantic electric ray	*Torpedo nobiliana*	120-450	LC
African softnose skate	*Bathyraja smithii*	400-1 020	LC
Smoothnose legskate	*Crurirajа durbanensis*	>1 000	DD
Roughnose legskate	*Crurirajа parcomaculata*	150-620	LC
African dwarf skate	*Neoraja stehmanni*	290-1 025	LC
Thorny skate	*Raja radiata*	50-600	VU
Bigmouth skate	*Raja robertsi*	>1 000	LC
Slime skate	*Dipturus pullopunctatus*	15-460	LC

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Common Name	Scientific name	Depth Range (m)	IUCN Conservation Status
Rough-belly skate	*Raja springeri*	85-500	LC
Yellowspot skate	*Raja wallacei*	70-500	VU
Roughskin skate	*Dipturus spinacidermis*	1 000-1 350	EN
Biscuit skate	*Raja clavata*	25-500	NT
Munchkin skate	*Rajella caudaspinosa*	300-520	LC
Bigthorn skate	*Raja confundens*	100-800	LC
Ghost skate	*Rajella dissimilis*	420-1 005	LC
Leopard skate	*Rajella leopardus*	300-1 000	LC
Smoothback skate	*Rajella ravidula*	500-1 000	LC
Spearnose skate	*Rostroraja alba*	75-260	EN
St Joseph	*Callorhinchus capensis*	30-380	LC (LC)
Cape chimaera	*Chimaera notafricana*	680-1 000	LC
Brown chimaera	*Chimaera carophila*	420-850	LC
Spearnose chimaera	*Rhinochimaera atlantica*	650-960	LC

LC - Least Concern VU - Vulnerable NT - Near Threatened
EN - Endangered CR - Critically Endangered DD - Data Deficient

3.3.2 Seamount and Submarine Canyon Communities

Features such as banks, knolls and seamounts (referred to collectively here as "seamounts"), which protrude into the water column, are subject to, and interact with, the water currents surrounding them. The effects of such seabed features on the surrounding water masses can include the up-welling of relatively cool, nutrient-rich water into nutrient-poor surface water thereby resulting in higher productivity (Clark *et al.* 1999), which can in turn strongly influences the distribution of organisms on and around seamounts. Evidence of enrichment of bottom-associated communities and high abundances of demersal fishes has been regularly reported over such seabed features.

The enhanced fluxes of detritus and plankton that develop in response to the complex current regimes lead to the development of detritivore-based food-webs, which in turn lead to the presence of seamount scavengers and predators. Seamounts provide an important habitat for commercial deepwater fish stocks such as orange roughy, oreos, alfonsino and Patagonian toothfish, which aggregate around these features for either spawning or feeding (Koslow 1996).

Such complex benthic ecosystems in turn enhance foraging opportunities for many other predators, serving as mid-ocean focal points for a variety of pelagic species with large ranges (turtles, tunas and billfish, pelagic sharks, cetaceans and pelagic seabirds) that may migrate large distances in search of food or may only congregate on seamounts at certain times (Hui 1985; Haney *et al.* 1995). Seamounts thus serve as feeding grounds, spawning and nursery grounds and possibly navigational markers for a large number of species (SPRFMA 2007; Derville *et al.* 2020).

Enhanced currents, steep slopes and volcanic rocky substrata, in combination with locally generated detritus, favour the development of suspension feeders in the benthic communities characterising seamounts (Rogers 1994). Deep- and cold-water corals (including stony corals, black corals and soft corals) are a prominent component of the suspension-feeding fauna of many seamounts, accompanied

by barnacles, bryozoans, polychaetes, molluscs, sponges, sea squirts, basket stars, brittle stars and crinoids (reviewed in Rogers 2004). There is also associated mobile benthic fauna that includes echinoderms (sea urchins and sea cucumbers) and crustaceans (crabs and lobsters) (reviewed by Rogers 1994; Kenyon *et al.* 2003). Some of the smaller cnidarians species remain solitary while others form reefs thereby adding structural complexity to otherwise uniform seabed habitats.

Consequently, the fauna of seamounts is usually highly unique and may have a limited distribution restricted to a single geographic region, a seamount chain or even a single seamount location (Rogers *et al.* 2008). As a result of conservative life histories (*i.e.* very slow growing, slow to mature, high longevity, low fecundity and unpredictable recruitment) and sensitivity to changes in environmental conditions, such biological communities have been identified as Vulnerable Marine Ecosystems (VMEs). They are recognised as being particularly sensitive to anthropogenic disturbance (primarily deep-water trawl fisheries and mining), and once damaged are very slow to recover, or may never recover (FAO 2008).

Geological features of note within the broader project area are Child's Bank and Tripp Seamount, with an unnamed seamount located in ~3 500 m at ~32°20'S; 13°30'E, as well as the Cape Canyon and Cape Point Valley. Child's Bank, which is situated at about 31°S, was described by Dingle *et al.* (1987) to be a carbonate mound (bioherm). The top of this feature is a sandy plateau with dense aggregations of brittle stars, while the steeper slopes have dense invertebrate assemblages including unidentified cold-water corals/rugged limestone feature, bounded at outer edges by precipitous cliffs at least 150 m high (Birch & Rogers 1973). Composed of sediments and the calcareous deposits from an accumulation of carbonate skeletons of sessile organisms (e.g. cold-water coral, foraminifera or marl), such features typically have topographic relief, forming isolated seabed knolls in otherwise low profile homogenous seabed habitats (Kopaska-Merkel & Haywick 2001; Kenyon *et al.* 2003, Wheeler *et al.* 2005, Colman *et al.* 2005). Tripp Seamount situated at about 29°40'S, lies ~30 km north of the northern boundary of the survey area. It rises from the seabed at ~1 000 m to a depth of 150 m and roughly circular with a flat apex that drops steeply on all sides. There is reference to decapods crustaceans from Tripp Seamount (Kensley 1980, 1981) and exploratory deepwater trawl fishing (Hampton 2003), but otherwise knowledge of benthic communities characterising this seamount is lacking.

The Cape Rise comprises a group of NE-SW trending seamounts - the Southeast Atlantic Seamounts - which include Argentina and Protea Seamounts and the recently discovered Mount Marek. These rise up from over ~2 500 m depth in the Cape Basin abyss to 700 m deep. Other than a geoscience survey conducted in 1986 using a deep water camera to sample the lower bathyal and abyssal zones, including the seamount flanks, of the Cape Basin (Rogers 1986) no biodiversity surveys are known to have been conducted at Protea and Argentina seamounts. Southern Africa's seamounts and their associated benthic communities have not been sampled by either geologists or biologists (Sink & Samaai 2009) and little is known about the benthic and neritic communities associated with them.

A recent study reporting on the megabenthos and benthopelagic fish on the Southeast Atlantic Seamounts (Bergstad *et al.* 2019), provides descriptions of the Erica and Schmitt-Ott Seamounts that lie approximately 450 - 500 km southwest of the Argentina Seamount and rise from the surrounding abyss to depths of 770 m and 920 m, respectively. Corals were the most frequent and widespread sessile invertebrate recorded on video transects, dominated by gorgonians whose abundance increased towards the seamount summits. Scleractinian and hydrocorals were also observed as was a diversity of sponges, echinoderms and crustaceans. Fish associated with the seamount included

oreo dories, grenadiers and lanternshark. Similar communities might therefore be expected from the Protea and Argentina Seamounts.

During 2016-2018 the Department of Environmental Affairs: Oceans and Coast Branch (DEA: O&C) undertook research cruises to explore some of the undocumented areas of seabed off the West Coast, among them the Cape Canyon. Using tow-cameras, benthic grabs and dredges, the biota of the canyon head to ~500 m depth were sampled (Figure 13). A diversity of echinoderms, molluscs, and crustaceans were reported to dominate the canyon head, while scavengers such as ophiuroidea and decapoda were prevalent within habitats ranging from sandy areas, to patches of inshore and offshore mud belts. At depths of <100 m inshore of the canyon head, boulder beds hosted gorgonian and stylasterine corals.

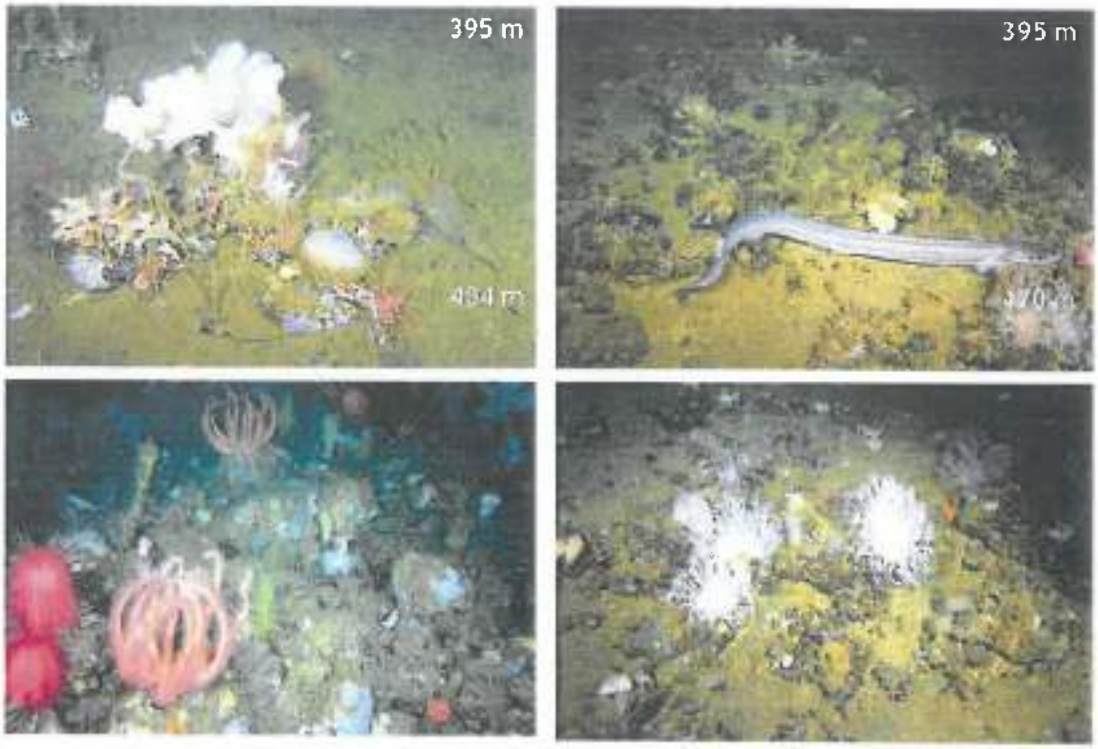

Figure 13: Deep water benthic macrofauna from various depths in the Cape Canyon (Source: www.environment.gov.za/dearesearchteamreturnfromdeepseaexpedition).

The concept of a 'Vulnerable Marine Ecosystem' (VME) centres upon the presence of distinct, diverse benthic assemblages that are limited and fragmented in their spatial extent, and dominated (in terms of biomass and/or spatial cover) by rare, endangered or endemic component species that are physically fragile and vulnerable to damage (or structural/biological alteration) by human activities (Parker *et al.* 2009; Auster *et al.* 2011; Hansen *et al.* 2013).

VMEs are known to be associated with higher biodiversity levels and indicator species that add structural complexity, resulting in greater species abundance, richness, biomass and diversity compared to surrounding uniform seabed habitats (Buhl-Mortensen *et al.* 2010; Hogg *et al.* 2010; Barrio Froján *et al.* 2012; Beazley *et al.* 2013, 2015). Compared to the surrounding deep-sea environment, VMEs typically form biological hotspots with a distinct, abundant and diverse fauna,

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many species of which remain unidentified. Levels of endemism on VMEs are also relatively high compared to the deep sea. The coral frameworks offer refugia for a great variety of invertebrates and fish (including commercially important species) within, or in association with, the living and dead coral framework thereby creating spatially fragmented areas of high biological diversity. The skeletal remains of Scleractinia coral rubble and Hexactinellid poriferans can also represent another important deep-sea habitat, acting to stabilise seafloor sediments allowing for colonisation by distinct infaunal taxa that show elevated abundance and biomass in such localised habitats (Bett & Rice 1992; Raes & Vanreusel 2005; Beazley *et al.* 2013; Ashford *et al.* 2019).

VMEs are also thought to contribute toward the long-term viability of a stock through providing an important source of habitat for commercial species (Pham *et al.* 2015; Ashford *et al.* 2019). They can provide a wide range of ecosystem services ranging from provision of aggregation- and spawning sites to providing shelter from predation and adverse hydrological conditions (Husebø & Nøttestad *et al.* 2002; Krieger & Wing, 2002; Tissot *et al.*, 2006; Baillon *et al.* 2012; Pham *et al.* 2015). Indicator taxa for VMEs are also known to provide increased access to food sources, both directly to associated benthic fauna, and indirectly to other pelagic species such as fish and other predators due to the high abundance and biomass of associated fauna (Krieger & Wing, 2002; Husebø & Nøttestad *et al.* 2002; Buhl-Mortensen *et al.*, 2010; Hogg *et al.*, 2010; Auster *et al.* 2011).

VME frameworks are typically elevated from the seabed, increasing turbulence and raising supply of suspended particles to suspension feeders (Krieger & Wing 2002; Buhl-Mortensen & Mortensen 2005; Buhl-Mortensen *et al.* 2010). Poriferans and cold-water corals have further been shown to provide a strong link between pelagic and benthic food webs (Pile & Young 2006; Cathalot *et al.* 2015). VMEs are increasingly being recognised as providers of important ecosystem services due to associated increased biodiversity and levels of ecosystem functioning (Ashford *et al.* 2019).

It is not always the case that seamount habitats are VMEs, as some seamounts may not host communities of fragile animals or be associated with high levels of endemism. Evidence from video footage taken on hard-substrate habitats in 100 - 120 m depth off southern Namibia and to the south-east of Child's Bank (De Beers Marine, unpublished data) (Figure 14), and in 190-527 m depth on Child's Bank (Sink *et al.* 2019) suggest that vulnerable communities including gorgonians, octocorals and reef-building sponges and hard-corals do occur on the continental shelf, some of which are thought to be Vulnerable Marine Ecosystem (VME) indicator species (Table 2). The distribution of 22 potential VME indicator taxa for the South African EEZ was recently mapped, with those from the West Coast listed in Table 2 (Atkinson & Sink 2018; Sink *et al.* 2019).

As sampling beyond 1 000 m depth has not taken place (Atkinson & Sink 2018) it is not known whether similar communities may be expected in the Reconnaissance Permit Area. Should they occur, however, they would receive the sound in the far field only and no detrimental effects to the communities or to individual benthic species are expected. The distribution of known and potential Vulnerable Marine Ecosystem habitat based on potential VME features, DFFE and SAEON trawl survey data, and many visual surveys indicating the presence of indicator taxa were mapped by Harris *et al.* 2022 (Figure 15). Some sites need more research to determine their status. The location of the Reconnaissance Permit Area is well offshore of these known and potential VMEs emphasising the gaps in our knowledge specific to the vulnerability of marine communities of abyssal habitats.

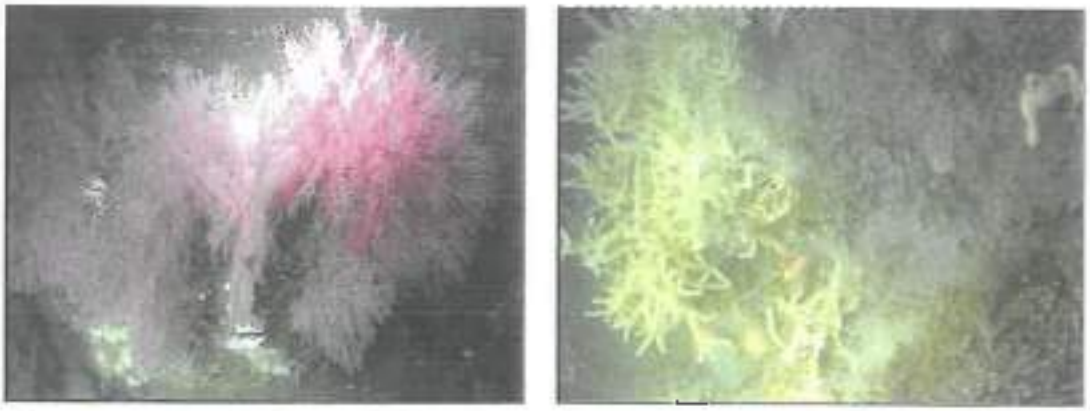

Figure 14: Gorgonians and bryozoans communities recorded on deep-water reefs (100-120 m) off the southern African West Coast (Photos: De Beers Marine).

Table 2: Table of Potential VME species from the the continental shelf and shelf edge on the West Coast (Atkinson & Sink 2018)

Phylum	Name	Common Name
Porifera	*Suberites dendelenae*	Amorphous solid sponge
	Rossella cf. antarctica	Glass sponge
Cnidaria	*Melithaea* spp.	Colourful sea fan
	Thouarella spp.	Bottlebrush sea fan
Family: Isididae	?	Bamboo coral
	Anthoptilum grandiflorum	Large sea pen*
	Lophelia pertusa	Reef-building cold water coral
	Solaster spp.	Fine-branching hydrocoral
Bryozoa	*Adeonella* spp.	Sabre bryozoan
	Phidoloporidae spp.	Honeycomb false lace coral
Hemichordata	*Cephalodiscus gilchristi*	Agar animal

Sediment samples collected at the base of Norwegian cold-water coral reefs revealed high interstitial concentrations of light hydrocarbons (methane, propane, ethane and higher hydrocarbons C4+) (Hovland & Thomsen 1997), which are typically considered indicative of localised light hydrocarbon micro-seepage through the seabed. Bacteria and other micro-organisms thrive on such hydrocarbon pore-water seepages, thereby providing suspension-feeders, including corals and gorgonians, with a substantial nutrient source. Some scientists believe there is a strong correlation between the occurrence of deep-water coral reefs and the relatively high values of light hydrocarbons (methane, ethane, propane and n-butane) in near-surface sediments (Hovland *et al.* 1998, Duncan & Roberts 2001, Hall-Spencer *et al.* 2002, Roberts & Gage 2003). A recent study by January (2018) identified that hydrocarbon seeps and gas escape structures have been identified in the Orange Basin area. Large fluid seep/pockmark fields of varying morphologies were also reported to the south of the Reconnaissance Permit Area by Palan (2017).

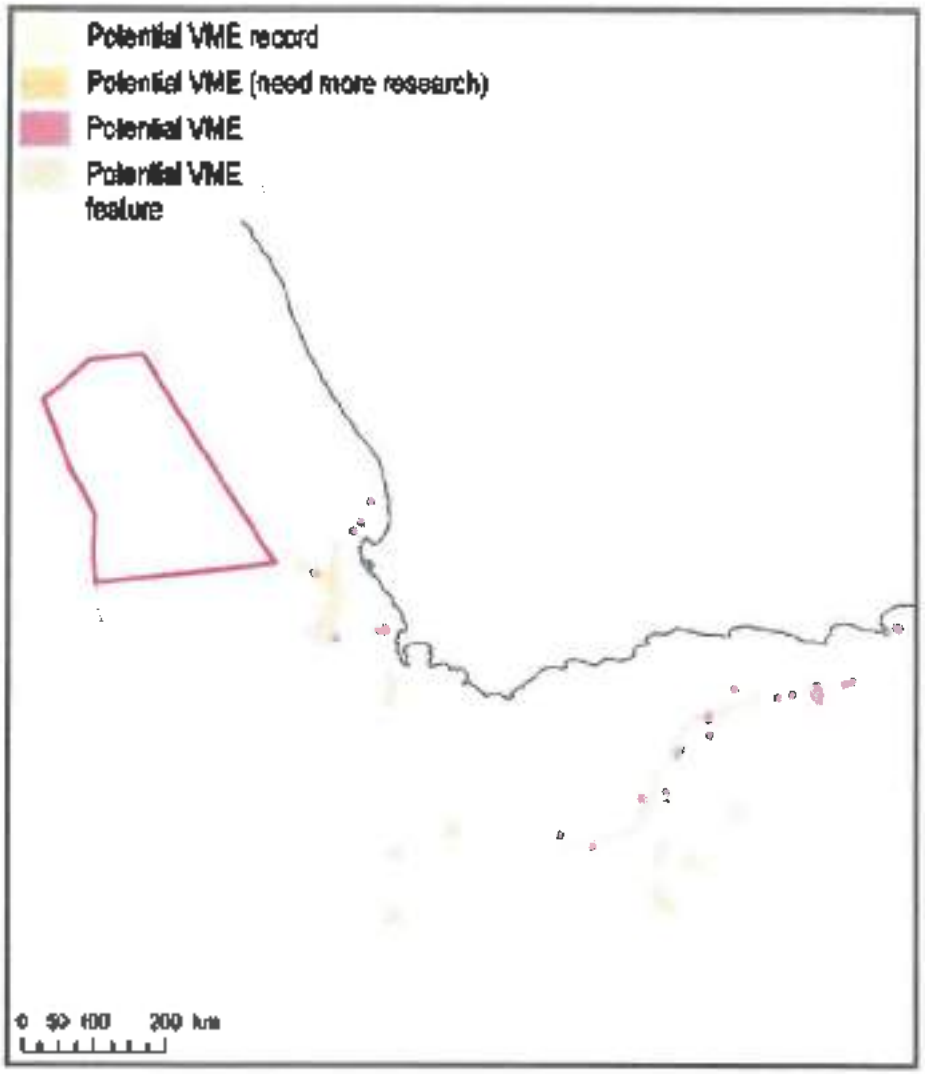

Figure 15: The Reconnaissance Permit Area (red polygon) in relation to the distribution of known and potential Vulnerable Marine Ecosystem habitat (adapted from Harris *et al.* 2022).

3.3.3 Pelagic Communities

In contrast to demersal and benthic biota associated with the seabed, pelagic species live and feed in the open water column. The pelagic communities are typically divided into plankton and fish, and their main predators, marine mammals (seals, dolphins and whales), seabirds and turtles. These are discussed separately below.

3.3.3.1 *Plankton*

Plankton is particularly abundant in the shelf waters off the West Coast, being associated with the upwelling characteristic of the area. Plankton range from single-celled bacteria to jellyfish of 2-m diameter, and include bacterio-plankton, phytoplankton, zooplankton, and ichthyoplankton (Figure 16).

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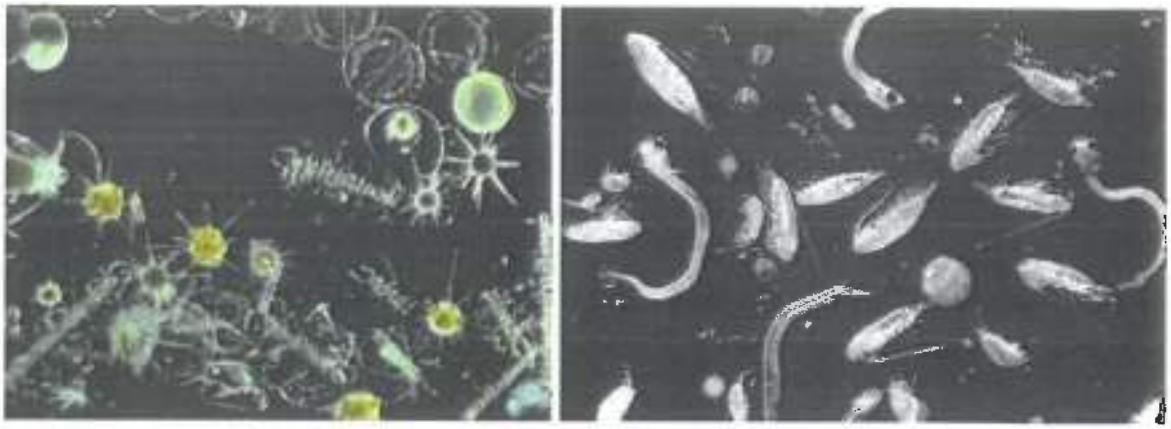

Figure 16: Phytoplankton (left, photo: hymagazine.com) and zooplankton (right, photo: mysciencebox.org) is associated with upwelling cells.

Phytoplankton are the principle primary producers with mean productivity ranging from 2.5 - 3.5 g C/m^2/day for the midshelf region and decreasing to 1 g C/m^2/day inshore of 130 m (Shannon & Field 1985; Mitchell-Innes & Walker 1991; Walker & Peterson 1991). The phytoplankton is dominated by large-celled organisms, which are adapted to the turbulent sea conditions. The most common diatom genera are *Chaetoceros, Nitzchia, Thalassiosira, Skeletonema, Rhizosolenia, Coscinodiscus* and *Asterionella* (Shannon & Pillar 1985). Diatom blooms occur after upwelling events, whereas dinoflagellates (e.g. *Prorocentrum, Ceratium* and *Peridinium*) are more common in blooms that occur during quiescent periods, since they can grow rapidly at low nutrient concentrations. In the surf zone, diatoms and dinoflagellates are nearly equally important members of the phytoplankton, and some silicoflagellates are also present.

Red-tides are ubiquitous features of the Benguela system (see Shannon & Pillar, 1986). The most common species associated with red tides (dinoflagellate and/or ciliate blooms) are *Noctiluca scintillans, Gonyaulax tamarensis, G. polygramma* and the ciliate *Mesodinium rubrum*. *Gonyaulax* and *Mesodinium* have been linked with toxic red tides. Most of these red-tide events occur quite close inshore although Hutchings *et al.* (1983) have recorded red-tides 30 km offshore. They are unlikely to occur in the offshore regions of the proposed 3D survey area.

The mesozooplankton (≥200 µm) is dominated by copepods, which are overall the most dominant and diverse group in southern African zooplankton. Important species are *Centropages brachiatus, Calanoides carinatus, Metridia lucens, Nannocalanus minor, Clausocalanus arcuicornis, Paracalanus parvus, P. crassirostris* and *Ctenocalanus vanus*. All of the above species typically occur in the phytoplankton rich upper mixed layer of the water column, with the exception of *M. lucens* which undertakes considerable vertical migration.

The macrozooplankton (≥1 600 µm) are dominated by euphausiids of which 18 species occur in the area. The dominant species occurring in the nearshore are *Euphausia lucens* and *Nyctiphanes capensis*, although neither species appears to survive well in waters seaward of oceanic fronts over the continental shelf (Pillar *et al.* 1991).

Standing stock estimates of mesozooplankton for the southern Benguela area range from 0.2 - 2.0 g C/m^3, with maximum values recorded during upwelling periods. Macrozooplankton biomass ranges from 0.1-1.0 g C/m^2, with production increasing north of Cape Columbine (Pillar 1986). Although it shows no appreciable onshore-offshore gradients, standing stock is highest over the shelf, with

accumulation of some mobile zooplankters (euphausiids) known to occur at oceanographic fronts. Beyond the continental slope biomass decreases markedly. Localised peaks in biomass may, however, occur in the vicinity of Child's Bank and Tripp Seamount in response to topographically steered upwelling around such seabed features.

Zooplankton biomass varies with phytoplankton abundance and, accordingly, seasonal minima will exist during non-upwelling periods when primary production is lower (Brown 1984; Brown & Henry 1985), and during winter when predation by recruiting anchovy is high. More intense variation will occur in relation to the upwelling cycle; newly upwelled water supporting low zooplankton biomass due to paucity of food, whilst high biomasses develop in aged upwelled water subsequent to significant development of phytoplankton. Irregular pulsing of the upwelling system, combined with seasonal recruitment of pelagic fish species into West Coast shelf waters during winter, thus results in a highly variable and dynamic balance between plankton replenishment and food availability for pelagic fish species.

Although ichthyoplankton (fish eggs and larvae) comprise a minor component of the overall plankton, it remains significant due to the commercial importance of the overall fishery in the region. Various pelagic and demersal fish species are known to spawn in the inshore regions of the southern Benguela, (including pilchard, round herring, chub mackerel lanternfish and hakes (Crawford *et al.* 1987; Hutchings 1994; Hutchings *et al.* 2002) (see Figure 17, Figure 18a and 18b, and Figure 19), and their eggs and larvae form an important contribution to the ichthyoplankton in the region. Spawning of key species is presented below.

- Hake, snoek and round herring move to the western Agulhas Bank and southern west coast to spawn in late winter and early spring (key period), when offshore Ekman losses are at a minimum and their eggs and larvae drift northwards and inshore to the west coast nursery grounds. Figure 18a and 18b highlight the temporal variation in hake eggs and larvae with there being a greater concentration of eggs and larvae between September - October compared to March - April. However, hake are reported to spawn throughout the year (Stremme *et al.* 2015). Snoek spawn along the shelf break (150-400 m) of the western Agulhas Bank and the West Coast between June and October (Griffiths 2002).
- Horse mackerel spawn over the east/central Agulhas Bank during winter months.
- Sardines spawn on the whole Agulhas Bank during November, but generally have two spawning peaks, in early spring and autumn, on either side of the peak anchovy spawning period (Figure 19, left). There is also sardine spawning on the east coast and even off KwaZulu-Natal, where sardine eggs are found during July-November.
- Anchovies spawn on the whole Agulhas Bank (Figure 19, right), with spawning peaking during mid-summer (November-December) and some shifts to the west coast in years when Agulhas Bank water intrudes strongly north of Cape Point.

The eggs and larvae are carried around Cape Point and up the coast in northward flowing surface waters. At the start of winter every year, the juveniles recruit in large numbers into coastal waters across broad stretches of the shelf between the Orange River and Cape Columbine to utilise the shallow shelf region as nursery grounds before gradually moving southwards in the inshore southerly flowing surface current, towards the major spawning grounds east of Cape Point. Following spawning, the eggs and larvae of snoek are transported to inshore (<150 m) nursery grounds north of Cape Columbine and east of Danger Point, where the juveniles remain until

maturity. There is no overlap of the Reconnaissance Permit Area or indicative 3D acquisition area with the northward egg and larval drift of commercially important species, and the return migration of recruits (Figure 17). In the offshore oceanic waters of the proposed 3D survey area, ichthyoplankton abundance is, therefore, expected to be low.

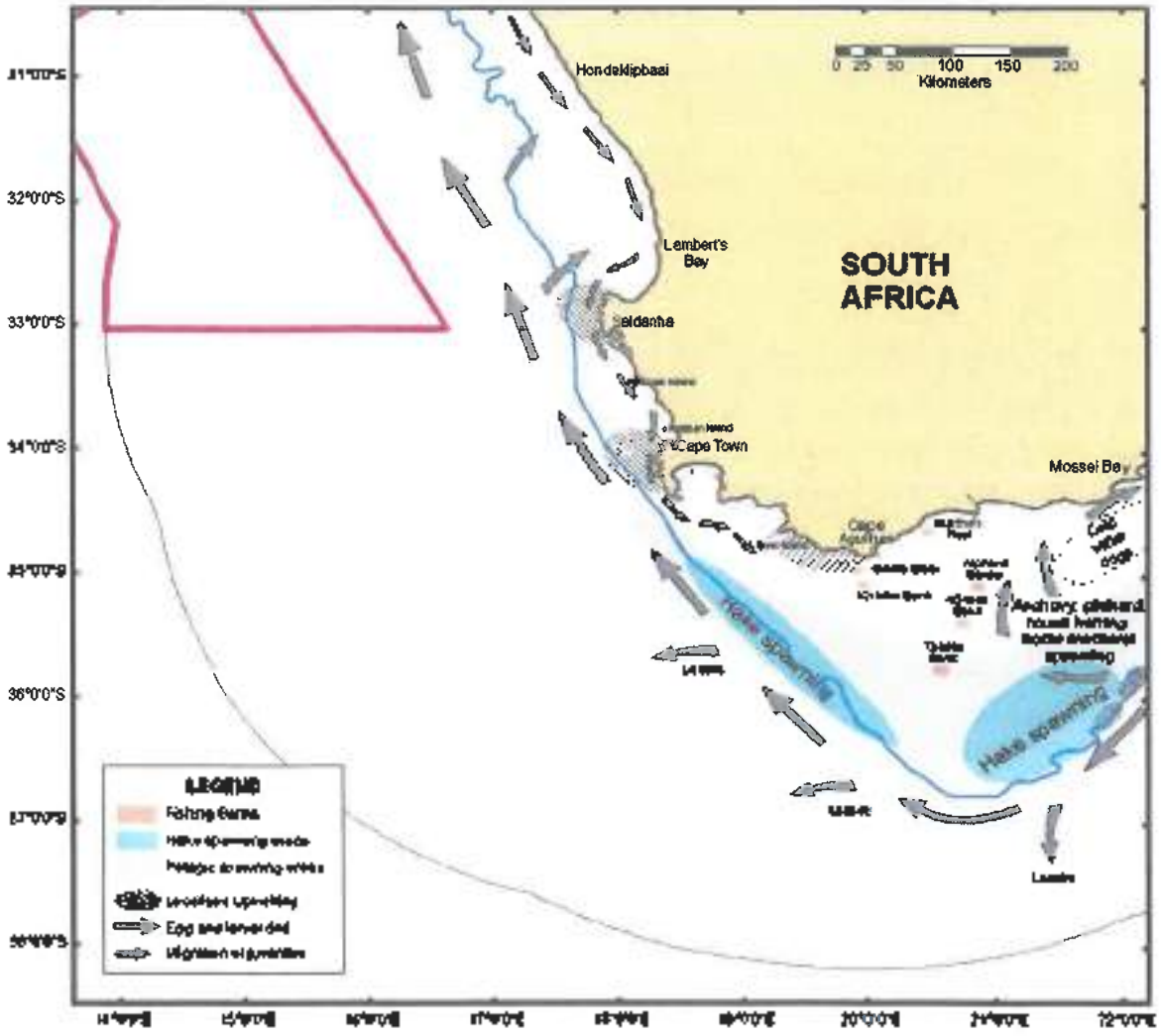

Figure 17: The Reconnaissance Permit Area (red polygon) in relation to major spawning, recruitment and nursery areas in the southern Benguela region (adapted from Crawford *et al.* 1987; Hutchings 1994; Hutchings *et al.* 2002).

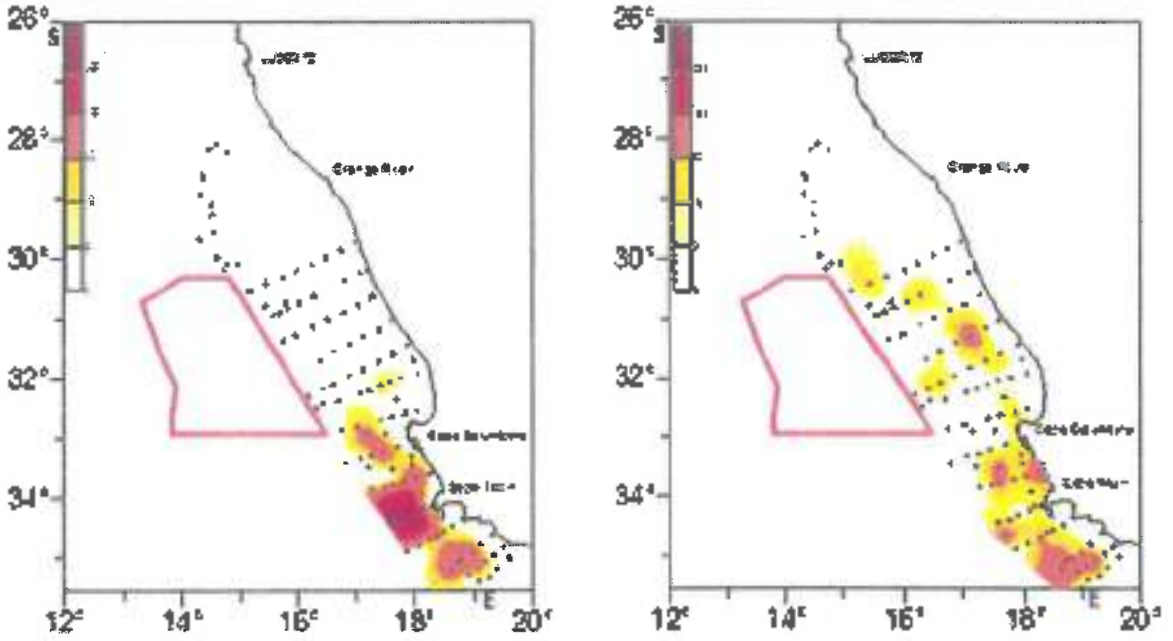

Figure 18a: Distribution of hake eggs (left) and larvae (right) off the West Coast of South Africa between September and October 2005 (adapted from Stenevik *et al.* 2008) in relation to the Reconnaissance Permit Area (red polygon).

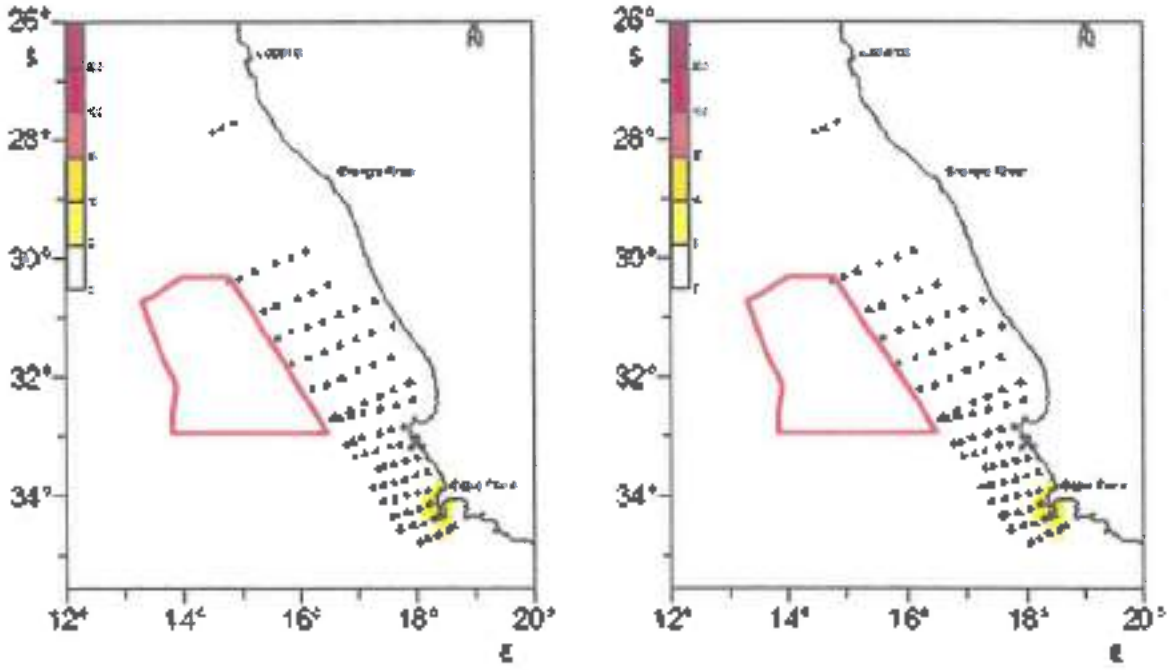

Figure 18b: Distribution of hake eggs (left) and larvae (right) off the West Coast of South Africa between March and April 2007 (adapted from Stenevik *et al.* 2008) in relation to the Reconnaissance Permit Area (red polygon).

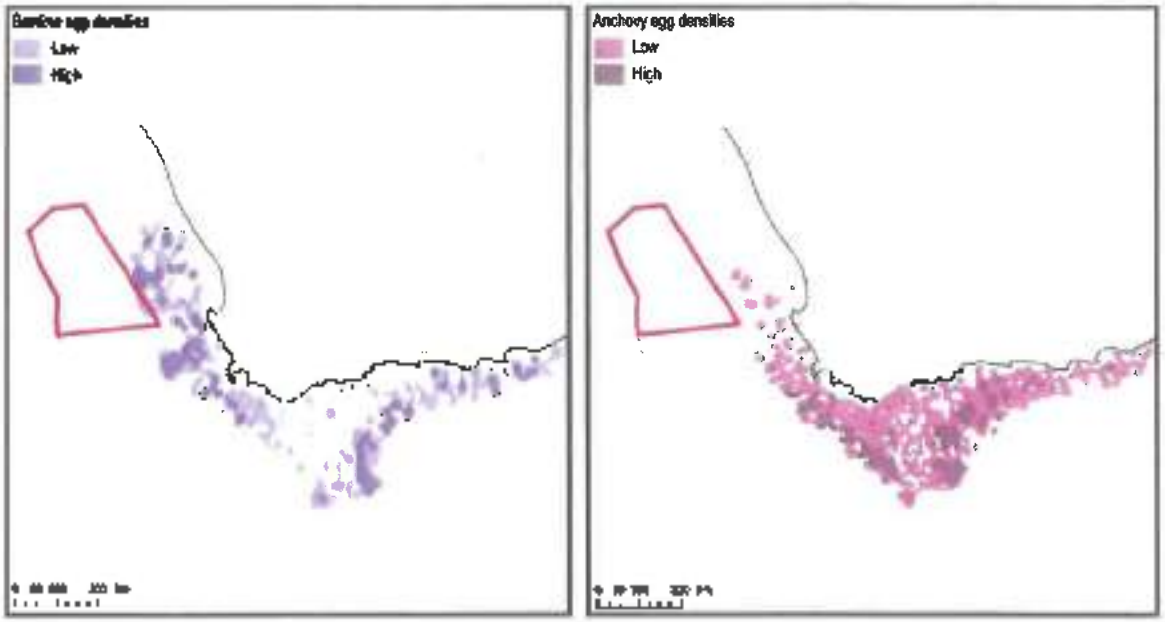

Figure 19: Distribution of sardine (left) and anchovy (right) spawning areas, as measured by egg densities, in relation to the Reconnaissance Permit Area (red polygon) (adapted from Harris *et al.* 2022).

3.3.3.2 Cephalopods

Fourteen species of cephalopds have been recorded in the southern Benguela, the majority of which are sepiods/cuttlefish (Lipinski 1992; Augustyn *et al.* 1995). Most of the cephalopod resource is distributed on the mid-shelf with *Sepia australis* being most abundant at depths between 60-190 m, whereas *S. hieronis* densities were higher at depths between 110-250 m. *Rossia enigmatica* occurs more commonly on the edge of the shelf to depths of 500 m. Biomass of these species was generally higher in the summer than in winter.

Cuttlefish are largely epi-benthic and occur on mud and fine sediments in association with their major prey item; mantis shrimps (Augustyn *et al.* 1995). They form an important food item for demersal fish.

The colossal squid *Mesonychoteuthis hamiltoni* and the giant squid *Architeuthis* sp. may also be encountered in the project area. Both are deep dwelling species, with the colossal squid's distribution confined to the entire circum-antarctic Southern Ocean (Figure 20, top) while the giant squid is usually found near continental and island slopes all around the world's oceans (Figure 20, bottom). Both species could thus potentially occur in the pelagic habitats of the project area, although the likelihood of encounter is extremely low.

Growing to in excess of 10 m in length, they are the principal prey of the sperm whale, and are also taken by beaked whales, pilot whales, elephant seals and sleeper sharks. Nothing is known of their vertical distribution, but data from trawled specimens and sperm whale diving behaviour suggest they may span a depth range of 300 - 1 000 m. They lack gas-filled swim bladders and maintain neutral buoyancy through an ammonium chloride solution occurring throughout their bodies.

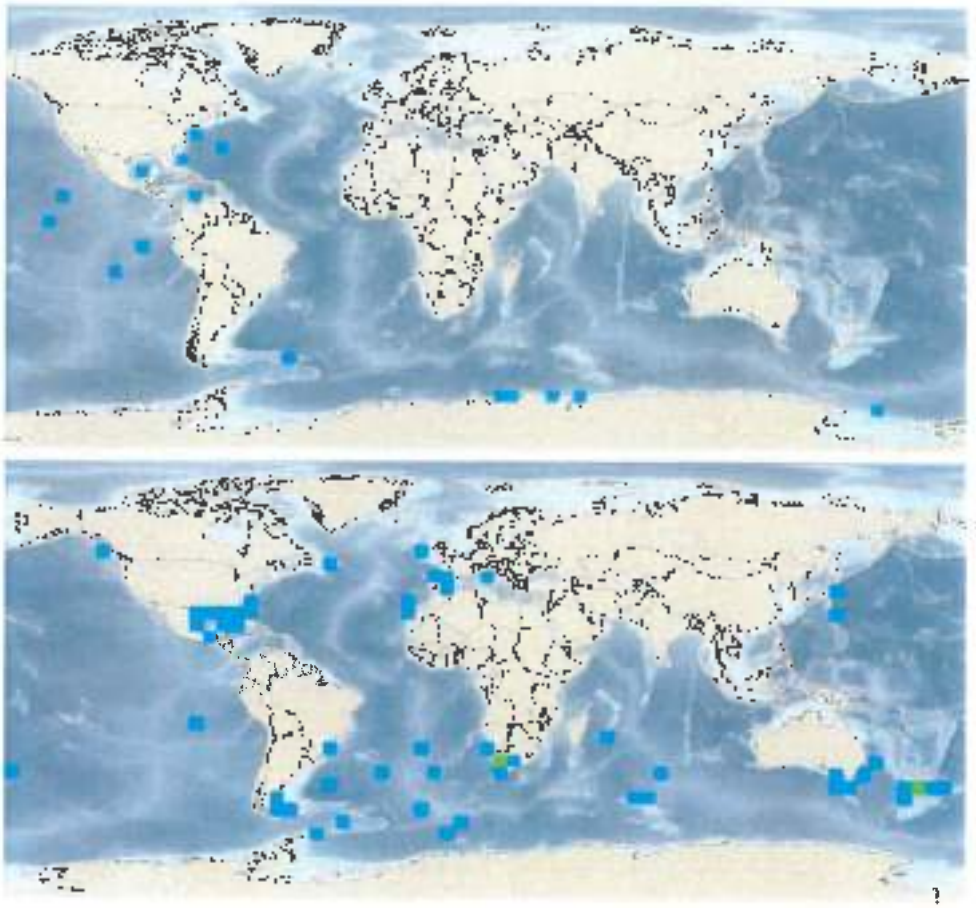

Figure 20: Distribution of the colossal squid (top) and the giant squid (bottom). Blue squares <5 records, green squares 5-10 records (Source: http://iobis.org).

3.3.3.3 *Pelagic Fish*

Small pelagic species include the sardine/pilchard (*Sadinops ocellatus*) (Figure 21, left), anchovy (*Engraulis capensis*), chub mackerel (*Scomber japonicus*), horse mackerel (*Trachurus capensis*) (Figure 21, right) and round herring (*Etrumeus whiteheadi*). These species typically occur in mixed shoals of various sizes (Crawford *et al.* 1987), and generally occur within the 200 m contour and thus likely to only be encountered in southeastern inshore portion of the project area. Most of the pelagic species exhibit similar life history patterns involving seasonal migrations between the west and south coasts. The spawning areas of the major pelagic species are distributed on the continental shelf and along the shelf edge extending from south of St Helena Bay to Mossel Bay on the South Coast (Shannon & Pillar 1986) (see Figure 17). They spawn downstream of major upwelling centres in spring and summer, and their eggs and larvae are subsequently carried around Cape Point and up the coast in northward flowing surface waters.

At the start of winter every year, juveniles of most small pelagic shoaling species recruit into coastal waters in large numbers between the Orange River and Cape Columbine. They recruit in the pelagic stage, across broad stretches of the shelf, to utilise the shallow shelf region as nursery grounds before gradually moving southwards in the inshore southerly flowing surface current, towards the major spawning grounds east of Cape Point. Recruitment success relies on the interaction of oceanographic

events, and is thus subject to spatial and temporal variability. Consequently, the abundance of adults and juveniles of these small, short-lived (1-3 years) pelagic fish is highly variable both within and between species.

Figure 21: Cape fur seal preying on a shoal of pilchards (left). School of horse mackerel (right) (photos: www.underwatervideo.co.za; www.delivery.superstock.com).

Two species that migrate along the West Coast following the shoals of anchovy and pilchards are snoek *Thyrsites atun* and chub mackerel *Scomber japonicas*. Both these species have been rated as 'Least concern' on the national assessment (Sink *et al.* 2019). While the appearance of chub mackerel along the West and South-West coasts is highly seasonal, adult snoek are found throughout their distribution range and longshore movement are random and without a seasonal basis (Griffiths 2002). Initially postulated to be a single stock that undergoes a seasonal longshore migration from southern Angola through Namibia to the South African West Coast (Crawford & De Villiers 1985; Crawford *et al.* 1987), Benguela snoek are now recognised as two separate sub-populations separated by the Lüderitz upwelling cell (Griffiths 2003). On the West Coast, snoek move offshore to spawn and there is some southward dispersion as the spawning season progresses, with females on the West Coast moving inshore to feed between spawning events as spawning progresses. In contrast, those found further south along the western Agulhas Bank remain on the spawning grounds throughout the spawning season (Griffiths 2002) (Figure 22). They are voracious predators occurring throughout the water column, feeding on both demersal and pelagic invertebrates and fish. Chub mackerel similarly migrate along the southern African West Coast reaching South-Western Cape waters between April and August. They move inshore in June and July to spawn before starting the return northwards offshore migration later in the year. Their abundance and seasonal migrations are thought to be related to the availability of their shoaling prey species (Payne & Crawford 1989). The distribution of snoek and chub mackerel therefore lies well inshore of the Reconnaissance Permit Area.

The fish most likely to be encountered on the shelf, beyond the shelf break and in the offshore waters of the proposed 3D survey areas are the large migratory pelagic species, including various tunas, billfish and sharks, many of which are considered threatened by the International Union for the Conservation of Nature (IUCN), primarily due to overfishing (Error! Reference source not found.). Tuna and swordfish are targeted by high seas fishing fleets and illegal overfishing has severely damaged the stocks of many of these species. Similarly, pelagic sharks, are either caught as bycatch in the pelagic tuna longline fisheries, or are specifically targeted for their fins, where the fins are removed and the remainder of the body discarded.

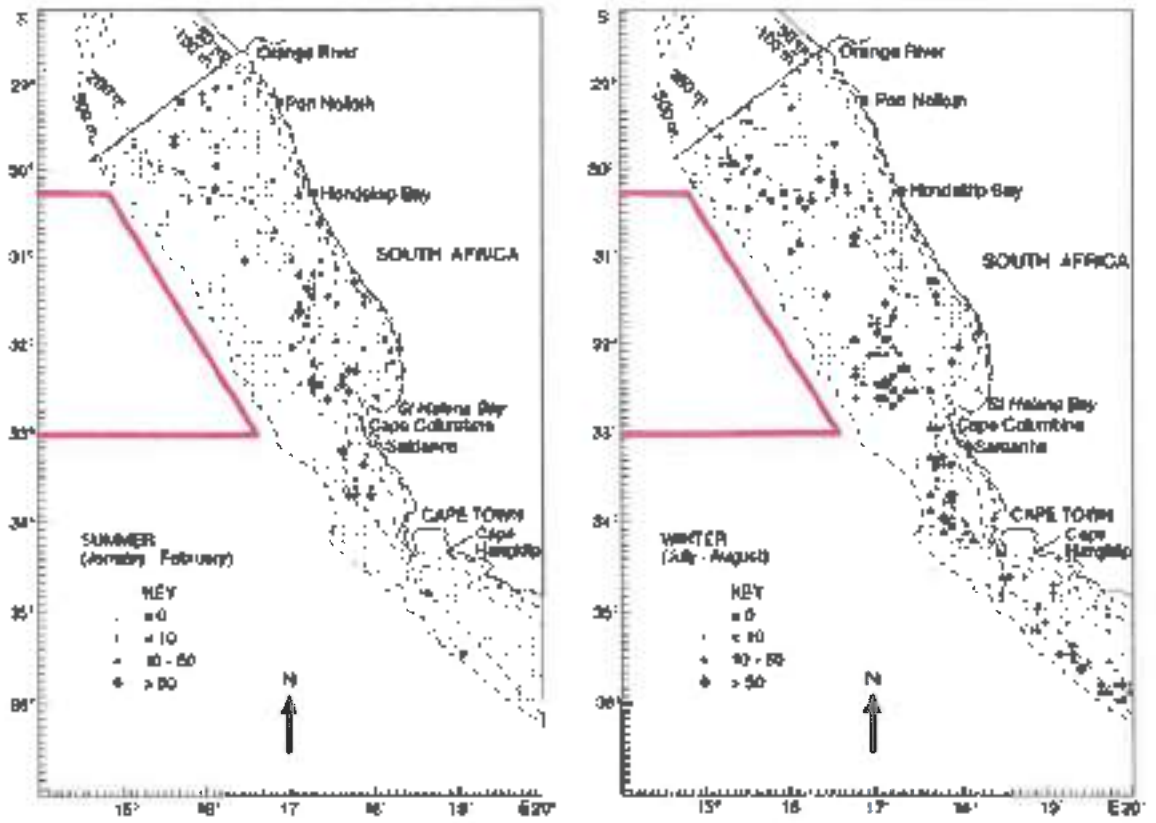

Figure 22: Mean number of snoek per demersal trawl per grid block (5 x 5 Nm) by season for (A) the west coast (July 1985-Jan 1991) and (B) the south coast in relation to the Reconnaissance Permit Area (red polygon) (adapted from Griffiths 2002).

These large pelagic species migrate throughout the southern oceans, between surface and deep waters (>300 m) and have a highly seasonal abundance in the Benguela. Species occurring off western southern Africa include the albacore/longfin tuna *Thunnus alalunga* (Figure 23, right), yellowfin *T. albacares*, bigeye *T. obesus*, and skipjack *Katsuwonus pelamis tunas*, as well as the Atlantic blue marlin *Makaira nigricans* (Figure 23, left), the white marlin *Tetrapturus albidus* and the broadbill swordfish *Xiphias gladius* (Payne & Crawford 1989). The distribution of these species is dependent on food availability in the mixed boundary layer between the Benguela and warm central Atlantic waters. Concentrations of large pelagic species are also known to occur associated with underwater feature such as canyons and seamounts as well as meteorologically induced oceanic fronts (Shannon *et al.* 1989; Penney *et al.* 1992). Seasonal association with Child's Bank and Tripp Seamount occurs between October and June, with commercial catches often peaking in March and April (www.fao.org/fi/fcp/en/ NAM/body.htm; see CapMarine 2022 - Fisheries Specialist Study).

Table 3: Some of the more important large migratory pelagic fish likely to occur in the offshore regions of the West Coast (TOPS list under NEMBA, Act 10 of 2004; Sink *et al.* 2019; www.iucnredlist.org;). The National and Global IUCN Conservation Status are also provided.

Common Name	Species	National Assessment	IUCN Conservation Status
Tunas			
Southern Bluefin Tuna	*Thunnus maccoyii*	Not Assessed	Endangered
Bigeye Tuna	*Thunnus obesus*	Vulnerable	Vulnerable
Longfin Tuna/Albacore	*Thunnus alalunga*	Near Threatened	Least concern
Yellowfin Tuna	*Thunnus albacares*	Near Threatened	Least concern
Frigate Tuna	*Auxis thazard*	Not Assessed	Least concern
Eastern Little Tuna	*Euthynnus affinis*	Least concern	Least concern
Skipjack Tuna	*Katsuwonus pelamis*	Least concern	Least concern
Atlantic Bonito	*Sarda sarda*	Not Assessed	Least concern
Billfish			
Black Marlin	*Istiompax indica*	Data deficient	Data deficient
Blue Marlin	*Makaira nigricans*	Vulnerable	Vulnerable
Striped Marlin	*Kajikia audax*	Near Threatened	Near Threatened
Sailfish	*Istiophorus platypterus*	Least concern	Least concern
Swordfish	*Xiphias gladius*	Data deficient	Least concern
Pelagic Sharks			
Oceanic Whitetip Shark	*Carcharhinus longimanus*	Not Assessed	Vulnerable
Dusky Shark	*Carcharhinus obscurus*	Data deficient	Vulnerable
Bronze Whaler Shark	*Carcharhinus brachyurus*	Data deficient	Near Threatened
Great White Shark	*Carcharodon carcharias*	Least concern	Vulnerable
Shortfin Mako	*Isurus oxyrinchus*	Vulnerable	Endangered
Longfin Mako	*Isurus paucus*	Not Assessed	Vulnerable
Whale Shark	*Rhincodon typus*	Not Assessed	Endangered
Blue Shark	*Prionace glauca*	Least concern	Near Threatened

A number of species of pelagic sharks are also known to occur on the West and South-West Coast, including blue *Prionace glauca*, short-fin mako *Isurus oxyrinchus* and oceanic whitetip sharks *Carcharhinus longimanus*. Occurring throughout the world in warm temperate waters, these species are usually found further offshore on the West Coast. Great whites *Carcharodon carcharias* and whale sharks *Rhincodon typus* may also be encountered in coastal and offshore areas, although the latter occurs more frequently along the South and East coasts. The recapture of a juvenile blue shark off Uruguay, which had been tagged off the Cape of Good Hope, supports the hypothesis of a single blue shark stock in the South Atlantic (Hazin 2000; Montealegre-Quijano & Vooren 2010) and Indian Oceans (da Silva et al. 2010). Using the Benguela drift in a north-westerly direction, it is likely that juveniles from the parturition off the south-western Cape would migrate through the project area *en route* to South America (da Silva *et al.* 2010).

The shortfin mako inhabits offshore temperate and tropical seas worldwide. It can be found from the surface to depths of 500 m, and as one of the few endothermic sharks is seldom found in waters <16

°C (Compagno 2001; Loefer *et al.* 2005). As the fastest species of shark, shortfin makos have been recorded to reach speeds of 40 km/h with burst of up to 74 km/h, and can jump to a height of 9 m (http://www.elasmo-research.org/education/shark_profiles/ i_oxyrinchus.htm). Most makos caught by longliners off South Africa are immature, with reports of juveniles and sub-adults sharks occurring near the edge of the Agulhas Bank and off the South Coast between June and November (Groenevald *et al.* 2014), whereas larger and reproductively mature sharks were more common in the inshore environment along the East Coast (Foulis 2013).

Figure 23: Large migratory pelagic fish such as blue marlin (left) and longfin tuna (right) occur in offshore waters (photos: www.samathatours.com; www.osfimages.com).

Whale sharks are regarded as a broad ranging species typically occurring in offshore epipelagic areas with sea surface temperatures of 18-32°C (Eckert & Stewart 2001). Adult whale sharks reach an average size of 9.7 m and 9 tonnes, making them the largest non-cetacean animal in the world. They are slow-moving filter-feeders and therefore particularly vulnerable to ship strikes (Rowat 2007). Although primarily solitary animals, seasonal feeding aggregations occur at several coastal sites all over the world, those closest to the project area being off Sodwana Bay in KwaZulu Natal (KZN) in the Greater St. Lucia Wetland Park (Cliff *et al.* 2007). Satellite tagging has revealed that individuals may travel distances of tens of 1 000s of kms (Eckert & Stewart 2001; Rowat & Gore 2007; Brunnschweiler *et al.* 2009). On the West Coast their summer and winter distributions are centred around the Orange River mouth and between Cape Columbine and Cape Point (Harris *et al.* 2022). The likelihood of an encounter in the offshore waters of the Reconnaissance Permit Area is relatively low.

The whale shark and shortfin mako are listed in Appendix II (species in which trade must be controlled in order to avoid utilization incompatible with their survival) of CITES (Convention on International Trade in Endangered Species) and Appendix I and/or II of the Bonn Convention for the Conservation of Migratory Species (CMS). The whale shark is also listed as 'vulnerable' in the List of Marine Threatened or Protected Species (TOPS) as part of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA).

3.3.3.4 Turtles

Three species of turtle occur along the West Coast, namely the Leatherback (*Dermochelys coriacea*) (Figure 24, left), and occasionally the Loggerhead (*Caretta caretta*) (Figure 24, right) and the Green (*Chelonia mydas*) turtle. Loggerhead and Green turtles are expected to occur only as occasional visitors along the West Coast. The most recent conservation status, which assessed the species on a sub-regional scale, is provided in Table 4.

The Leatherback is the only turtle likely to be encountered in the offshore waters of west South Africa. The Benguela ecosystem, especially the northern Benguela where jelly fish numbers are high, is increasingly being recognized as a potentially important feeding area for leatherback turtles from several globally significant nesting populations in the south Atlantic (Gabon, Brazil) and south east Indian Ocean (South Africa) (Lambardi *et al.* 2008, Elwen & Leeney 2011; SASTN 2011[2]). Leatherback turtles from the east South Africa population have been satellite tracked swimming around the west coast of South Africa and remaining in the warmer waters west of the Benguela ecosystem (Lambardi *et al.* 2008) (Figure 25).

Figure 24: Leatherback (left) and loggerhead turtles (right) occur along the West Coast of Southern Africa (Photos: Ketos Ecology 2009; www.aquaworld-crete.com).

Table 4: Global and Regional Conservation Status of the turtles occurring off the South Coast showing variation depending on the listing used.

Listing	Leatherback	Loggerhead	Green
IUCN Red List:			
Species (date)	V (2013)	V (2017)	E (2004)
Population (RMU)	CR (2011)	NT (2017)	*
Sub-Regional/National			
NEMBA TOPS (2017)	CR	E	E
Sink & Lawrence (2006)	CR	E	E
Hughes & Nel (2014)	E	V	NT

NT - Near Threatened V - Vulnerable E - Endangered CR - Critically Endangered
DD - Data Deficient UR - Under Review * - not yet assessed

[2] *SASTN Meeting - Second meeting of the South Atlantic Sea Turtle Network, Swakopmund, Namibia, 24-30 July 2011.*

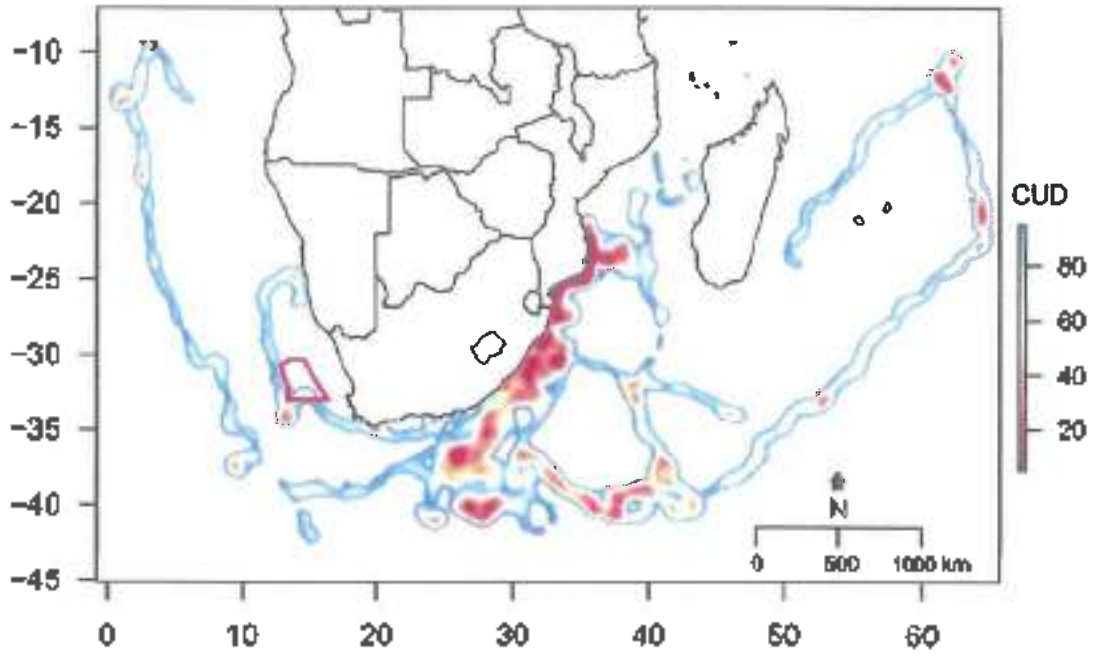

Figure 25: The Reconnaissance Permit Area (red polygon) in relation to the migration corridors of leatherback turtles in the south-western Indian Ocean. Relative use (CUD, cumulative utilization distribution) of corridors is shown through intensity of shading: light, low use; dark, high use (adapted from Harris *et al.* 2018).

Leatherback turtles inhabit deeper waters and are considered a pelagic species, travelling the ocean currents in search of their prey (primarily jellyfish). While hunting they may dive to over 600 m and remain submerged for up to 54 minutes (Hays *et al.* 2004). Their abundance in the study area is unknown but expected to be low. Leatherbacks feed on jellyfish and are known to have mistaken plastic marine debris for their natural food. Ingesting this can obstruct the gut, lead to absorption of toxins and reduce the absorption of nutrients from their real food. Leatherback Turtles are listed as 'Critically Endangered' worldwide by the IUCN and are in the highest categories in terms of need for conservation in CITES (Convention on International Trade in Endangered Species), and CMS (Convention on Migratory Species). The 2017 South African list of Threatened and Endangered Species (TOPS) similarly lists the species as 'Critically Endangered', whereas on the National Assessment (Hughes & Nel 2014) leatherbacks were listed as 'Endangered', whereas Loggerhead and green turtles are listed globally as 'Vulnerable' and 'Endangered', respectively, whereas on TOPS both species are listed as 'Endangered'. As a signatory of CMS, South Africa has endorsed and signed a CMS International Memorandum of Understanding specific to the conservation of marine turtles. South Africa is thus committed to conserve these species at an international level.

3.3.3.5 Seabirds

Large numbers of pelagic seabirds exploit the pelagic fish stocks of the Benguela system. Of the 49 species of seabirds that occur in the Benguela region, 14 are defined as resident, 10 are visitors from the northern hemisphere and 25 are migrants from the southern Ocean. The species classified as being common in the southern Benguela are listed in Table 5. The area between Cape Point and the Orange River supports 38% and 33% of the overall population of pelagic seabirds in winter and summer, respectively. Most of the species in the region reach highest densities offshore of the shelf break (200 - 500 m depth), with highest population levels during their non-breeding season (winter). Pintado petrels and Prion spp. Show the most marked variation here. Pelagic seabird species are therefore likely to be relatively frequently encountered in the offshore waters of the Reconnaissance Permit Area.

Fifteen species of seabirds breed in southern Africa; Cape Gannet (Figure 26, left), African Penguin (Figure 26, right), four species of Cormorant, White Pelican, three Gull and four Tern species (Table 6). The breeding areas are distributed around the coast with islands being especially important. The closest breeding islands to the Reconnaissance Permit Area are Bird Island in Lambert's Bay, the Saldanha Bay Islands and Dassen Island, which lie approximately 192 km,126 km and 150 km to the east and south east of the eastern and southern boundary of the Reconnaissance Permit Area, respectively. The number of successfully breeding birds at the particular breeding sites varies with food abundance. Most of the breeding seabird species forage at sea with most birds being found relatively close inshore (10-30 km). Cape Gannets, which breed at only three locations in South Africa (Bird Island Lamberts Bay, Malgas Island and Bird Island Algoa Bay) are known to forage within 200 km offshore (Dundee 2006; Ludynia 2007; Grémillet *et al.* 2008; Crawford *et al.* 2011), and African Penguins have also been recorded as far as 60 km offshore. The proposed 3D survey area lies well offshore of the aggregate core home ranges of Cape Gannet and African Penguin (Figure 27) (BirdLife South Africa 2022). Aggregate core home ranges and foraging areas for Cape Cormorant and Bank Cormorant similarly lie well inshore of the Reconnaissance Permit Area (see Harris *et al.* 2022). There is, however, overlap of the foraging areas of Wandering Albatross and Atlantic Yellow-nosed Albatross with the Reconnaissance Permit Area (Figure 27) (BirdLife South Africa 2022; Harris *et al.* 2022).

Figure 26: Cape Gannets *Morus capensis* (left) (Photo: NACOMA) and African Penguins *Spheniscus demersus* (right) (Photo: Klaus Jost) breed primarily on the offshore islands.

Table 5: Pelagic seabirds common in the southern Benguela region (Crawford et al. 1991; BirdLife 2021). IUCN Red List and Regional Assessment status are provided (Sink et al. 2019).

Common Name	Species name	Global IUCN	Regional Assessment
Shy Albatross	*Thalassarche cauta*	Near Threatened	Near Threatened
Black-browed Albatross	*Thalassarche melanophrys*	Least concern	Endangered
Atlantic Yellow-nosed	*Thalassarche chlororhynchos*	Endangered	Endangered
Indian Yellow-nosed Albatross	*Thalassarche carteri*	Endangered	Endangered
Wandering Albatross	*Diomedea exulans*	Vulnerable	Vulnerable
Southern Royal Albatross	*Diomedea epomophora*	Vulnerable	Vulnerable
Northern Royal Albatross	*Diomedea sanfordi*	Endangered	Endangered
Sooty Albatross	*Phoebetria fusca*	Endangered	Endangered
Light-mantled Albatross	*Phoebetria [illegible]*	Near Threatened	Near Threatened
Tristan Albatross	*Diomedea dabbenena*	[illegible]	[illegible]
Grey-headed Albatross	*Thalassarche chrysostoma*	Endangered	Endangered
Giant Petrel sp.	*Macronectes halli/giganteus*	Least concern	Near Threatened
Southern Fulmar	*Fulmarus glacialoides*	Least concern	Least concern
Pintado Petrel	*Daption capense*	Least concern	Least concern
Blue Petrel	*Halobaena caerulea*	Least concern	Near Threatened
Salvin's Prion	*Pachyptila salvini*	Least concern	Near Threatened
Arctic Prion	*Pachyptila desolata*	Least concern	Least concern
Slender-billed Prion	*Pachyptila belcheri*	Least concern	Least concern
Broad-billed Prion	*Pachyptila vittata*	Least concern	Least concern
Kerguelen Petrel	*Aphrodroma brevirostris*	Least concern	Near Threatened
Greasy-winged Petrel	*Pterodroma macroptera*	Least concern	Near Threatened
Soft-plumaged Petrel	*Pterodroma mollis*	Least concern	Near Threatened
White-chinned Petrel	*Procellaria aequinoctialis*	Vulnerable	Vulnerable
Spectacled Petrel	*Procellaria conspicillata*	Vulnerable	Vulnerable
Cory's Shearwater	*Calonectris diomedea*	Least concern	Least concern
Sooty Shearwater	*Puffinus griseus*	Near Threatened	Near Threatened
Flesh-footed Shearwater	*Ardenna carneipes*	Near Threatened	Least concern
Great Shearwater	*Puffinus gravis*	Least concern	Least concern
Manx Shearwater	*Puffinus puffinus*	Least concern	Least concern
Little Shearwater	*Puffinus assimilis*	Least concern	Least concern
European Storm Petrel	*Hydrobates pelagicus*	Least concern	Least concern
Leach's Storm Petrel	*Oceanodroma leucorhoa*	Vulnerable	[illegible]
Wilson's Storm Petrel	*Oceanites oceanicus*	Least concern	Least concern
Black-bellied Storm Petrel	*Fregetta tropica*	Least concern	Near Threatened
White-bellied Storm Petrel	*Fregetta grallaria*	Least concern	Least concern
Pomarine Jaeger	*Stercorarius pomarinus*	Least concern	Least concern
Subantarctic Skua	*Catharacta antarctica*	Least concern	Endangered
Parasitic Jaeger	*Stercorarius parasiticus*	Least concern	Least concern
Long-tailed Jaeger	*Stercorarius longicaudus*	Least concern	Least concern
Sabine's Gull	*Larus sabini*	Least concern	Least concern
Lesser Crested Tern	*Thalasseus bengalensis*	Least concern	Least concern
Sandwich Tern	*Thalasseus sandvicensis*	Least concern	Least concern
Little Tern	*Sternula albifrons*	Least concern	Least concern
Common Tern	*Sterna hirundo*	Least concern	Least concern
Arctic Tern	*Sterna paradisaea*	Least concern	Least concern
Antarctic Tern	*Sterna [illegible]*	Least concern	Endangered

Table 6: Breeding resident seabirds present along the South-West Coast (adapted from CCA & CMS 2001). IUCN Red List and National Assessment status are provided (Sink *et al.* 2019). * denotes endemicity.

Common Name	Species Name	Global IUCN	National Assessment
African Penguin*	*Spheniscus demersus*	Endangered	Endangered
African Black Oystercatcher*	*Haematopus moquini*	Near Threatened	Least Concern
White-breasted Cormorant	*Phalacrocorax carbo*	Least Concern	Least Concern
Cape Cormorant*	*Phalacrocorax capensis*	Endangered	Endangered
Bank Cormorant*	*Phalacrocorax neglectus*	Endangered	Endangered
Crowned Cormorant*	*Phalacrocorax coronatus*	Near Threatened	Near Threatened
White Pelican	*Pelecanus onocrotalus*	Least Concern	Vulnerable
Cape Gannet*	*Morus capensis*	Endangered	Endangered
Kelp Gull	*Larus dominicanus*	Least Concern	Least Concern
Greyheaded Gull	*Larus cirrocephalus*	Least Concern	Least Concern
Hartlaub's Gull*	*Larus hartlaubii*	Least Concern	Least Concern
Caspian Tern	*Hydroprogne caspia*	Least Concern	Vulnerable
Swift Tern	*Sterna bergii*	Least Concern	Least Concern
Roseate Tern	*Sterna dougallii*	Least Concern	Endangered
Damara Tern*	*Sterna balaenarum*	Vulnerable	Vulnerable

Interactions with commercial fishing operations, either through incidental bycatch or competition for food resources, are the greatest threat to southern African seabirds, impacting 56% of seabirds of special concern. Crawford *et al.* (2014) reported that four of the seabirds assessed as 'Endangered' compete with South Africa's fisheries for food: African Penguins, Cape Gannets and Cape Cormorants for sardines and anchovies, and Bank Cormorants for rock lobsters (Crawford *et al.* 2015). Populations of seabirds off the West Coast have recently shown significant decreases, with the population numbers of African Penguins currently only 2.5% of what the population was 80 years ago; declining from 1 million breeding pairs in the 1920s, 25 000 pairs in 2009 and 15 000 in 2018 (Sink *et al.* 2019). For Cape Gannets, the global population decreased from about 250 000 pairs in the 1950s and 1960s to approximately 130 000 in 2018, primarily as a result of a >90% decrease in Namibia's population in response to the collapse of Namibia's sardine resource. In South Africa, numbers of Cape Gannets have increased since 1956 and South Africa now holds >90% of the global population. However, numbers have recently decreased in the Western Cape but increased in Algoa Bay mirroring the southward and eastward shift sardine and anchovy. Algoa Bay currently holds approximately 75% of the South African Gannet population.

Cape cormorants and Bank cormorants showed a substantial decline from the late 1970s/early 1980s to the late 2000s/early 2010s, with numbers of Cape cormorants dropping from 106 500 to 65 800 breeding pairs, and Bank cormorants from 1 500 to only 800 breeding pairs over that period (Crawford *et al.* 2015).

Demersal and pelagic longlining are key contributors to the mortality of albatrosses (Browed albatross 7%, Indian and Atlantic Yellow-Nosed Albatross 3%), petrels (white-chinned petrel 66%), shearwaters and Cape Gannets (2%) through accidental capture (bycatch and/or entanglement in fishing gear), with an estimated annual mortality of 450 individuals of 14 species for the period 2006 to 2013 (Rollinson *et al.* 2017). Other threats include predation by mice on petrel and albatross chicks on sub-Antarctic islands, predation of chicks of Cape, Crowned and Bank Cormorants by Great White

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Pelicans, and predation of eggs and chicks of African Penguins, Bank, Cape and Crowned Cormorants by Kelp gulls. Disease (avian flu), climate change (heat stress and environmental variability) and oil spills are also considered major contributors to seabird declines (Sink *et al.* 2019).

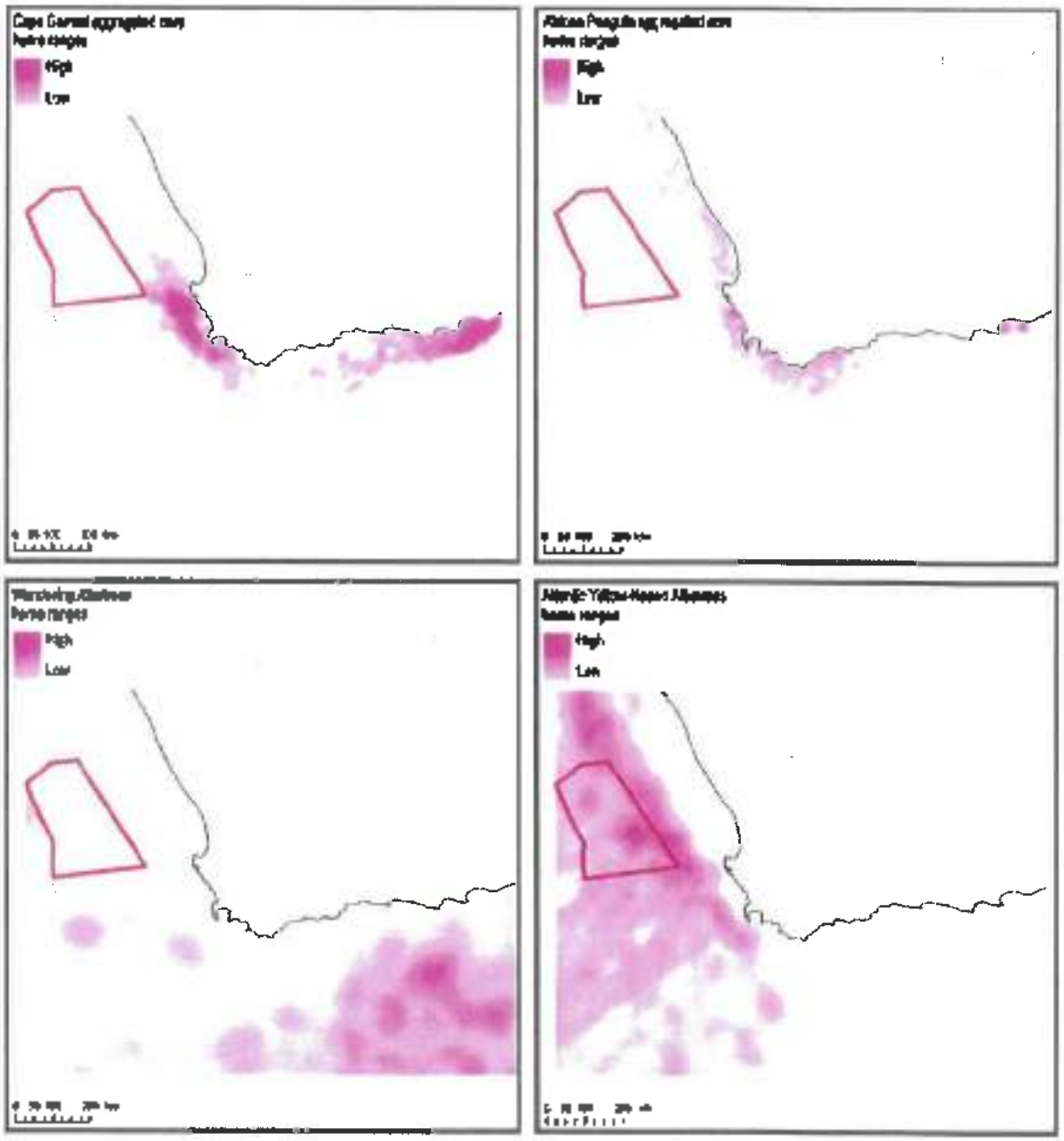

Figure 27: The Reconnaissance Permit Area (red polygon) in relation to aggregate core home ranges of Cape Gannet (top left), African Penguin (top right) for different colonies and life-history stages, and foraging areas of Wandering Albatross (bottom left) and Atlantic Yellow-nosed Albatross (bottom right). For foraging areas, darker shades are areas of higher use and where foraging areas from different colonies overlap (adapted from Harris *et al.* 2022).

3.3.3.6 *Marine Mammals*

The marine mammal fauna occurring off the southern African coast includes several species of whales and dolphins and one resident seal species. Thirty three species of whales and dolphins are known (based on historic sightings or strandings records) or likely (based on habitat projections of known species parameters) to occur in these waters (Table 7). Of the species listed, the blue whale is considered 'Critically Endangered', fin and sei whales are 'Endangered' and one is considered vulnerable (IUCN Red Data list Categories). Altogether 17 species are listed as 'data deficient' underlining how little is known about cetaceans, their distributions and population trends. The offshore areas have been particularly poorly studied with most available information from deeper waters (>200 m) arising from historic whaling records prior to 1970. In the past ten years, passive acoustic monitoring and satellite telemetry have begun to shed light on current patterns of seasonality and movement for some large whale species (Best *et al.* 2009; Elwen *et al.* 2011; Rosenbaum *et al.* 2014; Shabangu *et al.* 2019; Thomisch *et al.* 2019) but information on smaller cetaceans in deeper waters remains poor. Records from marine mammal observers on seismic survey vessels have provided valuable data into cetacean presence although these are predominantly during summer months (Purdon *et al.* 2020). Information on general distribution and seasonality is improving but data population sizes and trends for most cetacean species occurring on the west coast of southern Africa is lacking.

The 3D acquisition area extends from the Namibian border to 32°27' offshore of St Helena Bay from roughly the 500 m isobath to nearly 4 000 m water depth. Oceanographically this area lies largely outside the cool waters of the Benguela Ecosystem and receives some input from the warm Agulhas Current as well as the warm waters of the South Atlantic. In terms of cetacean distribution patterns, the area thus covers a broad range of habitats and species associated with each of those water masses may occur within the target area. Records from stranded specimens show that the area between St Helena Bay (~32° S) and Cape Agulhas (~34° S, 20° E) is an area of transition between Atlantic and Indian Ocean species, and includes records from Benguela associated species such as dusky dolphins, Heaviside's dolphins and long finned pilot whales, and those of the warmer east coast such as striped and Risso's dolphins (Findlay *et al.* 1992). Species such as rough toothed dolphins, Pan-tropical spotted dolphins and short finned pilot whales are known from the southern Atlantic. Owing to the uncertainty of species occurrence offshore, species that may occur there have been included here for the sake of completeness.

The distribution of cetaceans can largely be split into those associated with the continental shelf and those that occur in deep, oceanic water. Importantly, species from both environments may be found on the continental slope (200 - 2 000 m) making this the most species rich area for cetaceans and also high in density (De Rock *et al.* 2019, SLR data). Cetacean density on the continental shelf is usually higher than in pelagic waters as species associated with the pelagic environment tend to be wide ranging across 1 000s of km. The most common species within the project area (in terms of likely encounter rate not total population sizes) are likely to be the long-finned pilot whale, Risso's dolphin, common dolphin, sperm whale (winter distribution) and humpback whale (Figure 28) (Harris *et al.* 2022).

Cetaceans are comprised of two taxonomic groups, the mysticetes (filter feeders with baleen) and the odontocetes (predatory whales and dolphins with teeth). The term 'whale' is used to describe species in both groups and is taxonomically meaningless (e.g. the killer whale and pilot whale are members of the Odontoceti, family Delphinidae and are thus dolphins). Due to differences in

sociality, communication abilities, ranging behavior and acoustic behavior, these two groups are considered separately.

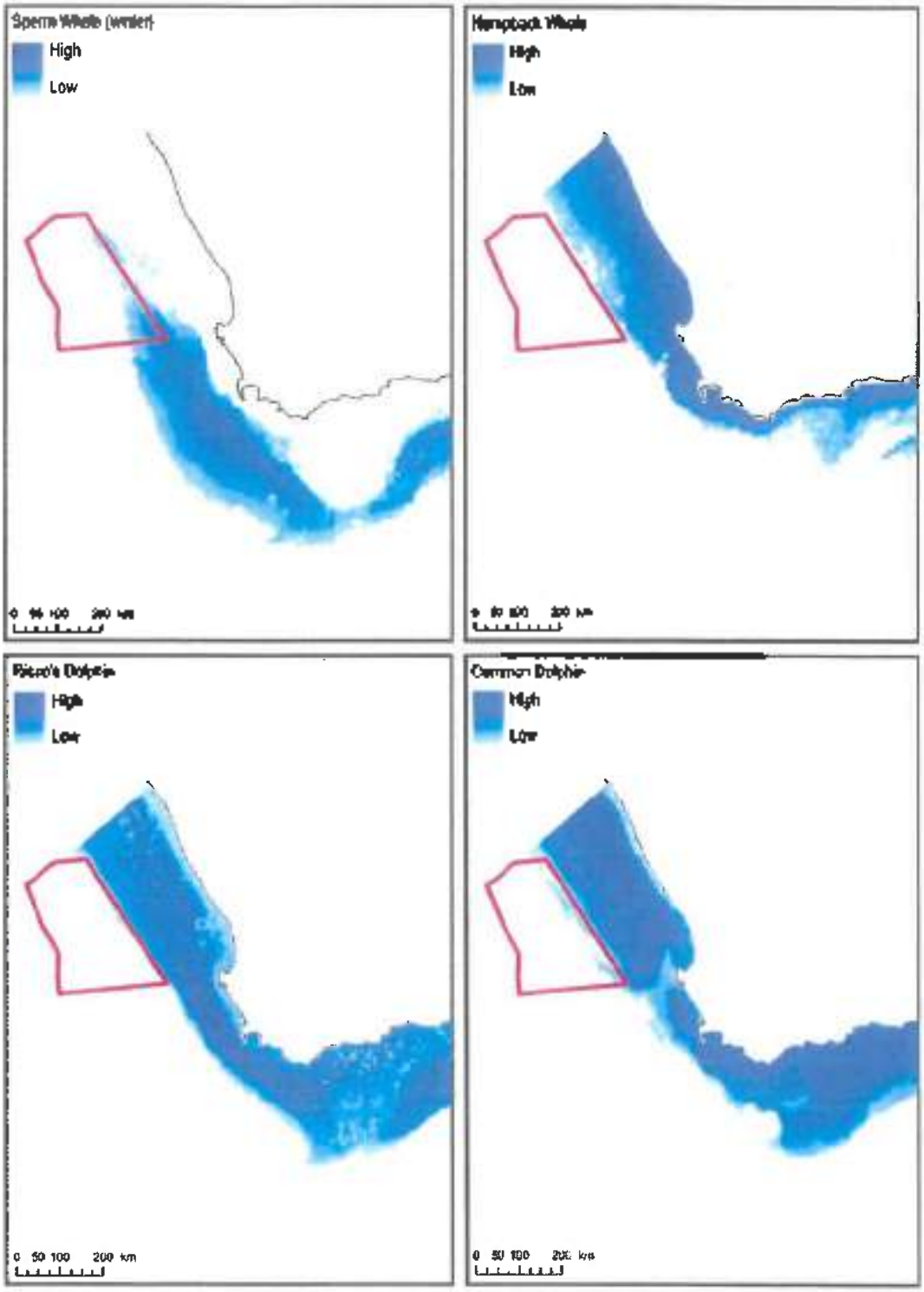

Figure 28: The Reconnaissance Permit Area (red polygon) in relation to the predicted distribution of Sperm whales (winter distribution)(left), humpback whale (middle) and Risso's dolphin (right) with darker shades of blue indicating highest likelihood of occurrence (adapted from Harris et al. 2022).

Table 7 lists the cetaceans likely to be found within the project area, based on all available data sources but mainly: Findlay *et al.* (1992), Best (2007), Weir (2011), De Rock *et al.* (2019), Purdon *et al.* (2020a, 2020b, 2020c), and unpublished records held by Sea Search and those held by SLR consulting and shared for this report (see also Figure 29a-b, Figure 30). The majority of data available on the seasonality and distribution of large whales in the project area is the result of commercial whaling activities mostly dating from the 1960s. Changes in the timing and distribution of migration may have occurred since these data were collected due to extirpation of populations or behaviours (e.g. migration routes may be learnt behaviours). The large whale species for which there are current data available are the humpback and southern right whale, although almost all data is limited to that collected on the continental shelf close to shore. A review of the distribution and seasonality of the key cetacean species likely to be found within the project area is provided below.

Mysticete (Baleen) whales

The majority of mysticetes whales fall into the family Balaenopeteridae. Those occurring in the area include the blue, fin, sei, Antarctic minke, dwarf minke, humpback and Bryde's whales. The southern right whale (Family Balaenidae) and pygmy right whale (Family Neobalaenidae) are from taxonomically separate groups. The majority of mysticete species occur in pelagic waters with only occasional visits to shelf waters. All of these species show some degree of migration either to or through the latitudes encompassed by the broader project area when *en route* between higher latitude (Antarctic or Subantarctic) feeding grounds and lower latitude breeding grounds.

Depending on the ultimate location of these feeding and breeding grounds, seasonality may be either unimodal, usually in winter months, or bimodal (e.g. May to July and October to November), reflecting a northward and southward migration through the area. Northward and southward migrations may take place at different distances from the coast due to whales following geographic or oceanographic features, thereby influencing the seasonality of occurrence at different locations. Because of the complexities of the migration patterns, each species is discussed separately below.

Bryde's whales: Two genetically and morphologically distinct populations of Bryde's whales (Figure 31, left) live off the coast of southern Africa (Best 2001; Penry 2010). The "offshore population" lives beyond the shelf (>200 m depth) off west Africa and migrates between wintering grounds off equatorial west Africa (Gabon) and summering grounds off western South Africa. Its seasonality on the West Coast is thus opposite to the majority of the balaenopterids with abundance likely to be highest in the area in January - March. The "inshore population" of Bryde's whale live mainly on the continental shelf and Agulhas Bank, and are unique amongst baleen whales in the region by being non-migratory. The inshore population has recently been recognised as its own (yet to be named) sub species (*Balaenoptera brydei edemf*, Penry *et al.* 2018) with a total population for this subspecies of likely fewer than 600 individuals. The published range of the population is the continental shelf and Agulhas Bank of South Africa ranging from Durban in the east to at least St Helena Bay off the west coast with possible movements further north up the West Coast and into Namibia during the winter months (Best 2007). The offshore stock was subjected to heavy whaling in the mid-20th century (Best 2001) and there are no current data on population size or stock recovery therefrom and is currently listed as 'Data deficient' on the South African Red List. The inshore stock is regarded as extremely 'Vulnerable' and listed as such on the South African red list as it regularly suffers losses from entanglement in trap fisheries and has been subject to significant changes in its prey base due to losses and shifts in the sardine and small pelgic stocks around South Africa.

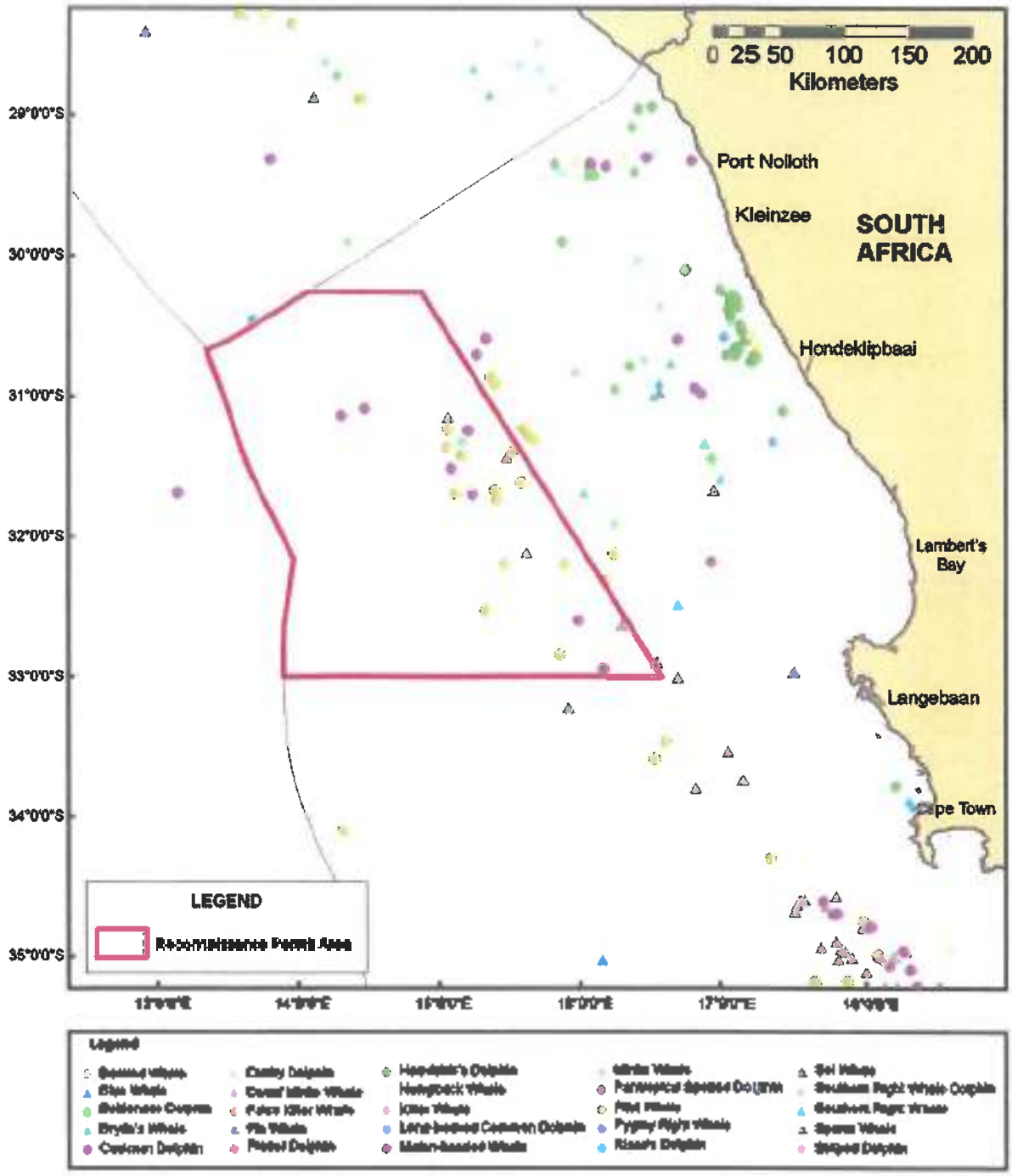

Figure 29a: The Reconnaissance Permit Area (red polygon) in relation to the distribution and movement of cetaceans along the West Coast collated between 2001 and 2020 (SLR MMO database).

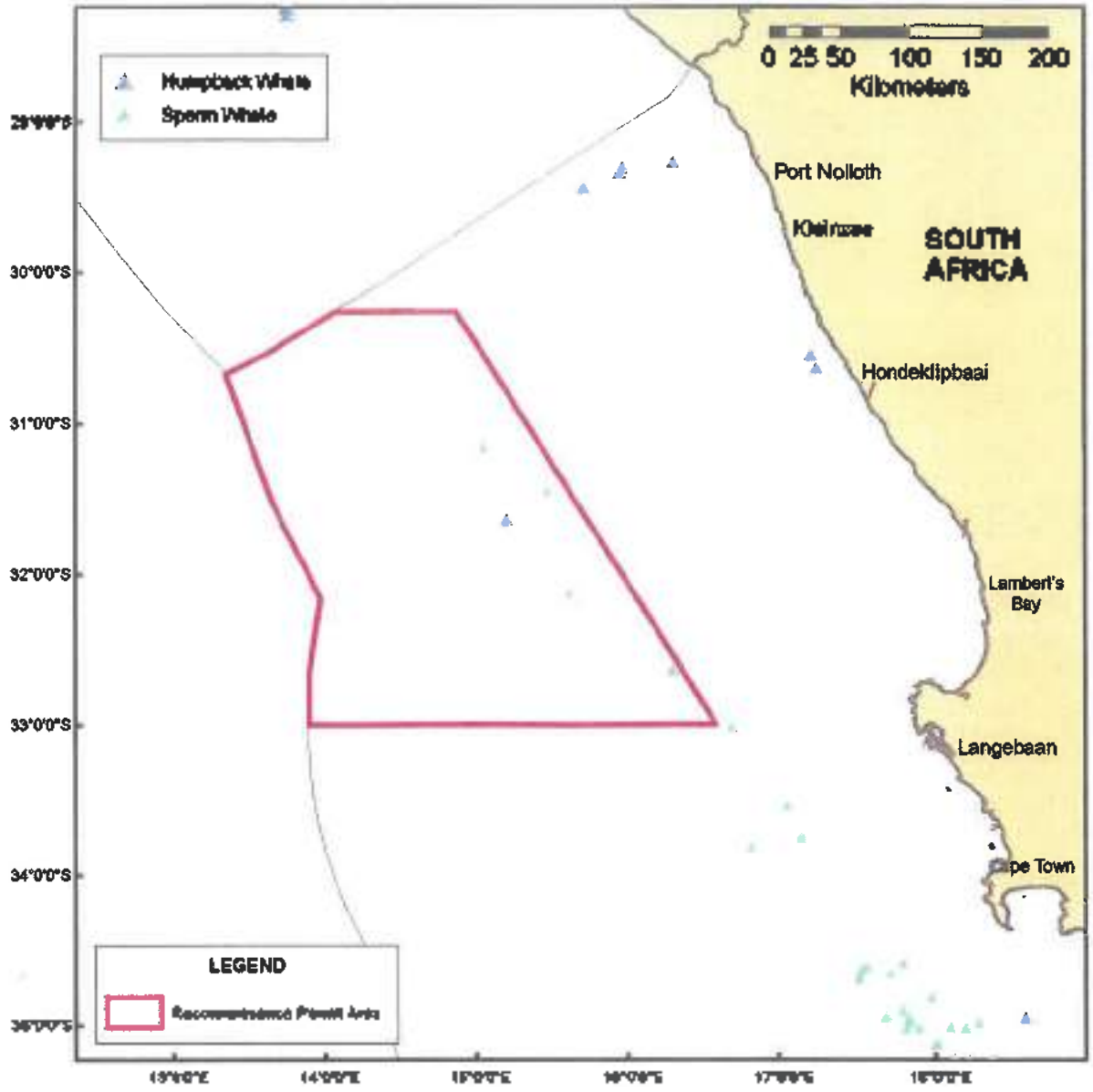

Figure 29b: The Reconnaissance Permit Area (red polygon) in relation to the distribution and movement of Humpback whales and Sperm whales along the West Coast collated between 2001 and 2020 (SLR MMO database).

Sei whales: Almost all information is based on whaling records 1958-1963, most from shore-based catchers operating within a few hundred kilometres of Saldanha Bay. At this time the species was not well differentiated from Bryde's whales and records and catches of the two species intertwined. There is no current information on population recovery, abundance or much information on distribution patterns outside of the whaling catches and the species remains listed as 'Endangered' on the SA Red List. Sei whales feed at high latitudes (40-50°S) during summer months and migrate north through South African waters to unknown breeding grounds further north (Best 2007). Their migration pattern thus shows a bimodal peak with numbers west of Saldanha Bay being highest in May and June, and again in August, September and October. All whales were caught in waters

Table 7: Cetaceans occurrence off the West Coast of South Africa, their seasonality, likely encounter frequency with proposed exploration activities and South African (Child *et al.* 2016) and Global IUCN Red List conservation status.

Common Name	Species	Hearing Frequency	Shelf (<200 m)	Offshore (>200 m)	Seasonality	RSA Regional Assessment	IUCN Global Assessment
Delphinids							
Dusky dolphin	*Lagenorhynchus obscurus*	HF	Yes (0- 800 m)	No	Year round	Least Concern	Least Concern
Heaviside's dolphin	*Cephalorhynchus heavisidii*	VHF	Yes (0-200 m)	No	Year round	Least Concern	Near Threatened
Common bottlenose dolphin	*Tursiops truncatus*	MF	Yes	Yes	Year round	Least Concern	Least Concern
Common dolphin	*Delphinus delphis*	MF	Yes	Yes	Year round	Least Concern	Least Concern
Southern right whale dolphin	*Lissodelphis peronii*	MF	Yes	Yes	Year round	Least Concern	Least Concern
Striped dolphin	*Stenella coeruleoalba*	MF	No	Yes	Year round	Least Concern	Least Concern
Pantropical spotted dolphin	*Stenella attenuata*	MF	Edge	Yes	Year round	Least Concern	Least Concern
Long-finned pilot whale	*Globicephala melas*	MF	Edge	Yes	Year round	Least Concern	Least Concern
Short-finned pilot whale	*Globicephala macrorhynchus*	MF	Edge	Yes	Year round	Least Concern	Least Concern
Rough-toothed dolphin	*Steno bredanensis*	MF	No	Yes	Year round	Not Assessed	Least Concern
Killer whale	*Orcinus orca*	MF	Occasional	Yes	Year round	Least Concern	Data deficient
False killer whale	*Pseudorca crassidens*	MF	Occasional	Yes	Year round	Least Concern	Near Threatened
Pygmy killer whale	*Feresa attenuata*	MF	No	Yes	Year round	Least Concern	Least Concern
Risso's dolphin	*Grampus griseus*	MF	Yes (edge)	Yes	Year round	Data Deficient	Least Concern
Sperm whales							
Pygmy sperm whale	*Kogia breviceps*	VHF	Edge	Yes	Year round	Data Deficient	Data Deficient
Dwarf sperm whale	*Kogia sima*	VHF	Edge	Yes	Year round	Data Deficient	Data Deficient
Sperm whale	*Physeter macrocephalus*	MF	Edge	Yes	Year round	Vulnerable	Vulnerable

Common Name	Species	Hearing Frequency	Shelf (<200 m)	Offshore (>200 m)	Seasonality	RSA Regional Assessment	IUCN Global Assessment
Beaked whales							
Cuvier's	*Ziphius cavirostris*	HF	No	Yes	Year round	Data Deficient	Least Concern
Arnoux's	*Beradius arnouxii*	HF	No	Yes	Year round	Data Deficient	Data Deficient
Southern bottlenose	*Hyperoodon planifrons*	HF	No	Yes	Year round	Least Concern	Least Concern
Layard's	*Mesoplodon layardii*	HF	No	Yes	Year round	Data Deficient	Data Deficient
True's	*Mesoplodon mirus*	HF	No	Yes	Year round	Data Deficient	Data Deficient
Gray's	*Mesoplodon grayi*	HF	No	Yes	Year round	Data Deficient	Data Deficient
Blainville's	*Mesoplodon densirostris*	HF	No	Yes	Year round	Data Deficient	Data Deficient
Baleen whales							
Antarctic Minke	*Balaenoptera bonaerensis*	LF	Yes	Yes	>Winter	Least Concern	Near Threatened
Dwarf minke	*B. acutorostrata*	LF	Yes	Yes	Year round	Least Concern	Least Concern
Fin whale	*B. physalus*	LF	Yes	Yes	MJJ & ON	Endangered	Vulnerable
Blue whale (Antarctic)	*B. musculus intermedia*	LF	No	Yes	Winter peak	[illegible]	[illegible]
Sei whale	*B. borealis*	LF	Yes	Yes	MJ & ASO	Endangered	Endangered
Bryde's (inshore)	*B brydei (subspp)*	LF	Yes	Edge	Year round	Vulnerable	Least Concern
Bryde's (offshore)	*B. brydei*	LF	Edge	Yes	Summer (JFM)	Data Deficient	Least Concern
Pygmy right	*Caperea marginata*	LF	Yes	?	Year round	Least Concern	Least Concern
Humpback sp.	*Megaptera novaeangliae*	LF	Yes	Yes	Year round, SONDJF	Least Concern	Least Concern
Humpback B2 population	*Megaptera novaeangliae*	LF	Yes	Yes	Spring/Summer peak OND.F	Vulnerable	Not Assessed
Southern Right	*Eubalaena australis*	LF	Yes	No	Year round, OND.JFMA	Least Concern	Least Concern

- Marine animals do not hear equally well at all frequencies within their functional hearing range. Based on the hearing range and sensitivities, Southall *et al.* (2019) have categorised noise sensitive marine mammal species into six underwater hearing groups: low-frequency (LF), high-frequency (HF) and very high-frequency (VHF) cetaceans, Sirenians (SI), Phocid carnivores in water (PCW) and other marine carnivores in water (OCW).

Table 8: Seasonality of baleen whales in the broader project area based on data from multiple sources, predominantly commercial catches (Best 2007 and other sources) and data from stranding events (NDP unpubl data). Values of high (H), Medium (M) and Low (L) are relative within each row (species) and not comparable between species. For abundance / likely encounter rate within the broader project area, see Table 9.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bryde's Inshore	L	L	M	M	M	M	M	L	L	M	M	L
Sei	M	L	L	L	H	H	M	H	H	H	M	M
Fin	M	M	M	M	H	H	H	L	L	H	H	M
Blue	L	L	L	L	M	M	M	L	L	L	L	L
Minke	M	M	M	H	H	H	M	H	H	H	M	M
Humpback	H	M	L	L	L	M	M	M	H	H	H	H
Southern Right	H	M	L	L	L	M	M	M	H	H	H	H

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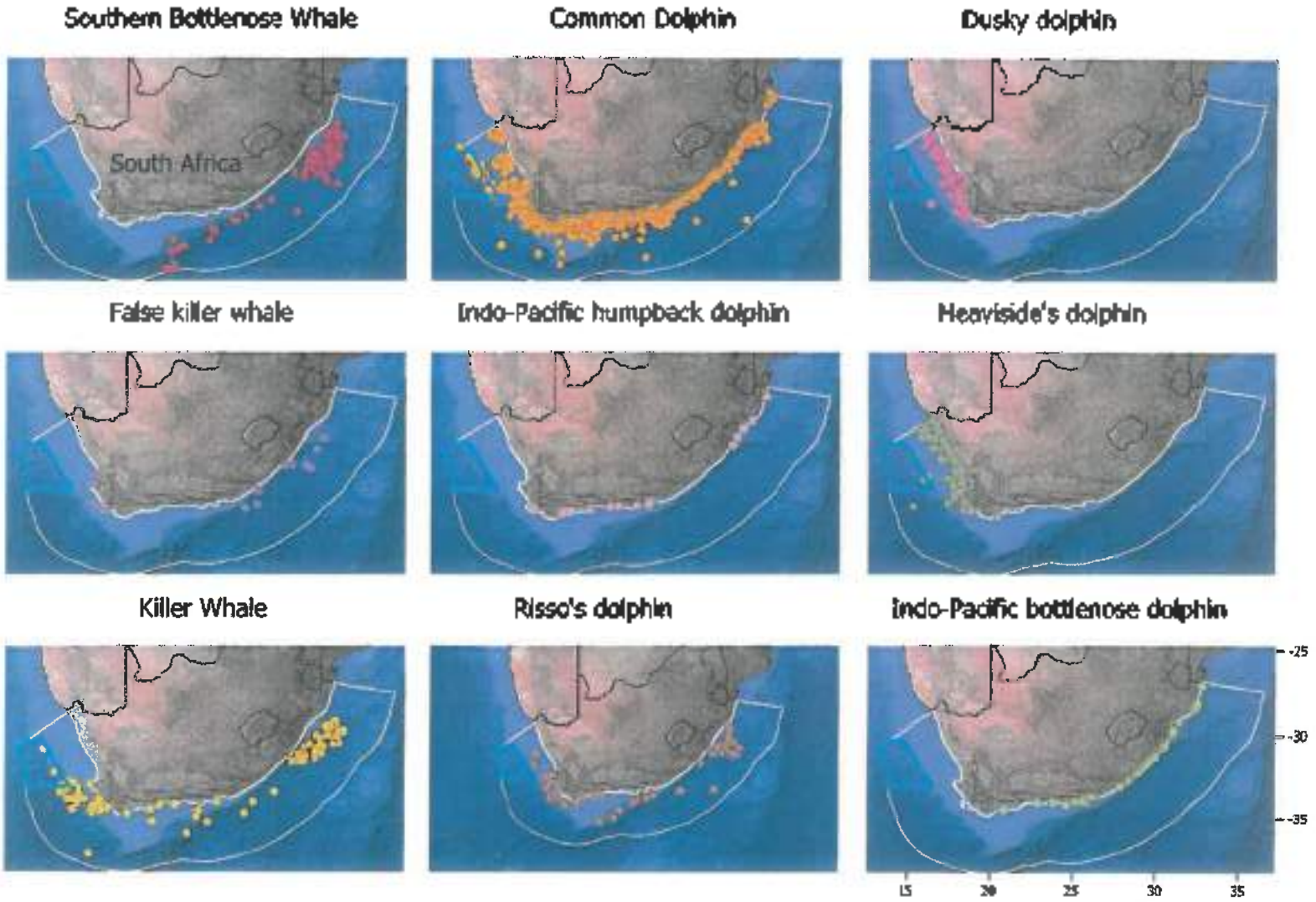

Figure 30: The Reconnaissance Permit area (cyan polygon) in relation to projections of predicted distributions for nine odontocete species off the West Coast of South Africa (adapted from: Purdon et al. 2020a).

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deeper than 200 m with most deeper than 1 000 m (Best & Lockyer 2002). A recent survey to Vema Seamount ~1 000 km west of Cape Town during Oct-Nov 2019, encountered a broadly spread feeding aggregation of over 30 sei and fin whales at around 200 m water depth (Elwen *et al.* in prep.). This poorly surveyed area (roughly 32°S, 15°E) is just to the NW of the historic whaling grounds suggesting this region remains an important feeding area for the species. This region lies well within the impact area of the proposed 3D seismic survey and caution is recommended to reduce impacts on this endangered and poorly known species.

Figure 31: The Bryde's whale *Balaenoptera brydei* (left) and the Minke whale *Balaenoptera bonaerensis* (right) (Photos: www.dailymail.co.uk; www.marineblo.org).

Fin whales: Fin whales were historically caught off the West Coast of South Africa, with a bimodal peak in the catch data suggesting animals were migrating further north during May-June to breed, before returning during August-October en route to Antarctic feeding grounds. However, the location of the breeding ground (if any) and how far north it is remains a mystery (Best 2007). Some juvenile animals may feed year round in deeper waters off the shelf (Best 2007). Aggregations of up to eight animals have been seen on multiple occasions on the coast either side of Lüderitz in Apr-May of 2014 and January 2015 (Sea Search unpubl. Data), the occasional single whale has been reported during humpback whale research in November in the southern Benguela, and a feeding aggregation of ~30 animals was observed in November 2019 ~200 km west of St Helena Bay in ~2 000 m of water (see above). Current sightings records support the bimodal peak in presence observed from whaling data (but with some chance of year-round sightings) with animals apparently feeding in the nutrient rich Benguela during their southward migration as is observed extensively for humpback and right whales (see below) there clearly is a chance of encounters year round. There are no recent data on abundance or distribution of fin whales off western South Africa.

Blue whales: Although Antarctic blue whales were historically caught in high numbers off the South African West Coast, with a single peak in catch rates during July in Namibia and Angola suggesting that these latitudes are close to the northern migration limit for the species in the eastern South Atlantic (Best 2007). Although there were only two confirmed sightings of the species in the area between 1973 and 2006 (Branch *et al.* 2007), evidence of blue whale presence off Namibia is increasing. Recent acoustic detections of blue whales in the Antarctic peak between December and January (Townsch *et al.* 2016), off western South Africa (Shanbangu *et al.* 2019) and in northern Namibia between May and July (Thomisch 2017) supporting observed timing from whaling records. Several recent (2014-2015) sightings of blue whales during seismic surveys off the southern part of Namibia (water depth >1 000 m) confirm their existence in the area and occurrence in Autumn

months. The chance of encountering the species in the proposed survey area is considered low but the species is 'Critically Endangered' so all precautions must be taken to avoid impact.

Minke whales: Two forms of minke whale (Figure 31, right) occur in the southern Hemisphere, the Antarctic minke whale (*Balaenoptera bonaerensis*) and the dwarf minke whale (*B. acutorostrata* subsp.); both species occur in the Benguela (Best 2007). Antarctic minke whales range from the pack ice of Antarctica to tropical waters and are usually seen more than ~50 km offshore. Although adults migrate from the Southern Ocean (summer) to tropical/temperate waters (winter) to breed, some animals, especially juveniles, are known to stay in tropical/temperate waters year-round. Recent data available from passive acoustic monitoring over a two-year period off the Walvis Ridge shows acoustic presence in June - August and November - December (Thomisch *et al.* 2016), supporting a bimodal distribution in the area. The dwarf minke whale has a more temperate distribution than the Antarctic minke and they do not range further south than 60-65°S. Dwarf minkes have a similar migration pattern to Antarctic minkes with at least some animals migrating to the Southern Ocean during summer. Dwarf minke whales occur closer to shore than Antarctic minkes and have been seen <2 km from shore on several occasions around South Africa. Both species are generally solitary and densities are likely to be low in the project area, although sightings have been reported (SLR data).

The pygmy right whale is the smallest of the baleen whales reaching only 6 m total length as an adult (Best 2007). The species is typically associated with cool temperate waters between 30°S and 55°S with records from southern and central Namibia being the northern most for the species (Leeney *et al.* 2013). Its distribution off the west coast of South Africa is thus likely to be limited to the cooler shelf waters of the main Benguela upwelling areas.

The most abundant baleen whales in the Benguela are southern right whales and humpback whales (Figure 32a & b). Both species have long been known to feed in the Benguela Ecosystem and numbers since 2000 have grown substantially. The feeding peak in the Benguela is spring and early summer (October - February) and follows the 'traditional' South African breeding season (June - November) and its' associated migrations (Johnson *et al.* 2022). Some individual right whales are known to move directly from the south coast breeding area into the west coast feeding area where they remained for several months (Barendse *et al.* 2011; Mate *et al.* 2011). Increasing numbers of summer records of both species, from the southern half of Namibia suggest that animals may also be feeding in the Lüderitz upwelling cell (NDP unpubl. Data).

Humpback whales: The majority of humpback whales passing through the Benguela are migrating to breeding grounds off tropical west Africa, between Angola and the Gulf of Guinea (Rosenbaum *et al.* 2009; Barendse *et al.* 2010). Until recently it was believed that that these breeding grounds were functionally separate from those off east (Mozambique-Kenya-Madagascar), with only rare movements between them (Pomilla & Rosenbaum 2005) and movements to other continental breeding grounds being even more rare. Recent satellite tagging of animals between Plettenberg Bay and Port Alfred during the northward migration, showed them to turn around and end up feeding in the Southern Benguela (Seakamela *et al.* 2015) before heading offshore and southwards using the same route as whales tracked off Gabon and the West Coast of South Africa. Unexpected results such as this highlight the complexities of understanding whale movements and distribution patterns and the fact that descriptions of broad season peaks in no way captures the wide array of behaviours exhibited by these animals. Furthermore, three separate matches have been made between individuals off South Africa and Brazil by citizen scientist photo-identification (www.happywhale.com). This included whales from the Cape Town and Algoa Bay-Transkei areas. Analysis of humpback whale breeding song

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on Sub-Antarctic feeding grounds also suggests exchange of singing male whales from western and eastern South Atlantic populations (Darling & Sousa-Lima 2005; Schall *et al.* 2021; but see also Darling *et al.* 2019; Tyarks *et al.* 2021).

Figure 32: The Humpback whale *Megaptera novaeangliae* (left) and the Southern Right whale *Eubalaena australis* (right) are the most abundant large cetaceans occurring along the southern African West Coast (Photos: www.divephotoguide.com; www.aad.gov.au).

In southern African coastal waters, the northward migration stream is larger than the southward peak (Best & Allison 2010; Elwen *et al.* 2014), suggesting that animals migrating north strike the coast at varying places north of St Helena Bay, resulting in increasing whale density on shelf waters and into deeper pelagic waters as one moves northwards. On the southward migration, many humpbacks follow the Walvis Ridge offshore then head directly to high latitude feeding grounds, while others follow a more coastal route (including the majority of mother-calf pairs) possibly lingering in the feeding grounds off west South Africa in summer (Elwen *et al.* 2014; Rosenbaum *et al.* 2014). Although migrating through the Benguela, there is no existing evidence of a clear 'corridor' and humpback whales appear to be spread out widely across the shelf and into deeper pelagic waters, especially during the southward migration (Barendse *et al.* 2010; Best & Allison 2010; Elwen *et al.* 2014). The only available abundance estimate put the number of animals in the West African breeding population (Gabon) to be in excess of 9 000 individuals in 2005 (IWC 2012) and it is likely to have increased substantially since this time at about 5% per annum (IWC 2012; see also Wilkinson 2021). The number of humpback whales feeding in the southern Benguela has increased substantially since estimates made in the early 2000s (Barendse *et al.* 2011). Since ~2011, 'supergroups' of up to 200 individual whales have been observed feeding within 10 km from shore (Findlay *et al.* 2017) with many hundred more passing through and whales are now seen in all months of the year around Cape Town. It has been suggested that the formation of these super-groups may be in response to anomalous oceanographic conditions in the Southern Benguela, which result in favourable food availability, thereby leading to these unique humpback whale feeding aggregations (Dey *et al.* 2021; see also Avila *et al.* 2019; Meynecke *et al.* 2020; Cade *et al.* 2021). Humpback whales are thus likely to be the most frequently encountered baleen whale in the project area (see Figure 29b), ranging from the coast out beyond the shelf, with year round presence but numbers peaking during the northward migration in June - February and a smaller peak with the southern breeding migration around September - October but with regular encounters until February associated with subsequent feeding in the Benguela ecosystem.

In the first half of 2017 (when numbers are expected to be at their lowest) more than 10 humpback whales were reported stranded along the Namibian and South African west coasts. A similar event was recorded in late 2021-early 2022 when numerous strandings of young humpbacks were reported along the Western Cape Coast and in Namibia (Simon Elwen, Sea Search, pers. Comm.). The cause of these deaths is not known, but a similar event off Brazil in 2010 (Siciliano *et al.* 2013) was linked to possible infectious disease or malnutrition. Unusual mortality events of humpback whales between 2016 and 2022 have similarly been reported along the US Atlantic Coast from Maine to Florida (https://www.fisheries.noaa.gov/national/marine-life-distress/2016-2022-humpback-whale-unusual-mortality-event-along-atlantic-coast). The West African population may be undergoing similar stresses in response to changes in their ecosystem (see for example Kershaw *et al.* 2021). It is not yet understood what may be driving these ecosystem changes and what the long-term effects to populations could potentially be.

Southern right whales: The southern African population of southern right whales historically extended from southern Mozambique (Maputo Bay) to southern Angola (Baie dos Tigres) and is considered to be a single population within this range (Roux *et al.* 2011). The most recent abundance estimate for this population is available for 2017 which estimated the population at ~6 100 individuals including all age and sex classes, and still growing at ~6.5% per annum (Brandão *et al.* 2017). When the population numbers crashed in 1920, the range contracted down to just the south coast of South Africa, but as the population recovers, it is repopulating its historic grounds including Namibia (Roux *et al.* 2001, 2015; de Rock *et al.* 2019) and Mozambique (Banks *et al.* 2011).

Some southern right whales move from the South Coast breeding ground directly to the West Coast feeding ground (Mate *et al.* 2011). When departing from feeding ground all satellite tagged animals in that study took a direct south-westward track. Mark-recapture data from 2003-2007 estimated roughly one third of the South African right whale population at that time were using St Helena Bay for feeding (Peters *et al.* 2005). While annual surveys have revealed a steady population increase since the protection of the species from commercial whaling, the South African right whale population has undergone substantial changes in breeding cycles and feeding areas (Van Den Berg *et al.* 2020), and numbers of animal using our coast since those studies were done - notably a significant decrease in the numbers of cow-calf-pairs following the all-time record in 2018, a marked decline of unaccompanied adults since 2010 and variable presence of mother-calf pairs since 2015 (Roux *et al.* 2015; Vermeulen *et al.* 2020). The change in demographics are indications of a population undergoing nutritional stress and has been attributed to likely spatial and/or temporal displacement of prey due to climate variability (Vermeulen *et al.* 2020; see also Derville *et al.* 2019, 2020; Kershaw *et al.* 2021; van Weelden *et al.* 2021). Recent sightings (2018-2021) confirm that there is still a clear peak in numbers on the West Coast (Table Bay to St Helena Bay) between February and April. Given this high proportion of the population known to feed in the southern Benguela, and current numbers reported, it is highly likely that several hundreds of right whales can be expected to pass through the southern portion of the Reconnaissance Permit Area when migrating southwards from the feeding areas between April and June (Figure 33).

Figure 33: The Reconnaissance Permit Area (red polygon) in relation to 'blue corridors' or 'whale superhighways' showing tracks of Humpback whales (orange) and Southern Right whales (green) between southern Africa and the Southern Ocean feeding grounds (adapted from Johnson et al. 2022).

Odontocetes (toothed) whales

The Odontoceti are a varied group of animals including the dolphins, porpoises, beaked whales and sperm whales. Species occurring within the broader project area display a diversity of features, for example their ranging patterns vary from extremely coastal and highly site specific to oceanic and wide ranging (see Figure 30). Those in the region can range in size from 1.6-m long (Heaviside's dolphin) to 17 m (bull sperm whale).

Sperm whales: Most information about sperm whales in the southern African sub-region results from data collected during commercial whaling activities prior to 1985 when over 10 000 whales were taken, (Best 1974, Best 2007) although passive acoustic monitoring (Shabangu & Andrew 2020) and sightings from NMOs are beginning to provide insights into current behaviour. Sperm whales are the Largest of the toothed whales and have a complex, structured social system with adult males behaving differently to younger males and female groups. They live in deep ocean waters, usually greater than 1 000 m depth, although they occasionally come onto the shelf in water 500 - 200 m deep (Best, 2007)

(Figure 34, left). They are considered to be relatively abundant globally (Whitehead 2002), although no estimates are available for South African waters. Seasonality of catches suggests that medium and large sized males are more abundant in winter months while female groups are more abundant in autumn (March - April), although animals occur year round (Best, 2007). Analysis of recent passive acoustic monitoring data from the edge of the continental shelf (800 - 1 000 m water depth, roughly 80 km WSW of Cape Point) confirms year-round presence. Sperm whales have also been regularly identified by MMOs working in this area (SLR data). Sperm whales feed at great depths during dives in excess of 30 minutes making them difficult to detect visually, however the regular echolocation clicks made by the species when diving make them relatively easy to detect acoustically using Passive Acoustic Monitoring (PAM).

Figure 34: Sperm whales *Physeter macrocephalus* (left) and killer whales *Orcinus orca* (right) are toothed whales likely to be encountered in offshore waters (Photos: www.onpoint.wbur.org; www.wikipedia.org).

Pygmy and Dwarf Sperm Whales: The genus *Kogia* currently contains two recognised species, the pygmy (*K. breviceps*) and dwarf (*K. sima*) sperm whales, both of which occur worldwide in pelagic and shelf edge waters, with with few sighting records of live animals in their natural habitat (McAlpine 2018). Their abundance, population trends and seasonality in South African waters are unknown (Seakamela *et al.* 2021). Due to their small body size, cryptic behaviour, low densities and small school sizes, these whales are difficult to observe at sea, and morphological similarities make field identification to species level problematic, although their narrow-band high frequency echolocation clicks make them detectable and identifiable (at least to the genus) using passive acoustic monitoring equipment. The majority of what is known about the distribution and ecology of Kogiid whales in the southern African subregion is derived mainly from stranding records (e.g. Ross 1979; Findlay *et al.* 1992; Plön 2004; Elwen *et al.* 2013, but see also Moura *et al.* 2016). *Kogia* species are most frequently occur in pelagic and shelf edge waters, are thus likely to occur in the survey area at low levels; seasonality is unknown. Dwarf sperm whales are associated with warmer tropical and warm-temperate waters, being recorded from both the Benguela and Agulhas ecosystem (Best 2007) in waters deeper than ~1 000 m.

During 2020 the incidence of kogiid strandings between Strandfontein on the West Coast and Groot Brak River on the South Coast (n=17), was considerably higher than the annual average during the previous 10 years (n=7). The dwarf sperm whale (*K. sima*) accounted for 60% of these strandings, of which most were recorded during autumn and winter. These seasonal stranding patterns are consistent with previously published accounts for the South African coast. In 2020, 40% of the total

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strandings were recorded in winter and 15% during summer. The occurrence of strandings throughout the year may, however, indicate the presence of a resident population with a seasonal distribution off the South Coast in autumn and winter (Seakamela *et al.* 2020, 2021). The cause of the strandings is unknown.

Killer whales: Killer whales in South African waters were referred to a single morphotype, Type A, although recently a second 'flat-toothed' morphotype that seems to specialise in an elasmobranch diet has been identified but only 5 records are known all from strandings (Best *et al.* 2014). Killer whales (Figure 34) have a circum-global distribution being found in all oceans from the equator to the ice edge (Best 2007). Killer whales occur year-round in low densities off South Africa (Best *et al.* 2010, Elwen *et al.* in prep.), Namibia (Elwen & Leeney 2011) and in the Eastern Tropical Atlantic (Weir *et al.* 2010). Historically sightings were correlated with that of baleen whales, especially sei whales on their southward migration. In more recent years - their presence in coastal waters (e.g. False Bay) has been strongly linked to the presence and hunting of common dolphins (Best *et al.* 2010; Sea Search unpublished data). Further from shore, there have been regular reports of killer whales associated with long-line fishing vessels on the southern and eastern Agulhas Bank, and the Cape Canyon to the south-west of Cape Point. Killer whales are found in all depths from the coast to deep open ocean environments and may thus be encountered in the project area at low levels.

False killer whale: Although the false killer whale is globally recognized as one species, clear differences in morphological and genetic characteristics between different study sites show that there is substantial difference between populations and a revision of the species taxonomy may be needed (Best 2007). False killer whales are more likely to be confused with the smaller melon-headed or pygmy killer whales with which they share all-black colouring and a similar head-shape, than with killer whales. The species has a tropical to temperate distribution and most sightings off southern Africa have occurred in water deeper than 1 000 m, but with a few recorded close to shore (Findlay *et al.* 1992). They usually occur in groups ranging in size from 1 - 100 animals (Best 2007). The strong bonds and matrilineal social structure of this species makes it vulnerable to mass stranding (8 instances of 4 or more animals stranding together have occurred in the Western Cape, all between St Helena Bay and Cape Agulhas). There is no information on population numbers or conservation status and no evidence of seasonality in the region (Best 2007).

Pilot Whales: Long finned pilot whales display a preference for temperate waters and are usually associated with the continental shelf or deep water adjacent to it, but moving inshore to follow prey (primarily squid) (Mate *et al.* 2005; Findlay *et al.* 1992; Weir 2011; Seakamela *et al.* 2022). They are regularly seen associated with the shelf edge by MMOs, fisheries observers and researchers. The distinction between long-finned and short finned pilot whales is difficult to make at sea. As the latter are regarded as more tropical species confined to the southwest Indian Ocean (Best 2007), it is likely that the majority of pilot whales encountered in the project area will be long-finned. There are many confirmed sightings of pilot whales along the shelf edge of South Africa and Namibia including within the survey area since 2010 (de Rock *et al.* 2019; Sea Search unpublished data, SLR data). Observed group sizes range from 8-100 individuals (Seakamela *et al.* 2022). Pilot whales are commonly sighting by MMOs and detected by PAM during a seismic surveys. A recent tagging study showed long-finned pilot whale movements within latitudes of 33-36°S, along the shelf-edge from offshore of Cape Columbine to the Agulhas Bank, with concentrations in canyon areas, especially around the Cape Point Valley, and to a lesser degree around the Cape Canyon. It is postulated that the pilot whales target prey species in these productive areas (Seakamela *et al.* 2022).

Common dolphin: Two forms of common dolphins occur around southern Africa, a long-beaked and short-beaked form (Findlay *et al.* 1992; Best 2007), although they are currently considered part of a single global species (Cunha *et al.* 2015). The long-beaked common dolphin lives on the continental shelf of south Africa rarely being observed north of St Helena Bay on the west coast or in waters more 500 m deep (Best 2007), although more recent sightings, including those from MMOs, suggest sightings regularly out to 1 000 m or more (SLR data, Sea Search data). Group sizes of common dolphins can be large, averaging 267 (± SD 287) for the South Africa region (Findlay *et al.* 1992). Far less is known about the short-beaked form, which is challenging to differentiate at sea from the long-beaked form. Group sizes are also typically large. It is likely that common dolphins encountered in the Northern Cape or deeper than 2 000 m are of the short-beaked form.

Dusky dolphin: In water <500 m deep, dusky dolphins (Figure 35, right) are likely to be the most frequently encountered small cetacean as they are very "boat friendly" and often approach vessels to bowride. The species is resident year round throughout the Benguela ecosystem in waters from the coast to at least 500 m deep (Findlay *et al.* 1992). A recent abundance estimate from southern Namibia calculated roughly ~3 500 dolphins in the ~400 km long Namibian Islands Marine Protected area (Martin *et al.* 2020), at a density of 0.16 dolphins/km^2 and similar density is expected to occur off the South African coast where they are regularly encountered in near shore waters between Cape Town and Lamberts Bay (Elwen *et al.* 2010; NDP unpubl. data) with group sizes of up to 800 having been reported (Findlay *et al.* 1992). Dusky dolphins are resident year round in the Benguela.

Heaviside's dolphins: Heaviside's dolphins (Figure 35, left) are relatively abundant in the Benguela ecosystem region with 10 000 animals estimated to live in the 400 km of coast between Cape Town and Lambert's Bay (Elwen *et al.* 2009) and ~1 600 in the ~400 km long Namibian Islands Marine Protected Area (Martin *et al.* 2020). This species occupies waters from the coast to at least 200 m depth, (Elwen *et al.* 2006; Best 2007; Martin *et al.* 2020), and may show a diurnal onshore-offshore movement pattern (Elwen *et al.* 2010a, 2010b), as they feed offshore at night. Heaviside's dolphins are resident year round but will only occur well inshore of the Reconnaissance Permit Area.

Figure 35: The dusky dolphin *Lagenorhynchus obscurus* (left) and endemic Heaviside's Dolphin *Cephalorhynchus heavisidii* (right) (Photos: Simon Elwen, Sea Search Research and Conservation).

Bottlenose dolphin: Two species of bottlenose dolphins occur around southern Africa. The smaller Indo-Pacific bottlenose dolphin (*aduncus* form) occurs exclusively to the east of Cape Point in water usually less than 50 m deep and generally within 1 km of the shore (Ross 1984; Ross *et al.* 1987). The

larger common bottlenose dolphin (*truncatus* form) is widely distributed in tropical and temperate waters throughout the world, but frequently occur in small (10s to low 100s) isolated coastal populations. An offshore 'form' of common bottlenose dolphins occurs around the coast of southern Africa including Namibia and Angola (Best 2007) with sightings restricted to the continental shelf edge and deeper. Offshore bottlenose dolphins frequently form mixed species groups, often with pilot whales or Risso's dolphins. Encounters in the offshore waters of Reconnaissance Permit Area are likely to be low.

Risso's Dolphin: A medium sized dolphin with a distinctively high level of scarring and a proportionally large dorsal fin and blunt head. Risso's dolphins are distributed worldwide in tropical and temperate seas and show a general preference for shelf edge waters <1 500 m deep (Best 2007; Purdon *et al.* 2020a, 2020b). Many sightings in southern Africa have occurred around the Cape Peninsula and along the shelf edge of the Agulhas Bank. Presence within the inshore portions of the Reconnaissance Permit Area is possible (see Figure 28).

Other Delphinids: Several other species of dolphins that might occur in deeper waters at low levels include the pygmy killer whale, southern right whale dolphin, rough toothed dolphin, pantropical spotted dolphin and striped dolphin (Findlay *et al.* 1992; Best 2007). Nothing is known about the population size or density of these species in the project area but encounters are likely to be rare.

Beaked whales: These whales were never targeted commercially and their pelagic distribution makes them the most poorly studied group of cetaceans. They are all considered to be true deep water species usually being seen in waters in excess of 1 000 - 2 000 m deep (see various species accounts in Best 2007). With recorded dives of well over an hour and in excess of 2 km deep, beaked whales are amongst the most extreme divers of any air breathing animals (Tyack *et al.* 2011). All the beaked whales that may be encountered in the project area are pelagic species that tend to occur in small groups usually less than five, although larger aggregations of some species are known (MacLeod & D'Amico 2006; Best 2007). The long, deep dives of beaked whales make them difficult to detect visually, but PAM will increase the probability of detection as animals are frequently echo-locating when on foraging dives. Beaked whales seem to be particularly susceptible to man-made sounds and several strandings and deaths at sea, often *en masse*, have been recorded in association with mid-frequency naval sonar (Cox *et al.* 2006; MacLeod & D'Amico 2006) and a seismic survey for hydrocarbons also running a multi-beam echo-sounder and sub bottom profiler (Southall *et al.* 2008; Cox *et al.* 2006; DeRuiter *et al.* 2013). Although the exact reason that beaked whales seem particularly vulnerable to man-made noise is not yet fully understood, existing evidence suggests that animals change their dive behaviour in response to acoustic disturbance (Tyack *et al.* 2011), showing a fear-response and surfacing too quickly with insufficient time to release nitrogen resulting in a form on decompression sickness. Necropsy of stranded animals has revealed gas embolisms and haemorrhage in the brain, ears and acoustic fat - injuries consistent with decompression sickness (acoustically mediated bubble formation) (Fernandez *et al.* 2005). Beyond decompression sickness, the fear/flee response may be the first stage in a multi-stage process ultimately resulting in stranding (Southall *et al.* 2008; Jepson *et al.* 2013). Thus, although hard to detect and avoid - beaked whales are amongst the most sensitive marine mammals to noise exposure and all cautions must be taken to reduce impact. Presence in the project area may fluctuate seasonally, but insufficient data exist to define this clearly. Sightings of beaked whales in the project area are expected to be very low.

All whales and dolphins are given protection under the South African Law. The Marine Living Resources Act, 1998 (No. 18 of 1998) states that no whales or dolphins may be harassed, killed or

fished. No vessel or aircraft may, without a permit or exemption, approach closer than 300 m to any whale and a vessel should move to a minimum distance of 300 m from any whales if a whale surfaces closer than 300 m from a vessel or aircraft.

Seals

The Cape fur seal (*Arctocephalus pusillus pusillus*) (Figure 36) is the only species of seal resident along the west coast of Africa, occurring at numerous breeding and non-breeding sites on the mainland and on nearshore islands and reefs (see Figure 40). The South African population, which includes the West Coast colonies, was estimated at ca. 725 000 individuals in 2020. This is about 40% of the total southern African population, which has previously been estimated at up to 2 million (Seakamela *et al.* 2022). Vagrant records from four other species of seal more usually associated with the subantarctic environment have also been recorded: southern elephant seal (*Mirounga leonina*), subantarctic fur seal (*Arctocephalus tropicalis*), crabeater (*Lobodon carcinophagus*) and leopard seals (*Hydrurga leptonyx*) (David 1989).

Figure 36: Colony of Cape fur seals *Arctocephalus pusillus pusillus* (Photo: Dirk Heinrich).

There are a number of Cape fur seal colonies within the broader study area: at Buchu Twins near Alexander Bay, at Cliff Point (~17 km north of Port Nolloth), at Kleinzee (incorporating Robeiland), Strandfontein Point (south of Hondeklipbaai), Paternoster Rocks and Jacobs Reef at Cape Columbine, Vondeling Island, Robbesteen near Koeberg, Seal Island in False Bay and Geyser Rock at Dyer Island, Quoin Point and Seal Island in Mossel Bay. The colony at Kleinzee has the highest seal population and produces the highest seal pup numbers on the South African Coast (Wickens 1994). The colony at Buchu Twins and Cliff Point, formerly non-breeding colonies, have also attained breeding status (M. Meyer, SFRI, pers. comm.). Non-breeding colonies and haul-out sites occur occur at Doringbaai south of Cliff Point, Rooiklippies, Swartduin and Noup between Kleinzee and Hondeklipbaai, at Spoeg River and Langklip south of Hondeklip Bay, on Bird Island at Lambert's Bay, at Paternoster Point at Cape Columbine and Duikerklip in Hout Bay. These colonies all fall well inshore and to the east of the Reconnaissance Permit Area.

Seals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles offshore (Shaughnessy 1979), with bulls ranging further out to sea than females. Their

diet varies with season and availability and includes pelagic species such as horse mackerel, pilchard, and hake, as well as squid and cuttlefish. Benthic feeding to depths of nearly 200 m for periods of up to 2 minutes has, however, also been recorded (Kirkman et al. 2015). Seals are unlikely to be encountered in the offshore waters of the Reconnaissance Permit Area (Figure 37).

The timing of the annual breeding cycle is very regular, occurring between November and January. Breeding success is highly dependent on the local abundance of food, territorial bulls and lactating females being most vulnerable to local fluctuations as they feed in the vicinity of the colonies prior to and after the pupping season (Oosthuizen 1991).

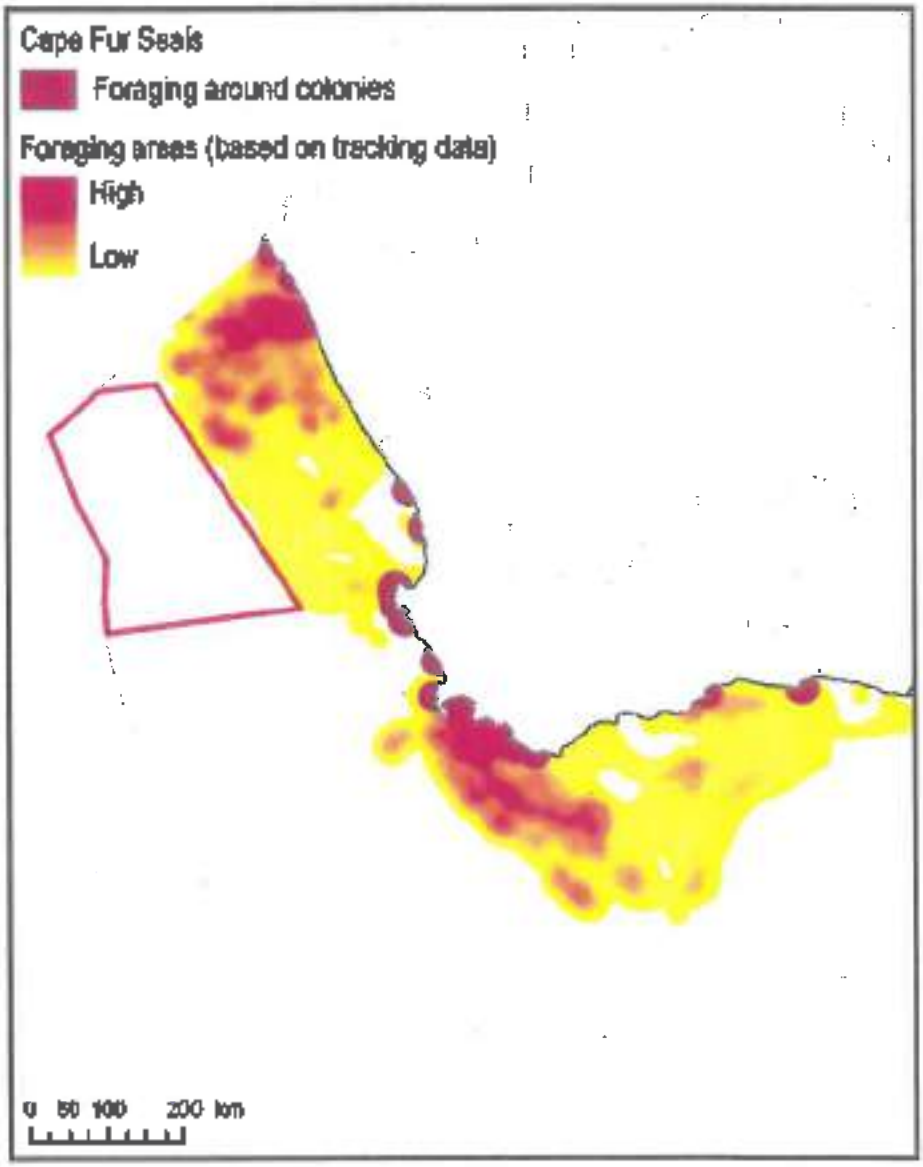

Figure 37: Reconnaissance Permit Area (red polygon) in relation to seal foraging areas on the West and South Coasts. Brown areas are generalised foraging areas around colonies, and areas in shades of red are foraging areas based on tracking data. Darker shades of red indicate areas of higher use.

Historically the Cape fur seal was heavily exploited for its luxurious pelt. Sealing restrictions were first introduced to southern Africa in 1893, and harvesting was controlled until 1990 when it was

finally prohibited. The protection of the species has resulted in the recovery of the populations, and numbers continue to increase. Consequently, their conservation status is not regarded as threatened. The Cape Fur Seal population in South Africa is regularly monitored by the Department of Fisheries, Forestry and Environment (DFFE) (e.g. Kirkman *et al.* 2013). The overall population is considered healthy and stable in size, although there has been a westward and northward shift in the distribution of the breeding population (Kirkman *et al.* 2013).

An unprecedented mortality event was recorded in South Africa between September and December 2021 at colonies around the West Coast Peninsula and north to Lambert's Bay and Elands Bay. Primarily pups and juveniles were affected. Post-mortem investigations revealed that seals died in a poor condition with reduced blubber reserves, and protein energy malnutrition was detected for aborted foetuses, for juveniles and subadults. Although no unusual environmental conditions were identified that may have triggered the die-off, or caused it indirectly (e.g. HABs), 2021 was a year of below average recruitment of anchovy and sardine, the main food source for seals. While a lack of food, as a result of possibly climate change and/or overfishing, has been predicted to be the cause of this mass mortality, the underlying causes of the mortality event remain uncertain (Seakamela *et al.* 2022).

3.4 Other Uses of the Area

3.4.1 Beneficial Uses

The proposed 3D survey area is located well offshore beyond the 1 000 m depth contour. Other users of the offshore areas include the commercial fishing industry (see CapMarine 2022 - Fisheries Specialist Study), with marine diamond mining concessions being located well inshore of the eastern portion of the Reconnaissance Permit Area (Figure 38). Recreational activities along the coastline north of St Helena Bay are limited to the area around Lambert's Bay, Hondeklip Bay and Port Nolloth.

On the Namaqualand coast marine diamond mining activity is restricted to nearshore, diver-assisted operations from small, converted fishing vessels working in the a-concessions, which extend to 1 000 m offshore of the high water mark. No deep-water diamond mining is currently underway in the South African offshore concession areas, although prospecting activities are ongoing. In Namibian waters, deep-water diamond mining by De Beers Marine Namibia is currently operational in the Atlantic 1 Mining Licence Area, immediately to the northeast of the Reconnaissance Permit Area.

These mining operations are typically conducted to depths of 150 m from fully self-contained mining vessels with on board processing facilities, using either large-diameter drill or seabed crawler technology. The vessels operate as semi-mobile mining platforms, anchored by a dynamic positioning system, commonly on a three to four anchor spread (Figure 39). Computer-controlled positioning winches enable the vessels to locate themselves precisely over a mining block of up to 400 m x 400 m. These mining vessels thus have limited manoeuvrability and other vessels should remain at a safe distance.

Other industrial uses of the marine environment include the intake of feed-water for mariculture, or diamond-gravel treatment, submarine telecommunications cables, ammunition dumps and hydrocarbon wellheads (Figure 38). None of these activities should in any way be affected by 3D seismic survey activities offshore.

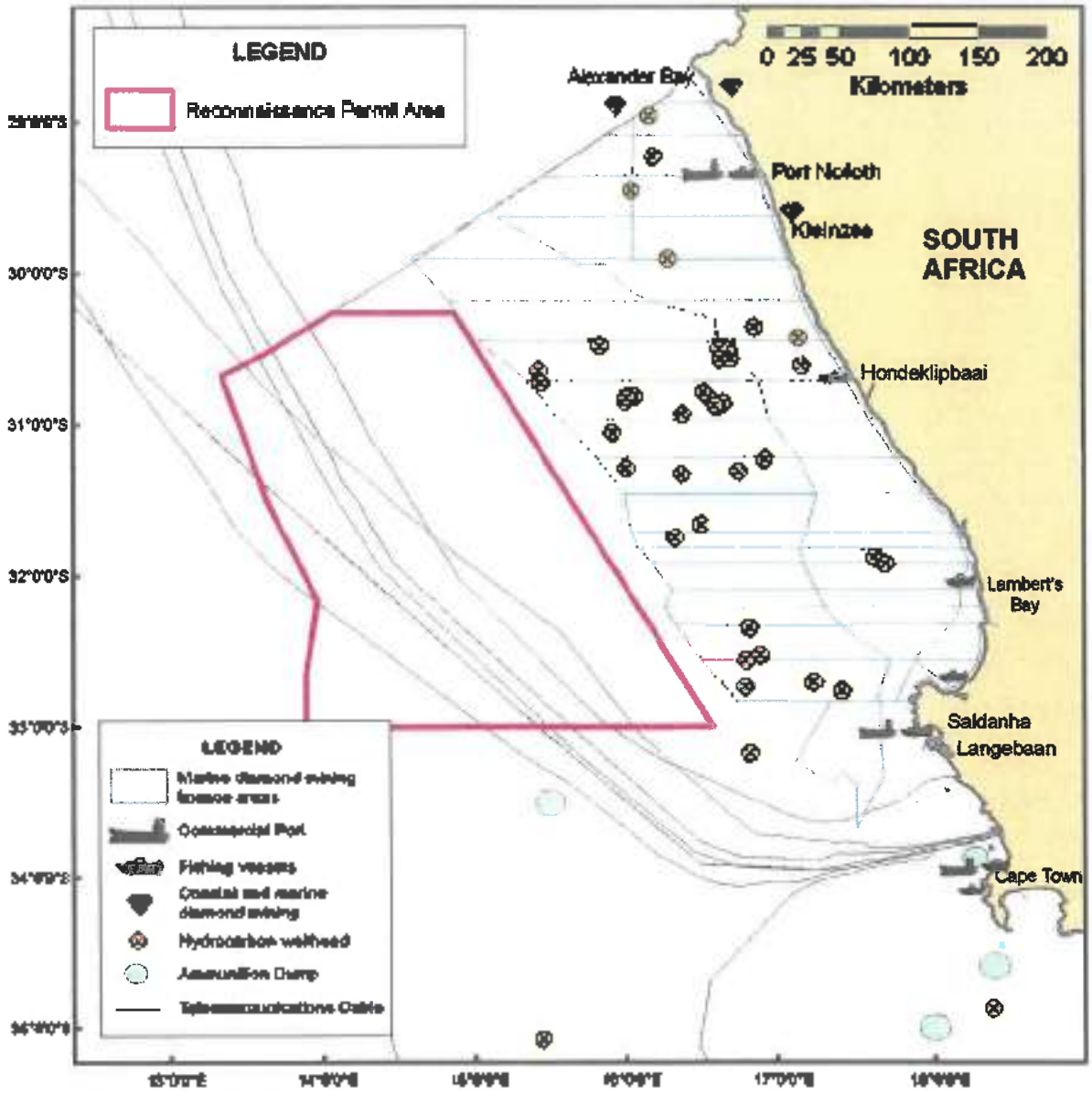

Figure 38: The Reconnaissance Permit Area (red polygon) in relation to project - environment interaction points on the West Coast, illustrating the location of marine diamond mining concessions and ports for commercial and fishing vessels. Existing hydrocarbon wellheads, telecommunications cables and ammunition dumps are also shown.

Figure 39: Typical crawler-vessel (left) and drillship (right) operating in the Atlantic 1 Mining Licence Area (Photos: De Beers Marine).

3.4.2 Conservation Areas and Marine Protected Areas

Numerous sanctuaries, marine protected areas (MPAs) exist offshore and along the coastline of the Western Cape, although none of them overlap with the Reconnaissance Permit Area. For the sake of completeness, these are described in more detail below.

Sanctuaries

Sanctuaries are considered a type of management area within South Africa's multi-purpose expanded MPA network in which access and/or resource use is prohibited. Sanctuaries in the vicinity of the project area in which restrictions apply are the McDougall's Bay, Stompneusbaai, Saldanha Bay, Table Bay and Hout Bay rock lobster sanctuaries, which are closed to commercial exploitation of rock lobsters. These sanctuaries were originally proclaimed early in the 20th century under the Sea Fisheries Act of 1988 as a management tool for the protection of the West Coast rock lobster (Mayfield *et al.* 2005). They lie well inshore or to the south of the Reconnaissance Permit Area.

Marine Protected Areas

'No-take' MPAs offering protection of the Namaqua biozones (sub-photic, deep-photic, shallow-photic, intertidal and supratidal zones) are absent northwards from Cape Columbine (Emanuel *et al.* 1992, Lombard *et al.* 2004). This resulted in substantial portions of the coastal and shelf-edge marine biodiversity in the area being assigned a threat status of 'Critically Endangered', 'Endangered' or 'Vulnerable' in the 2011 National Biodiversity Assessment (NBA) (Lombard *et al.* 2004; Sink *et al.* 2012). Using biodiversity data mapped for the 2004 and 2011 NBAs a systematic biodiversity plan was developed for the West Coast (Majiedt *et al.* 2013) with the objective of identifying both coastal and offshore priority areas for MPA expansion. Potentially vulnerable marine ecosystems (VMEs) that were explicitly considered during the planning included the shelf break, seamounts, submarine canyons, hard grounds, submarine banks, deep reefs and cold water coral reefs. To this end, nine focus areas were identified for protection on the West Coast between Cape Agulhas and the South African - Namibian border. These focus areas were carried forward during Operation Phakisa, which identified potential offshore MPAs. A network of 20 MPAs was gazetted on 23 May 2019, thereby increasing the ocean protection within the South African Exclusive Economic Zone (EEZ) to 5%. The approved MPAs within the broad project area are shown in Figure 40. There are six offshore Marine Protected Areas

(MPAs) that fall within the broader project area, namely the Orange Shelf Edge MPA, Child's Bank MPA, Benguela Muds MPA, Cape Canyon MPA, Robben Island MPA and the Southeast Atlantic Seamounts MPA. These are described briefly below.

The Orange Shelf Edge MPA covers depths of between 250 m and 1 500 m and is unique as it has to date never been trawled. Proclaimed in 2019, this MPA provides a glimpse into what a healthy seabed should look like, what animals live there and how the complex relationships between them support important commercial fish species such as hake, thereby contributing fundamentally towards sustainable fisheries development. This MPA also protects the pelagic habitats that are home to predators such as blue sharks, as well as surface waters where thousands of seabirds such as Atlantic yellow-nosed albatrosses feed. The MPA lies ~10 km to the north of the northern boundary of the Reconnaissance Permit Area.

The 1 335 km^2 Child's Bank MPA, located 27 km inshore of the Reconnaissance Permit Area at its closest point, supports seabed habitats inhabited by a diversity of starfish, brittle stars and basket stars, many of which feed in the currents passing the bank's steep walls. Although trawling has damaged coral in the area, some pristine coral gardens remain on the steepest slopes. The Child's Bank area was first proposed for protection in 2004 but was only proclaimed in 2019, after reducing its size to avoid petroleum wellheads and mining areas. The MPA provides critical protection to these deep sea habitats (180 - 450 m) as they allow for the recovery of important nursery areas for young fish.

The Benguela Muds MPA is the smallest of the South African offshore MPAs. At only 71 km^2 the muddy habitats located in this area are created by sediment washed down the Orange River and out to sea. These mud habitats are of limited extent and were considered 'critically endangered' on South Africa's deep continental margin of the west coast (Sink *et al.* 2014). The MPA represents the least trawled stretch of muddy seabed on the west coast. This MPA is located 28 km east of the southern portion of the Reconnaissance Permit Area.

The Cape Canyon is a deep and dramatic submarine canyon carved into the continental shelf and extending to a maximum depth of 3,600 m. The 580 km^2 MPA was proclaimed in 2019 and protects the upper part of the canyon where depths range from 180 to 500 m. Underwater footage has revealed a rich diversity of seafans, hermit crabs and mantis shrimps, with hake, monk and john dory resident on the soft canyon floor. Rocky areas in the west of the canyon support fragile rocky habitat, but the area also includes sandy and muddy habitats, which have been trawled in the past. Interaction of nutrient-rich bottom water with a complex seascape results in upwelling, which in turn provides productive surface waters in which seabirds, humpback whales and Cape fur seals feed. The MPA lies 78 km east of the southeastern corner of the Reconnaissance Permit Area.

The Namaqua Fossil Forest MPA, which lies ~173 km inshore of the Reconnaissance Permit Area, provides evidence of age-old temperate yellowwood forests from a hundred million years ago when the sea-level was more than 200 m below what it is today; trunks of fossilized yellowwood trees covered in delicate corals. These unique features stand out against surrounding mud, silt and gravel habitats. The fossilized trees are not known to be found anywhere else in our oceans and are valuable for research into past climates. In 2014 this area was recognised as globally important and declared as an Ecologically and Biologically Significant Area (EBSA). The 1 200 km^2 MPA protects the unique fossil forests and the surrounding seabed ecosystems and including a new species of sponge previously unknown to science.

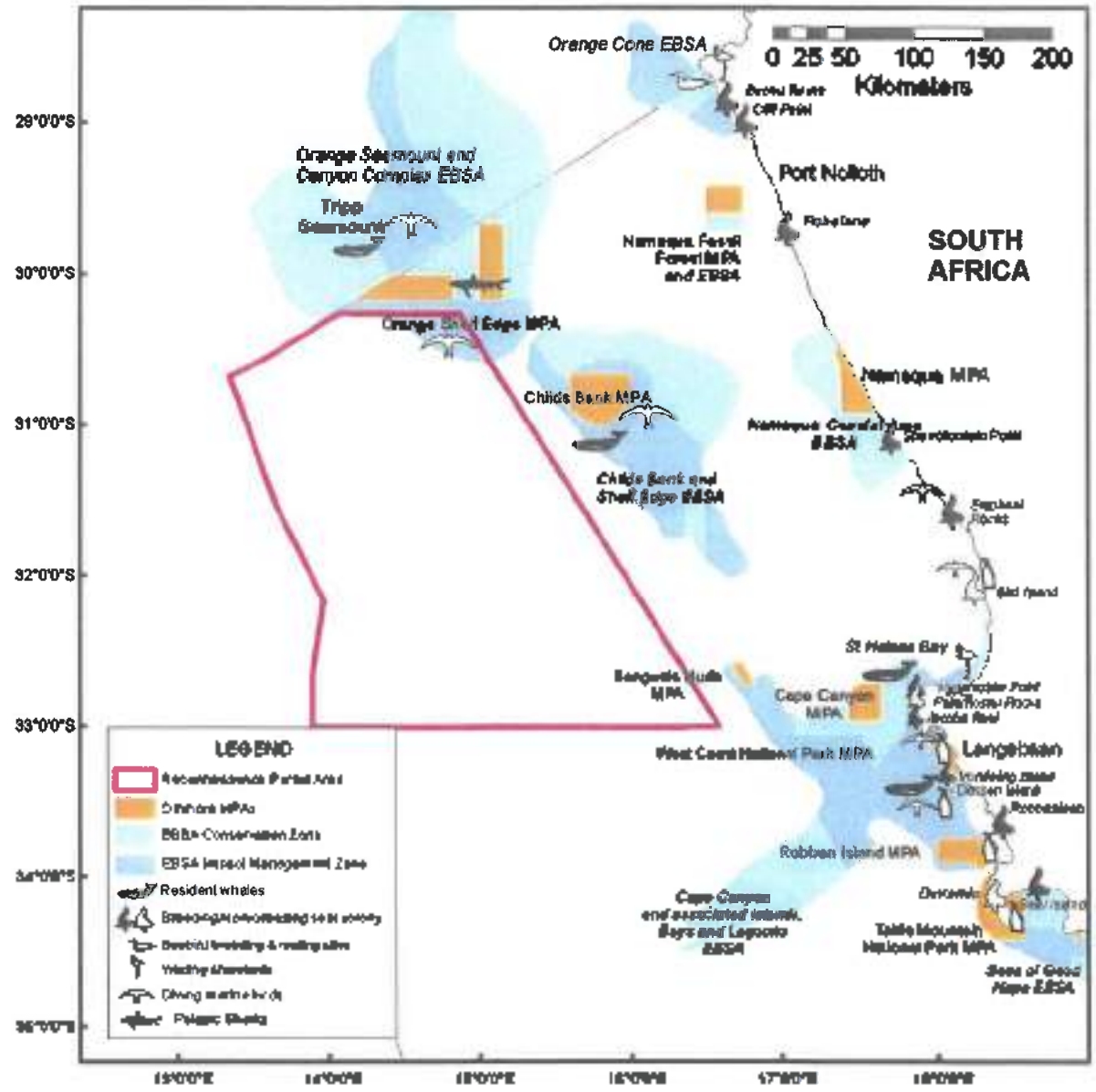

Figure 40: The Reconnaissance Permit Area (red polygon) in relation to project - environment interaction points on the West Coast, illustrating the location of seabird and seal colonies and resident whale populations, Marine Protected Areas (MPAs) and Ecologically and Biologically Significant Areas (EBSAs).

The Namaqua National Park MPA provides the first protection to habitats in the Namaqua bioregion, including several 'critically endangered' coastal ecosystem types. The area is a nursery area for Cape hakes, and the coastal areas support kelp forests and deep mussel beds, which serve as important habitats for the West Coast rock lobster. This 500 km² MPA was proclaimed in 2019, both to boost tourism to this remote area and to provide an important baseline from which to understand ecological changes (e.g. introduction of invasive alien marine species, climate change) and human impacts (harvesting, mining) along the West Coast. Protecting this stretch of coastline is part of South Africa's climate adaptation strategy.

The 612 km² Robben Island MPA was proclaimed in 2019 to protect the surrounding kelp forests - one of the few areas that still support viable stocks of abalone. The island harbours the 3rd largest penguin colony, with the breeding population peaking in 2004 at 8 524, but declining since. The island also holds the largest numbers of breeding Bank Cormorant in the Western Cape (120 pairs in 2000) and significant populations of Crowned Cormorant, African Black Oystercatcher (35 breeding pairs in 2000), Hartlaub's Gull and Swift Tern.

The Rocher Pan MPA, which stretches 500 m offshore of the high water mark of the adjacent Rocher Pan Nature Reserve, was declared in 1966. The MPA primarily protects a stretch of beach important as a breeding area to numerous waders.

The West Coast National Park, which was established in 1985 incorporates the Langebaan Lagoon and Sixteen Mile Beach MPAs, as well the islands Schaapen (29 ha), Marcus (17 ha), Malgas (18 ha) and Jutten (43 ha). Langebaan Lagoon was designated as a Ramsar site in April 1988 under the Convention on Wetlands of International Importance especially as Waterfowl Habitat. The lagoon is divided into three different utilization zones namely: wilderness, limited recreational and multi-purpose recreational areas. The wilderness zone has restricted access and includes the southern end of the lagoon and the inshore islands, which are the key refuge sites of the waders and breeding seabird populations respectively. The limited recreation zone includes the middle reaches of the lagoon, where activities such as sailing and canoeing are permitted. The mouth region is a multi-purpose recreation zone for power boats, yachts, water-skiers and fishermen. However, no collecting or removal of abalone and rock lobster is allowed. The length of the combined shorelines of Langebaan Lagoon MPA and Sixteen Mile Beach is 66 km. The uniqueness of Langebaan lies in its being a warm oligotrophic lagoon, along the cold, nutrient-rich and wave exposed West Coast.

Sensitive Areas

Despite the development of the offshore MPA network a number of 'Endangered' and 'Vulnerable' ecosystem types (i.e. Orange Cone Inner Shelf Mud Reef Mosaic, Orange Cone Muddy mid Shelf, Namaqua Muddy Sands, Southern Benguela Outer Shelf Mosaic, Southern Benguela Shelf Edge Mosaic and Southeast Atlantic Lower Slope) are currently 'not well protected' and further effort is needed to improve protection of these threatened ecosystem types (Sink *et al.* 2019) (Figure 41). Ideally, all highly threatened ('Critically Endangered' and 'Endangered') ecosystem types should be well protected. Currently, however, most of the Southern Benguela Sandy Shelf Edge and Southeast Atlantic Upper- and Mid-Slope are poorly protected receiving only 0.2-10% protection, whereas the Southeast Atlantic Lower Slope receives no protection at all (Sink *et al.* 2019). Expanding the size of the Orange Shelf Edge MPA to form a single MPA along the South African Border could improve protection of these threatened habitats. Most of the ecosystem types in the proposed 3D survey area are either poorly protected or not protected.

Ecologically or Biologically Significant Areas

As part of a regional Marine Spatial Management and Governance Programme (MARISMA 2014-2020) the Benguela Current Commission (BCC) and its member states have identified a number of Ecologically or Biologically Significant Areas (EBSAs) both spanning the border between Namibia and South Africa and along the South African West, South and East Coasts (see Figure 40), with the intention of implementing improved conservation and protection measures within these sites. South Africa currently has 11 EBSAs solely within its national jurisdiction with a further four having recently been proposed. It also shares five trans-boundary EBSAs with Namibia (3) and Mozambique (2). The principal objective of these EBSAs is identification of features of higher ecological value that may

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require enhanced conservation and management measures. They currently carry no legal status. The impact management and conservation zones within the EBSAs are under review and currently constitute a subset of the biodiversity priority areas map (see next section); EBSA conservation zones equate to Critical Biodiversity Areas (CBAs), whereas impact management zones equate to Ecological Support Area (ESAs). The relevant sea-use guidelines accompanying the CBA areas would apply.

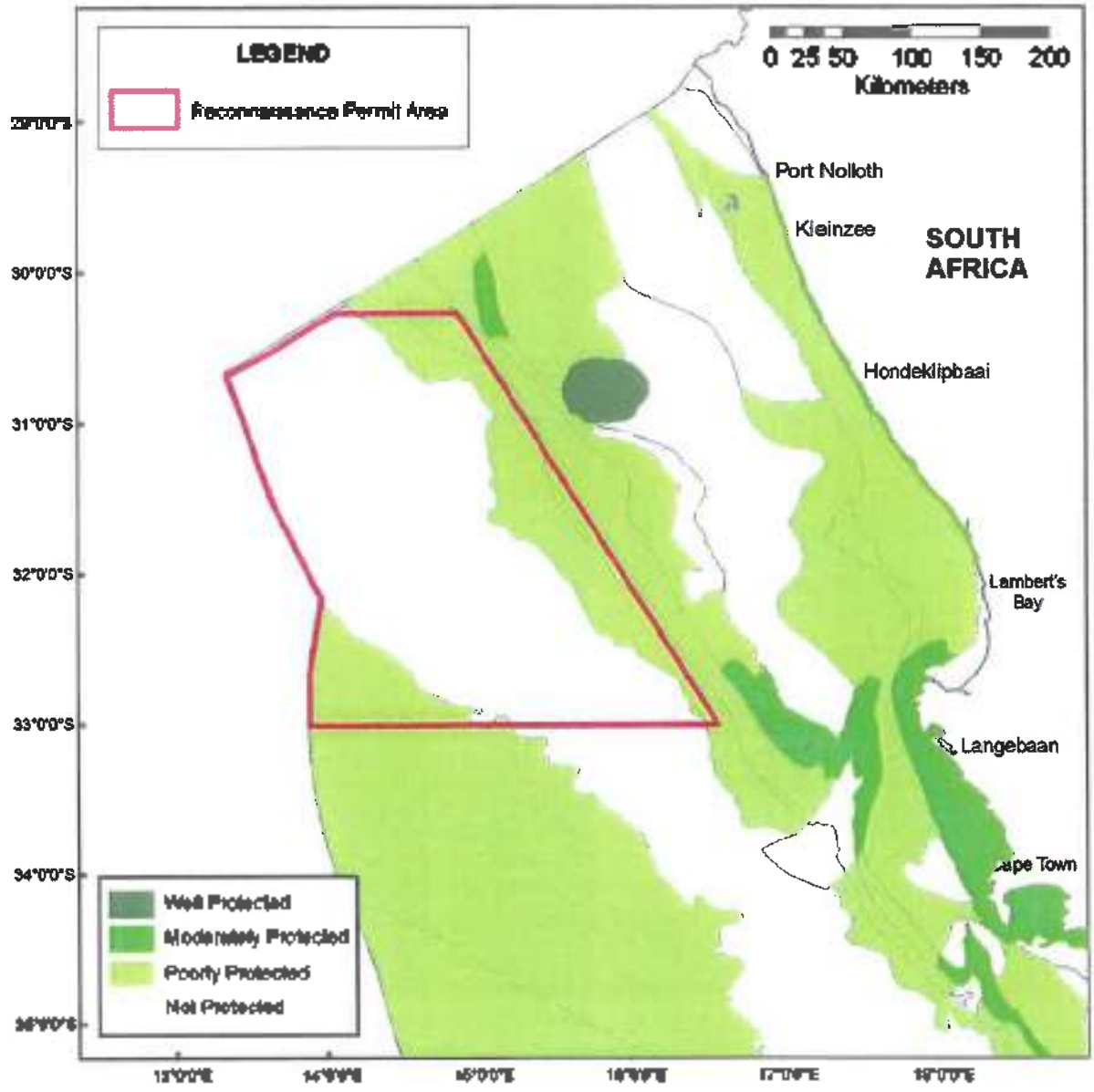

Figure 41: The Reconnaissance Permit Area (red polygon) in relation to protection levels of 150 marine ecosystem types as assessed by Sink *et al.* (2019).

The following summaries of the EBSAs in the Reconnaissance Permit area are adapted from http://cmr.mandela.ac.za/EBSA-Portal/Namibia/.

The Orange Seamount and Canyon Complex, occurs at the western continental margin of southern Africa, spanning the border between South Africa and Namibia. On the Namibian side, it includes

Tripp Seamount and a shelf-indenting canyon. The EBSA comprises shelf and shelf-edge habitat with hard and unconsolidated substrates, including at least eleven offshore benthic habitat types of which four habitat types are 'Threatened', one is 'Critically endangered' and one 'Endangered'. The Orange Shelf Edge EBSA is one of few places where these threatened habitat types are in relatively natural/pristine condition. The local habitat heterogeneity is also thought to contribute to the Orange Shelf Edge being a persistent hotspot of species richness for demersal fish species. Although focussed primarily on the conservation of benthic biodiversity and threatened benthic habitats, the EBSA also considers the pelagic habitat, which is characterized by medium productivity, cold to moderate Atlantic temperatures (SST mean = 18.3°C) and moderate chlorophyll levels related to the eastern limit of the Benguela upwelling on the outer shelf. There is an slight overlap of the Reconnaissance Permit Area with this EBSA.

The Orange Cone transboundary EBSA lies well inshore of the Reconnaissance Permit Area and spans the mouth of the Orange River. The estuary is biodiversity-rich but modified, and the coastal area includes many 'Critically endangered', 'Endangered' and 'Vulnerable' habitat types (with the area being particularly important for the 'Critically Endangered' Namaqua Sandy Inshore, Namaqua Inshore Reef and Hard Grounds and Namaqua Intermediate and Reflective Sandy Beach habitat types). The marine environment experiences slow, but variable currents and weaker winds, making it potentially favourable for reproduction of pelagic species. An ecological dependence for of river outflow for fish recruitment on the inshore Orange Cone is also likely. The Orange River Mouth is a transboundary Ramsar site and falls within the Tsau//Khaeb (Sperrgebiet) National Park. It is also under consideration as a protected area by South Africa, and is an Important Bird and Biodiversity Area.

The Namaqua Fossil Forest EBSA, which lies inshore of the Reconnaissance Permit Area, is a small seabed outcrop composed of fossilized yellowwood trees at 136-140 m depth, approximately 30 km offshore on the west coast of South Africa. A portion of the EBSA comprised the Namaqua Fossil Forest MPA. The fossilized tree trunks form outcrops of laterally extensive slabs of rock have been colonized by fragile, habitat-forming scleractinian corals and a newly described habitat-forming sponge species. The EBSA thus encompasses a unique feature with substantial structural complexity that is highly vulnerable to benthic impacts.

The Childs Bank and Shelf Edge EBSA, which lies ~ 17 km east of the Reconnaissance Permit Area at its closest point, is a unique submarine bank feature rising from 400 m to ~180 m on the western continental margin on South Africa. This area includes five benthic habitat types, including the bank itself, the outer shelf and the shelf edge, supporting hard and unconsolidated habitat types. Childs Bank and associated habitats are known to support structurally complex cold-water corals, hydrocorals, gorgonians and glass sponges; species that are particularly fragile, sensitive and vulnerable to disturbance, and recover slowly.

The Namaqua Coastal Area EBSA, which lies well inshore of the Reconnaissance Permit Area and encompasses the Namaqua Coastal Area MPA, is characterized by high productivity and community biomass along its shores. The area is important for several threatened ecosystem types represented there, including two 'Endangered' and four 'Vulnerable' ecosystem types, and is important for conservation of estuarine areas and coastal fish species.

The Cape Canyon and Associated Islands EBSA lies ~ 20 km inshore of the southern portion of the Reconnaissance Permit Area at its closest point. The EBSA includes the Benguela Muds MPA and the Cape Canyon, which is thought to hosts fragile habitat-forming species. The area is considered important for pelagic fish, foraging marine mammals and several threatened seabird species and

serves to protect nine 'Endangered' and 12 'Vulnerable' ecosystem types, and two that are 'Near Threatened'. There are several small coastal MPAs within the EBSA.

The proposed **Seas of Good Hope EBSA** is located at the coastal tip of Africa, wrapping around Cape Point and Cape Agulhas. It extends from the coast to the inner shelf, and includes key islands (Seal Island, Dyer Island And Geyser Rocks), two major bays (False Bay and Walker Bay), and is of key importance for threatened species and habitats. The threatened habitats include coastal, inshore and inner shelf ecosystem types. The important life-history stages supported by the area are breeding and/or foraging grounds for a myriad of top predators, including sharks, whales, and seabirds, some of which are threatened species. This EBSA is also the place where the Benguela and Agulhas Currents meet.

The **Benguela Upwelling System** is a transboundary EBSA is globally unique as the only cold-water upwelling system to be bounded in the north and south by warm-water current systems, and is characterized by very high primary production (>1 000 mg $C.m^{-2}.day^{-1}$). It includes important spawning and nursery areas for fish as well as foraging areas for threatened vertebrates, such as sea- and shorebirds, turtles, sharks, and marine mammals. Another key characteristic feature is the diatomaceous mud-belt in the Northern Benguela, which supports regionally unique low-oxygen benthic communities that depend on sulphide oxidising bacteria.

Biodiversity Priority Areas

The National Coastal and Marine Spatial Biodiversity Plan[3] comprises a map of Critical Biodiversity Areas (CBAs), Ecological Support Area (ESAs) and accompanying sea-use guidelines. The CBA Map presents a spatial plan for the marine environment, designed to inform planning and decision-making in support of sustainable development. The sea-use guidelines enhance the use of the CBA Map in a range of planning and decision-making processes by indicating the compatibility of various activities with the different biodiversity priority areas so that the broad management objective of each can be maintained. The intention is that the CBA Map (CBAs and ESAs) and sea-use guidelines inform the MSP Conservation Zones and management regulations, respectively.

The Reconnaissance Permit Area overlaps with areas mapped as Critical Biodiversity Area 1 (CBA 1): Natural and Critical Biodiversity Area 2: (CBA 2) Natural. Approximately 32.25 % of the proposed 3D acquisition area is covered by CBA 1 and CBA 2 Natural, 0.22% by CBA 1 and CBA 2 Restore, and 1.75% by ESA (see Figure 42). CBA 1 indicates irreplaceable or near-irreplaceable sites that are required to meet biodiversity targets with limited, if any, option to meet targets elsewhere, whereas CBA 2 are "best design sites" and there often alternative areas where feature targets can be met; however, these will be of higher cost to other sectors and / or will be larger areas.

[3] The latest version of National Coastal and Marine Spatial Biodiversity Plan (v1.2 was released in April 2022) (Harris *et al.* 2022). The Plan is intended to be used by managers and decision-makers in those national government departments whose activities occur in the coastal and marine space, e.g., environment, fishing, transport (shipping), petroleum, mining, and others. It is relevant for the Marine Spatial Planning Working Group where many of these departments are participating in developing South Africa's emerging marine spatial plans. It is also intended for use by relevant managers and decision-makers in the coastal provinces and coastal municipalities, EIA practitioners, organisations working in the coast and ocean, civil society, and the private sector.

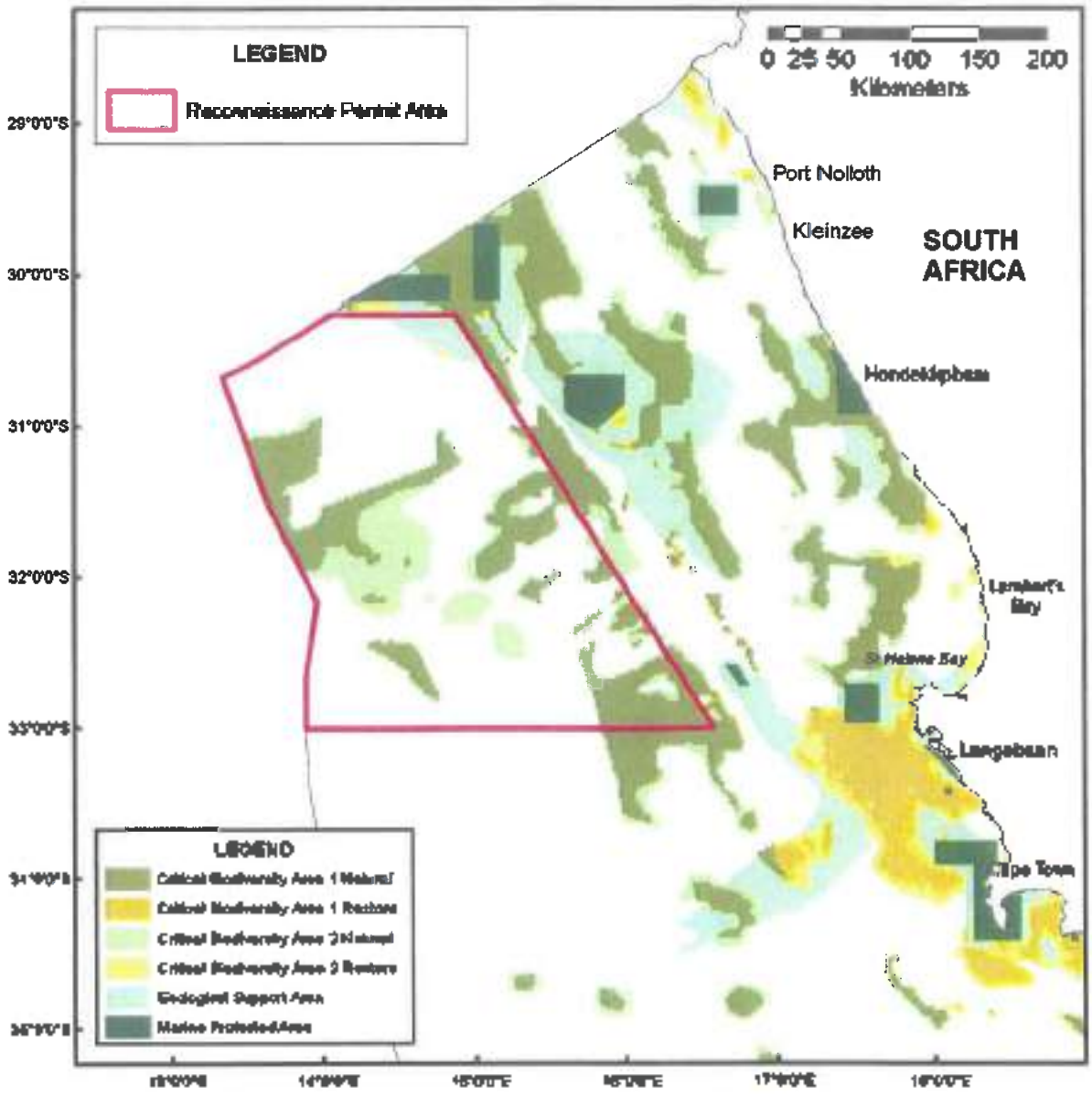

Figure 42: The Reconnaissance Permit Area (red polygon) in relation to Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) (Version 1.2 April 2022).

Regardless of how CBAs are split, CBAs are generally areas of low use and with low levels of human impact on the marine environment, but can also include some moderately to heavily used areas with higher levels of human impact. Given that some CBAs are not in natural or near-natural ecological condition, but still have very high biodiversity importance and are needed to meet biodiversity feature targets, CBA 1 and CBA 2 were split into two types based on their ecological condition. CBA Natural sites have natural / near-natural ecological condition, with the management objective of maintaining the sites in that natural / near natural state; and CBA Restore sites have moderately modified or poorer ecological condition, with the management objective to improve ecological condition and, in the long-term, restore these sites to a natural/near-natural state, or as close to that state as possible. ESAs include all portions of EBSAs that are not already within MPAs or CBAs, and a 5-km

buffer area around all MPAs (where these areas are not already CBAs or ESAs), with the exception of the eastern edge of Robben Island MPA in Table Bay where a 1.5-km buffer area was applied (Harris *et al.* 2022).

Activities within these management zones are classified into those that are "compatible", those that are "not compatible", and those that have "restricted compatibility". Non-invasive (e.g. seismic surveys) and invasive (e.g. exploration wells) exploration activities are classified as having "restricted compatibility". Activities with restricted compatibility require a detailed assessment to determine whether the recommendation is that they should be permitted (general), permitted subject to additional regulations (consent), or prohibited, depending on a variety of factors. Petroleum production is, however, classified as "not compatible" in CBAs, but may be compatible, subject to certain conditions, in ESAs (Harris *et.al.* 2022).

Important Bird Areas (IBAs)

There are numerous coastal Important Bird Areas (IBAs) in the general project area (Table 9) (www.http://datazone.birdlife.org/). These are all located well inshore of the Reconnaissance Permit area and should in no way be directly affected by the proposed seismic surveys.

Table 9: List of Important Bird Areas (IBAs) and their criteria listings. RAMSAR sites are shaded.

Site Name	IBA Criteria
Orange River Mouth Wetlands (ZA023)	A1, A3, A4i, A4iii
Olifants River Estuary (ZA078)	A3, A4i
Verlorenvlei Estuary (ZA082)	A4i
Berg River Estuary (ZA083)	A4i
West Coast National Park and Saldanha Bay Islands (ZA 084) (incorporating Langebaan RAMSAR site)	A1, A4i, A4ii, A4iii
Dassen Island (ZA088)	A1, A4i, A4ii, A4iii
Robben Island (ZA089)	A1, A4i, A4ii, A4iii
Rietvlei Wetland: Table Bay Nature Reserve (ZA090)	A1, A4i
Boulders Beach (ZA096)	A1
False Bay Nature Reserve (ZA095)	A1, A4i, A4iii

A1. Globally threatened species
A2. Restricted-range species
A3. Biome-restricted species
A4. Congregations
i. applies to 'waterbird' species
ii. This includes those seabird species not covered under i.
iii. modelled on criterion 5 of the Ramsar Convention for identifying wetlands of international importance. The use of this criterion is discouraged where quantitative data are good enough to permit the application of A4i and A4ii.

The Orange River Mouth wetland located ~235 km to the northeast of the Reconnaissance Permit Area provides an important habitat for large numbers of a great diversity of wetland birds and is listed as a Global IBA (www. http://datazone.birdlife.org/). The area was designated a Ramsar site in June 1991, and processes are underway to declare a jointly-managed transboundary Ramsar reserve.

Various marine IBAs have also been proposed in South African and Namibian territorial waters, with a candidate trans-boundary marine IBA suggested off the Orange River mouth and a further candidate marine IBA suggested in international waters west of the Cape Peninsula (Figure 43). There is no overlap of the Reconnaissance Permit Area with any of these Marine IBAs.

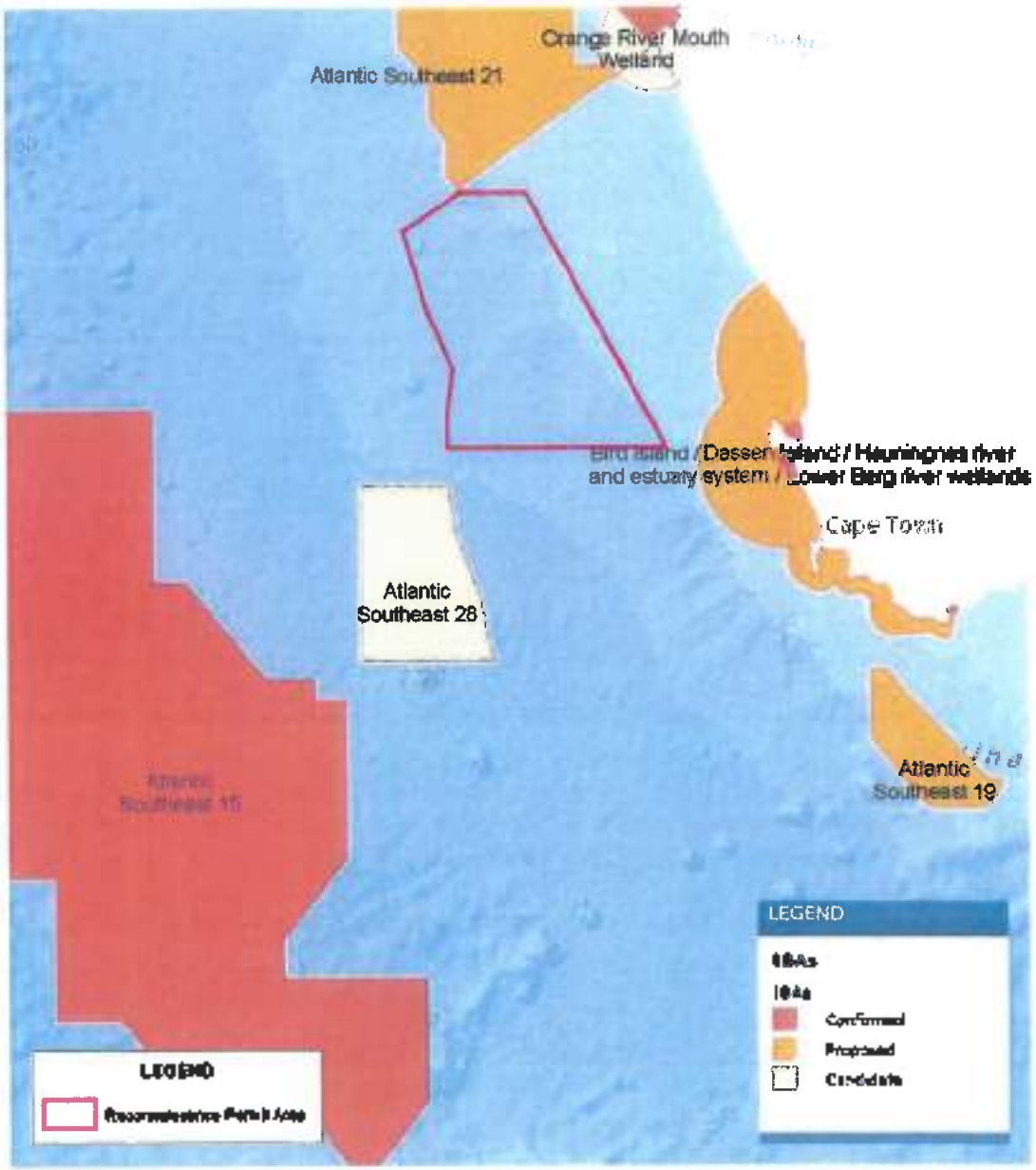

Figure 43: The Reconnaissance Permit Area (red polygon) in relation to coastal and marine IBAs in Namibia (Source: https://maps.birdlife.org/marineIBAs).

Important Marine Mammal Areas (IMMAs)

Important Marine Mammal Areas (IMMAs) were introduced in 2016 by the IUCN Marine Mammal Protected Areas Task Force to support marine mammal and marine biodiversity conservation. Complementing other marine spatial assessment tools, including the EBSAs and Key Biodiversity Areas (KBAs), IMMAs are identified on the basis of four main scientific criteria, namely species or population vulnerability, distribution and abundance, key life cycle activities and special attributes. Designed to capture critical aspects of marine mammal biology, ecology and population structure, they are devised through a biocentric expert process that is independent of any political and socio-economic pressure or concern. IMMAs are not prescriptive but comprise an advisory, expert-based classification of areas that merit monitoring and place-based protection for marine mammals and broader biodiversity.

Modelled on the BirdLife International process for determining IBAs, IMMAs are assessed against a number of criteria and sub-criteria, which are designed to capture critical aspects of marine mammal biology, ecology and population structure. These criteria are:

Criterion A - Species or Population Vulnerability

Areas containing habitat important for the survival and recovery of threatened and declining species.

Criterion B - Distribution and Abundance

Sub-criterion B1 - Small and Resident Populations: Areas supporting at least one resident population, containing an important proportion of that species or population that are occupied consistently.
Sub-criterion B2 - Aggregations: Areas with underlying qualities that support important concentrations of a species or population.

Criterion C - Key Life Cycle Activities

Sub-criterion C1 - Reproductive Areas: Areas that are important for a species or population to mate, give birth, and/or care for young until weaning.
Sub-criterion C2 - Feeding Areas: Areas and conditions that provide an important nutritional base on which a species or population depends.
Sub-criterion C3 - Migration Routes: Areas used for important migration or other movements, often connecting distinct life-cycle areas or the different parts of the year-round range of a non-migratory population.

Criterion D - Special Attributes

Sub-criterion D1 - Distinctiveness: Areas which sustain populations with important genetic, behavioural or ecologically distinctive characteristics.
Sub-criterion D2 - Diversity: Areas containing habitat that supports an important diversity of marine mammal species

Although much of the West Coast of South Africa has not yet been assessed with respect to its relevance as an IMMA, the coastline from the Olifants River mouth on the West Coast to the Mozambiquan border overlaps with three declared IMMAs (Figure 44) namely the

- Southern Coastal and Shelf Waters of South Africa IMMA (166 700 km^2),
- Cape Coastal Waters IMMA (6 359 km^2), and

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- South East African Coastal Migration Corridor IMMA (47 060 km²).

These are described briefly below based on information provided in IUCN-Marine Mammal Protected Areas Task Force (2021) (www.marinemammalhabitat.org).

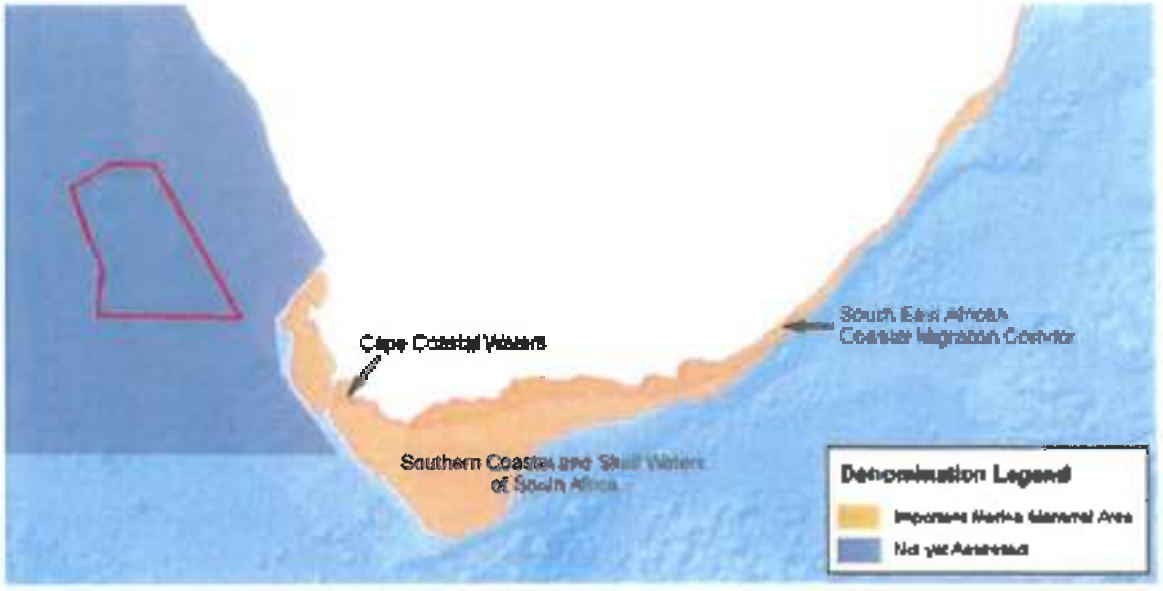

Figure 44: Reconnaissance Permit Area (red polygon) in relation to coastal and marine IMMAs (Source: www.marinemammalhabitat. org/imma-eatlas/).

The 166 700 km² Southern Coastal and Shelf Waters of South Africa IMMA extends from the Olifants River mouth to the mouth of the Cintsa River on the Wild Coast. Qualifying species are the Indian Ocean Humpback dolphin (Criterion A, B1), Bryde's whale (Criterion C2), Indo-Pacific bottlenose dolphin (Criterion B1, C3, D1), Common dolphin (Criterion C2) and Cape fur seal (criterion C2). The IMMA covers the area supporting the important 'sardine run' and the marine predators that follow and feed on the migrating schools (Criterion C2) as well as containing habitat that supports an important diversity of marine mammal species (Criterion D2) including the Indian Ocean humpback dolphin, the inshore form of Bryde's whale, Indo-Pacific bottlenose dolphin, common dolphin, Cape fur seal, humpback whales, killer whales and southern right whales.

The Cape Coastal Waters IMMA extends from Cape Point to Woody Cape at Algoa Bay and extends over some 6 359 km². It serves as one of the world's three most important calving and nursery grounds for southern right whales, which occur in the extreme nearshore waters (within 3 km of the coast) from Cape Agulhas to St. Sebastian Bay between June and November (Criterion B2, C1). Highest densities of cow-calf pairs occur between Cape Agulhas and the Duiwenhoks River mouth (Struisbaai, De Hoop, St Sebastian Bay), while unaccompanied adult densities peak in Walker Bay and False Bay. The IMMA also contains habitat that supports an important diversity of marine mammal species including the Indian Ocean humpback dolphin and Indo-Pacific bottlenose dolphin.

The South East African Coastal Migration Corridor IMMA extends some 47 060 km² from Cape Agulhas to the Mozambiquan border and serves as the primary migration route for C1 substock of Southern Hemisphere humpback whales (Criterion C3). On their northward migration between June and August, they are driven closer to shore due to the orientation of the coast with the Agulhas Current, whereas

during the southward migration from September to November, they remain further offshore (but generally within 15 km of the coast) utilising the southward flowing Agulhas Current as far west as Knysna. The IMMA also contains habitat that supports an important diversity of marine mammal species including the Indian Ocean humpback dolphin, Common dolphin, Indo-Pacific bottlenose dolphin, Spinner dolphin, Southern Right whale, and killer whale.

There is no overlap of the Reconnaissance Permit Area with these IMMAs as it falls within the area along the West Coast of South Africa that has not yet been assessed.

4. ASSESSMENT OF IMPACTS

For this project, the identification and assessment of impacts relating specifically to the marine ecology cover the four main activity phases (see Table 10 for an outline of the activities in these phases) of the proposed seismic acquisition project, namely:

- Mobilisation Phase
- Operational Phase
- Demobilisation Phase
- Unplanned Activities

4.1 Identification of Impacts

Interaction of these activities with the receiving environment gives rise to a number of environmental aspects, which in turn may result in a single or a number of impacts. The identified aspects and their potential impacts are summarised below, providing also the project phases during which the aspects would occur:

- Increase in underwater and atmospheric noise levels by the seismic vessel, during seismic acquisition, and by support vessels and helicopters
  - Disturbance / behavioural changes of coastal and marine fauna
  - Avoidance of key feeding areas (e.g. Child's Bank, Tripp Seamount and Southeast Atlantic Seamounts)
  - Effects on key breeding areas (e.g. coastal birds and cetaceans)
  - Abandonment of nests (birds) and young (birds and seals)
- Introduction of invasive alien species in the ballast water of the seismic vessel
  - Threats to West Coast ecosystem biodiversity
- Discharge of waste to sea (e.g. deck and machinery space drainage, sewage and galley wastes) from seismic and vessels, and local reduction in water quality
  - Reduced physiological functioning of marine organisms due to the biochemical effects on the water column
  - Increased food source for marine fauna
  - Fish aggregation and increased predator-prey interactions
- Increase in ambient lighting from seismic vessel and support vessels
  - Disorientation and mortality of marine birds
  - Physiological and behavioural effects on marine fauna
  - Fish aggregation and increased predator-prey interactions
- Localised reduction in water quality due to accidental release of fuel into the sea during bunkering and discharge of hydraulic fluid due to pipe rupture
  - Toxic effects on marine biota and reduced faunal health
- Uncontrolled release of oil/gas from the vessels due to vessel accident/collision
  - Toxic effects on marine biota and reduced faunal health
  - Pollution and smothering of coastal habitats
- Accidental loss of equipment
  - Disturbance and damage to seabed habitats
  - Entanglement of marine fauna

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4.2 Application of the Mitigation Hierarchy

A key component of this EMP process is to explore practical ways of avoiding and where not possible to reducing potentially significant impacts of the proposed seismic acquisition activities. The mitigation measures put forward are aimed at preventing, minimising or managing significant negative impacts to as low as reasonably practicable (ALARP). The mitigation measures are established through the consideration of legal requirements, project standards, best practice industry standards and specialist inputs.

The mitigation hierarchy, as specified in International Finance Corporation (IFC) Performance Standard 1, is based on a hierarchy of decisions and measures aimed at ensuring that wherever possible potential impacts are mitigated at source rather than mitigated through restoration after the impact has occurred. Any remaining significant residual impacts are then highlighted and additional actions are proposed. With few exceptions, however, identified impacts were of low to negligible significance with very low or zero potential for further mitigation. In such cases the appropriate project Standards will be used and additional best management practices are proposed.

4.3 Acoustic Impacts of Seismic Surveys on Marine Fauna

The ocean is a naturally noisy place and marine animals are continually subjected to both physically produced sounds from sources such as wind, rainfall, breaking waves and natural seismic noise, or biologically produced sounds generated during reproductive displays, territorial defence, feeding, or in echolocation (see references in McCauley 1994; Duarte *et al.* 2021).

Acoustic cues are thought to be important to many marine animals in the perception of their environment as well as for navigation purposes, predator avoidance, and in mediating social and reproductive behaviour. Anthropogenic sound sources in the ocean can thus be expected to interfere directly or indirectly with such activities thereby affecting the physiology and behaviour of marine organisms (NRC 2003). A comparison of the various noise sources in the ocean is shown in Figure 45.

Of all human-generated sound sources, the most persistent in the ocean is the noise of shipping (Erbe *et al.* 2018, 2019). Depending on size and speed, the sound levels radiating from vessels range from 160 to 220 dB re 1 µPa at 1 m (McCauley 1994; NRC 2003). Especially at low frequencies between 5 to 100 Hz, vessel traffic is a major contributor to noise in the world's oceans, and under the right conditions, these sounds can propagate hundreds of kilometres thereby affecting very large geographic areas (Coley 1994, 1995; NRC 2003; Pidcock *et al.* 2003; Duarte *et al.* 2021).

As the Reconnaissance Permit Area is located within the main offshore shipping routes that pass around southern Africa (Figure 46), the shipping noise component of the ambient noise environment is expected to be significant within and around the proposed 3D acquisition area (OceanMind Limited 2020). For the duration of the survey an exclusion zone would be established around the survey vessel. Given the significant local shipping traffic and relatively strong metocean conditions specific to the area, ambient noise levels are expected to be 90-130 dB re 1 µPa for the frequency range 10 Hz - 10 kHz (SLR Consulting Australia 2020, 2021).

Table 10: Aspects and impacts register relevant to marine fauna

Activity Phase		Activity	Aspect	Potential Impact
Seismic Surveying	Mobilisation Phase	Transit of survey vessels to survey area	Underwater noise levels	Disturbance to marine fauna
			Routine discharge to sea (e.g. deck and machinery space drainage, sewage and galley wastes) and local reduction in water quality	Physiological effect on marine fauna
				Increased food source for marine fauna
				Increased predator - prey interactions
			Vessel Lighting	Disorientation and mortality of marine birds
				Increased predator - prey interactions
			Discharge of ballast water and equipment fouling	Loss of biodiversity due to the introduction of invasive alien species
	Operation Phase	Operation of survey vessels	Increase in underwater noise levels	Disturbance to marine fauna
			Routine discharge of waste to sea (e.g. deck and machinery space drainage, sewage and galley wastes) and local reduction in water quality	Physiological effect on marine fauna
				Increased food source for marine fauna
				Fish aggregation and increased predator - prey interactions
			Increase in ambient lighting	Disorientation and mortality of marine birds
				Increased predator - prey interactions
		Seismic acquisition	Increase in underwater noise levels	Disturbance / behavioural changes to marine fauna
				Physiological effect on marine fauna
				Fish avoidance of key feeding areas
				Reduced fish catch and increased fishing effort
		Operation of helicopters	Increase in noise levels	Avoidance of key breeding areas (e.g. coastal birds and cetaceans)
				Abandonment of nests (birds) and young (birds and seals)
	Demobilisation Phase	Survey vessels leave survey area and transit to port or next destination	Increase in underwater noise levels during transit	Disturbance to marine fauna
			Routine discharge to sea (e.g. deck and machinery space drainage, sewage and galley wastes) and local reduction in water quality during transit	Physiological effect on marine fauna
				Increased food source for marine fauna
				Increased predator - prey interactions
			Increase in noise levels	Avoidance of key breeding areas (e.g. coastal birds and cetaceans)
				Abandonment of nests (birds) and young (birds and seals)
	Unplanned Activities	Collision with survey vessels and equipment	Collison and entanglement with marine fauna	Physiological effect on marine fauna
		Dropped objects / Lost equipment	Increased hard substrate on seafloor	Physical damage to and mortality of benthic species / habitats
				Obstruction to or damage of fishing gear
		Hydrocarbon spills	Release of fuel into sea during bunkering and localised reduction in water quality	Effect on faunal health (e.g. respiratory damage) or mortality (e.g. suffocation and poisoning)

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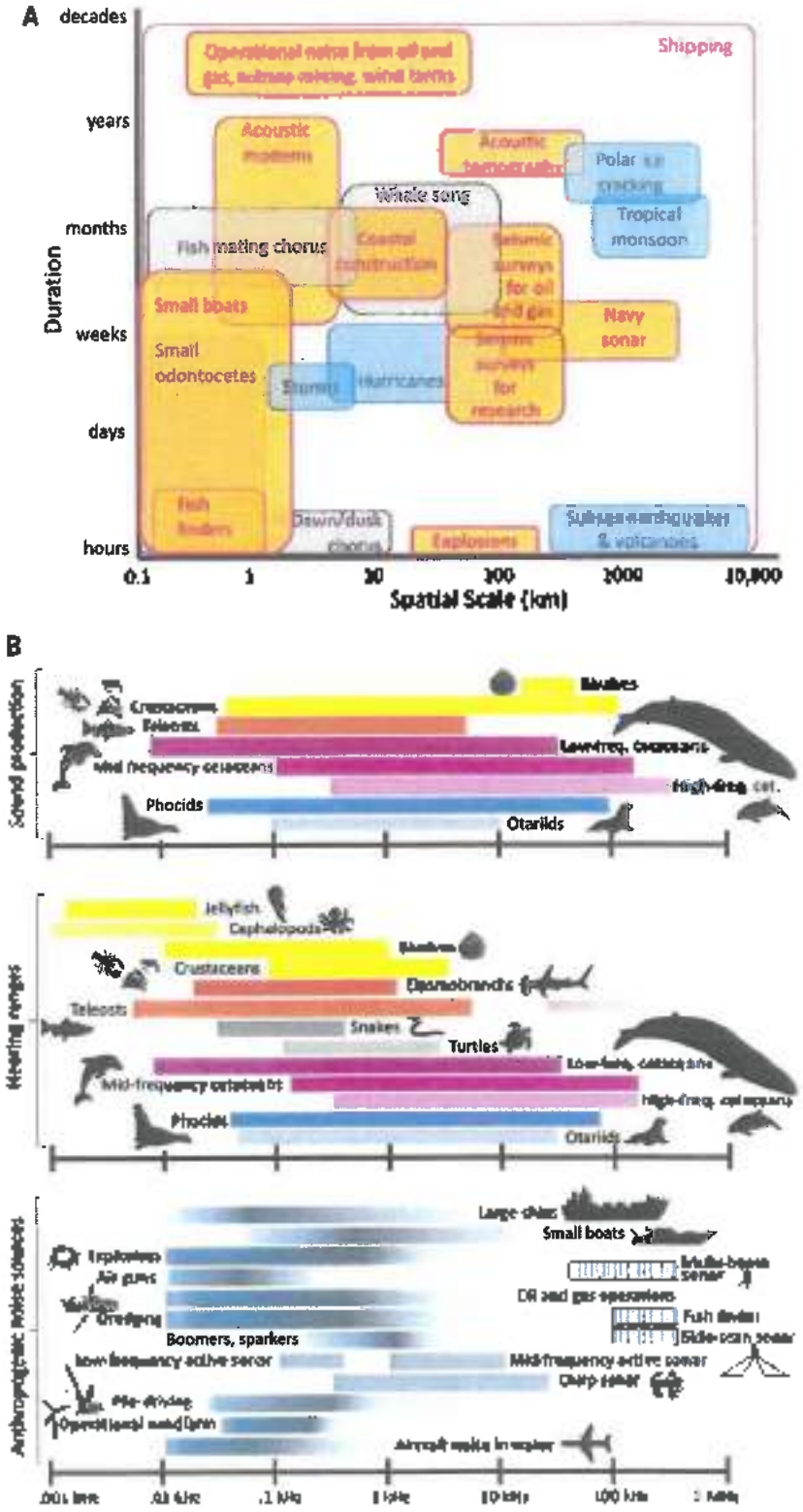

Figure 45: Sources and animal receivers of sound in the ocean. A) Spatial extent and duration of selected sound producing events, and B) Approximate sound production and hearing ranges of marine taxa and frequency ranges of selected anthropogenic sound sources. (Source: Duarte *et al.* 2021).

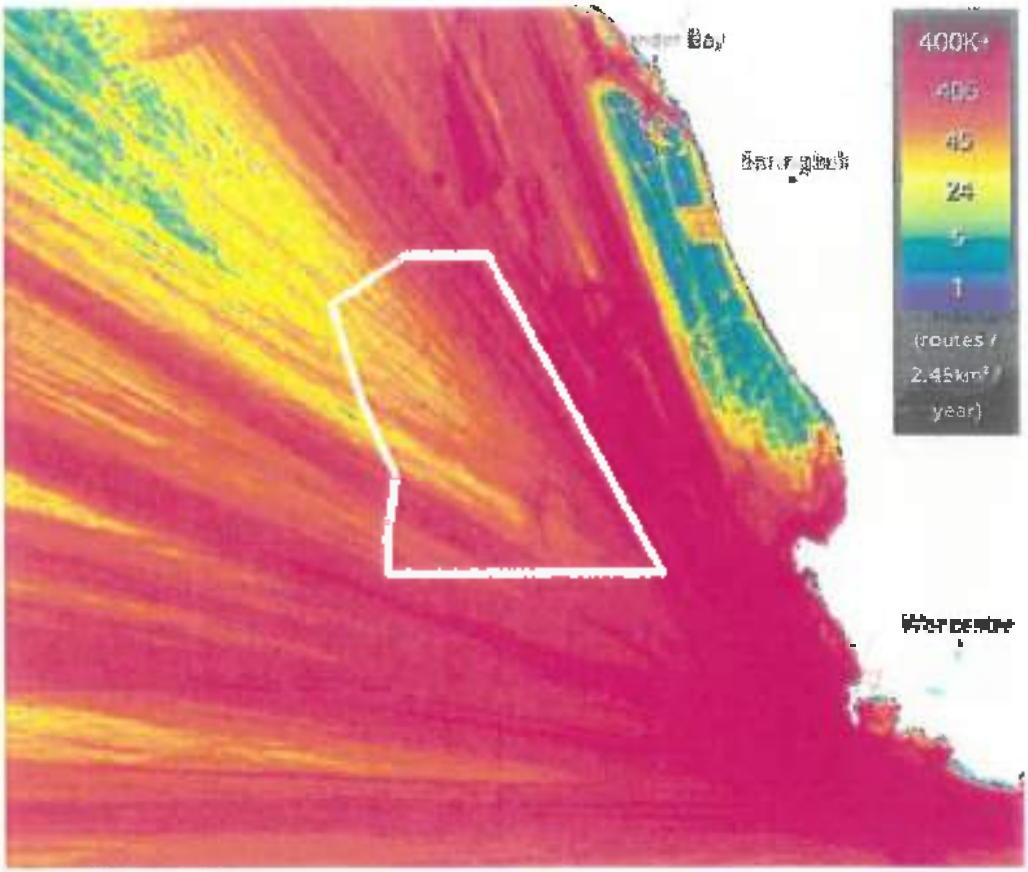

Figure 46: The Reconnaissance Permit Area (cyan polygon) in relation to offshore vessel traffic density (adapted from www.marinetraffic.com/en/ais/home).

The airguns used in modern seismic surveys produce some of the most intense non-explosive sound sources used by humans in the marine environment (Gordon *et al.* 2004), and are the second highest contributor of human-caused underwater noise in total energy output per year (Weilgart 2013). Until the demand for petroleum resources is substantially diminished and renewable energy resources can be adopted on a global scale, or alternatives to seismic surveys are found, seismic surveys will remain a major source of noise in the ocean (Przeslawski *et al.* 2018). However, the transmission and attenuation of seismic sound is probably of equal or greater importance in the assessment of environmental impacts than the produced source levels themselves, as transmission losses and attenuation are very site specific, and are affected by propagation conditions, distance or range, water and receiver depth and bathymetrical aspect with respect to the source array. In water depths of 25 - 50 m airgun arrays are often audible above ambient noise levels to ranges of 50 - 75 km, and with efficient propagation conditions such as experienced on the continental shelf or in deep oceanic water, detection ranges can exceed 100 km and 1 000 km[4], respectively (Bowles *et al.* 1991; Richardson *et al.* 1995; see also references in McCauley 1994). On analysing 10 years of recordings from the Mid-Atlantic Ridge, Nieukirk *et al.* (2012), found that airguns could be heard at distances of 4 000 km from the seismic vessels, and were audible for 80-95% of the time for more than 12 consecutive months in some locations.

[4] Audibility above ambient, however, does not imply impacts resulting in PTS, TTS or behavioural changes.

The signal character of seismic shots also changes considerably with propagation effects. Reflective boundaries include the sea surface, the sea floor and boundaries between water masses of different temperatures or salinities, with each of these preferentially scattering or absorbing different frequencies of the source signal. This results in the received signal having a different spectral makeup from the initial source signal. In shallow water (<50 m) at ranges exceeding 4 km from the source, signals tend to increase in length from <30 milliseconds, with a frequency peak between 10-100 Hz and a short rise time, to a longer signal of 0.25-0.75 seconds, with a downward frequency sweep of between 200 - 500 Hz and a longer rise time (McCauley 1994; McCauley *et al.* 2000).

In contrast, in deep water received levels vary widely with range and depth of the exposed animals, and exposure levels cannot be adequately estimated using simple geometric spreading laws (Madsen *et al.* 2006). These authors found that the received levels fell to a minimum between 5 - 9 km from the source and then started increasing again at ranges between 9 - 13 km, so that absolute received levels were as high at 12 km as they were at 2 km, with the complex sound reception fields arising from multi-path sound transmission.

Acoustic pressure variation is usually considered the major physical stimulus in animal hearing, but certain taxa are capable of detecting either or both the pressure and particle velocity components of a sound (Turl 1993). An important component of hearing is the ability to detect sounds over and above the ambient background noise. Auditory masking of a sound occurs when its' received level is at a similar level to background noise within the same frequencies. The signal to noise ratio required to detect a pure tone signal in the presence of background noise is referred to as the critical ratio.

The auditory thresholds of many species are affected by the ratio of the sound stimulus duration to the total time (duty cycle) of impulsive sounds of <200 millisecond duration. The lower the duty cycle the higher the hearing threshold usually is. Although seismic sound impulses are extremely short and have a low duty cycle at the source, received levels may be longer due to the transmission and attenuation of the sound (as discussed above).

Below follows a brief review of the impacts of seismic surveys on marine faunal communities. This information is largely drawn from McCauley (1994), McCauley *et al.* (2000), the Generic EMPR for Oil and Gas Prospecting off the Coast of South Africa (CCA & CMS 2001) and the very comprehensive review by Cetus Projects (2007), supplemented by more recent peer-reviewed literature available on the WWW. While the discussion and assessments focus primarily on marine mammals, the effects on pelagic and benthic invertebrates, fish, turtles and seabirds are also covered briefly.

The impact assessment table provided in each section provides a summary of the various impacts identified, with the significance rating for the pre-mitigation and residual impacts presenting the worst-case scenario.

4.3.1 Impacts of Seismic Noise on Whales and Dolphins

Source of Impact

The project activities that will result in impacts to marine cetaceans are listed below.

Project phase	Activity
Mobilisation	N/A
Operation	Seismic acquisition/ firing of airguns
Demobilisation	N/A

These activities and their associated aspects are described below:

- Noise generated by airguns during seismic acquisition.

Impact Description

The potential impact of seismic survey noise on whales and dolphins could include physiological injury to individuals, behavioural avoidance of individuals (and subsequent displacement from key habitat), masking of important environmental or biological sounds and indirect effects due to effects on predators or prey.

Project Controls

The operator will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques.

Sensitivity of Receptors

Thirty three species or sub species/populations of cetaceans (whales and dolphins) are known or likely to occur off the West Coast. The majority of migratory cetaceans in South African waters are baleen whales (mysticetes), while toothed whales (odontocetes) may be resident or migratory. Of the 33 species, the blue whale is listed as 'Critically endangered', the fin and sei whales are 'Endangered' and the sperm, Bryde's (inshore) and humpback (B2 ppopulation) whales are considered 'Vulnerable' (South African Red Data list Categories). Due to its location offshore and proximity to important seabed features such as Tripp Seamount, Child's Bank and the Cape Canyon, the sensitivity of migratory cetaceans is thus considered to be HIGH. However, the numbers of individuals encountered during the survey are likely to be low because of the extensive distributions of the various species concerned.

Impact Assessment

Reactions of cetaceans to anthropogenic sounds have been reviewed by McCauley (1994), Richardson *et al.* (1995), Gordon & Moscrop (1996) and Perry (1998). More recently reviews have focused specifically on the effects of sounds from seismic surveys on marine mammals (DFO 2004; NRC 2005; Nowacek *et al.* 2007; Southall *et al.* 2007; Abgrall *et al.* 2008; Stone & Tasker 2006; Stone *et al.* 2017, amongst others).

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The factors that affect the response of marine mammals to sounds in their environment include the sound level and its prevailing acoustic characteristics, the ecological features of the environment in which the animal encounters the sound and the physical and behavioural state of the animal, and the ecological features of the environment in which the animal encounters the sound. When discussing the potential effects of seismic surveys on marine mammals we should bear in mind the lack of data (uncertainty) concerning the auditory capabilities and thresholds of impacts on the different species encountered and the individual variability in hearing thresholds and behavioural responses, which are likely to influence the degree of impact (Luke *et al.* 2009; Gedamke *et al.* 2011). Furthermore, there is growing recognition that the sub-lethal effects of noise disturbance, which are both difficult to identify and measure, are likely to be relatively widespread and may have a greater impact than direct physical injury (Forney *et al.* 2017). Depending on the duration and spatial scale of noise exposure, sub-lethal effects could be either acute (generally short-term and associated with a specific activity) or chronic (longer-term and associated with many overlapping activities). These authors point out that a lack of observed response does not imply an absence of costs such as physiological stress and reduced reproduction, survival or feeding success. Apparent tolerance of disturbance may in fact have population-level impacts that are more subtle and difficult to record with conventional methodologies.

This uncertainty and the variability in hearing thresholds and behavioural responses can have a large influence on how risk to marine mammals is assessed. Assessing the impact of seismic activity on populations off southern Africa is further hampered by a poor understanding of the abundance and distribution of many of the species found here.

Cetacean vocalisations

Cetacean are highly reliant on acoustic channels for orientation in their environment, feeding and social communication (Tyack & Clark 2000). Baleen whales produce a wide repertoire of sounds ranging in frequencies from 12 Hz to 8 kHz (Richardson *et al.* 1995; Erbe *et al.* 2017). Vocalisations may be produced throughout the year (Dunlop *et al.* 2007; Mussoline *et al.* 2012; Vu *et al.* 2012), with peaks in call rates during breeding seasons in some species, most notably humpback whales (Winn & Winn 1978).

Odontocetes produce a spectrum of vocalizations including whistles, pulsed sounds and echolocation clicks (Popper 1980; Erbe *et al.* 2017). Whistles play a key role in social communication, they are concentrated in the 1-30 kHz frequency range but may extend up to 75 kHz (Samarra *et al.* 2010) and contain high frequency harmonics (Lammers *et al.* 2003). The characteristics of burst pulsed sounds are highly variable, concentrated in the mid frequency for killer whales (Richardson *et al.* 1995), but extending well into the ultrasonic frequency range for other dolphin species (Lammers *et al.* 2003). Although most odontocete vocalizations are predominantly in mid and high frequency bands, there are recent descriptions of dolphins producing low frequency moans (150-240 Hz) and low frequency modulated tonal calls (990 Hz) (van der Woude 2009; Simrad *et al.* 2012; Erbe *et al.* 2017), the function of which remains unclear but may be related to social behaviours.

Clicks are high intensity, short sounds associated with orientation and feeding. The frequency composition of echolocation clicks varies with species (Erbe *et al.* 2017). Most delphinids produce broad band echolocation clicks with frequencies which extend well up into the ultra-sonic range > 100 kHz (Richardson *et al.* 1995). Sperm whales produce broadband echolocation clicks reaching up to 40 kHz in frequency (Backus & Schevill 1966; Madsen *et al.* 2002a, 2002b). Neonatal sperm whales produce lower frequency sounds at 300-1700 Hz (Madsen *et al.* 2003). Porpoise, Kogiids and dolphins

in the genus *Cephalorhynchus* (including the Heaviside's dolphin) produce characteristic narrow band, high frequency (NBHF) echolocation clicks with a central frequency around 125 kHz (Madsen *et al.* 2005a; Morisaka *et al.* 2011). Beaked whales produce low frequency sounds (Richardson *et al.*, 1995) and mid frequency echolocation clicks, burst pulse vocalisations and frequency modulated pulses with energy concentrated at 10 kHz and above (Madsen *et al.* 2005b; Rankin *et al.* 2011).

Cetacean hearing

Cetacean hearing has received considerable attention in the international literature, and available information has been reviewed by several authors including Popper (1980), Fobes & Smock (1981), Schusterman (1981), Ridgway (1983), Watkins & Wartzok (1985), Johnson (1986), Moore & Schusterman (1987) and Au (1993).

Marine mammals as a group have wide variations in ear anatomy, frequency range and amplitude sensitivity. The hearing threshold is the amplitude necessary for detection of a sound and varies with frequency across the hearing range (Nowacek *et al.* 2007). Hearing thresholds differ between odontocetes and baleen whales, and between individuals, resulting in different levels of sensitivity to sounds at varying frequencies. For most species, hearing sensitivity corresponds closely to the frequencies at which they vocalise, however it is likely that hearing range is broader than vocalisation range (Bradley & Stern 2008). Consequently, baleen whale hearing is centred at below 1 kHz (Fleischer 1976, 1978; Norris & Leatherwood 1981), while toothed whale and dolphin hearing is centred at frequencies of between 10 and 100 kHz (Richardson *et al.* 1995). The combined information strongly suggests that baleen whales are likely to be most sensitive to sounds from 10's of Hz to around 10 kHz (Southall *et al.* 2007), while toothed whale and dolphin hearing is centred at frequencies of between 10 and 100 kHz (Richardson *et al.* 1995).

Behavioural and electrophysical audiograms are available for several species of small- to medium-sized toothed whales (killer whale: Hall & Johnson 1972; Bain *et al.* 1993, false killer whale: Thomas *et al.* 1988, bottlenose dolphins: Johnson 1967, beluga: White *et al.* 1978; Awbrey *et al.* 1988, Harbour porpoise: Andersen 1970, Chinese river dolphin: Ding Wang *et al.* 1992 and Amazon river dolphin: Jacobs & Hall 1972; Risso's dolphin: Nachtigall *et al.* 1995, 1996, Harbour porpoise: Lucke *et al.* 2009). In these species, hearing is centered at frequencies between 10 and 100 kHz (Richardson *et al.* 1995). The high hearing thresholds at low frequency for those species tested implies that the low frequency component of seismic shots (10 - 300 Hz) will not be audible to the small to medium odontocetes at any great distance. However, the higher frequency of an airgun array shot, which can extend to 15 kHz and above (Madsen *et al.* 2006) may be audible from tens of kilometres away, due to the very low sensitivity thresholds of many toothed whales at frequencies exceeding 1 kHz. For example, Sarnocińska *et al.* (2020) reported a decrease in echolocation signals of harbour porpoise in response to airgun signals 6-12 km away, potentially indicating temporary displacement from the area or changes in foraging behaviour (but see also Pirotta *et al.* 2014; Thompson *et al.* 2013).

No psycho-acoustical or electrophysical work on the sensitivity of baleen whales to sound has been conducted (Richardson *et al.* 1995) and hypotheses regarding the effects of sound in baleen whales are extrapolations from what is known to affect odontocetes or other marine mammals and from observations of behavioural responses. A partial response "audiogram" exists for the gray whale based on the avoidance of migrating whales to a pure tone source (Dahlheim & Ljungblad 1990). Humpback whales in the wild have been reported to detect sounds ranging from 10 Hz to 10 kHz at levels of 102 to 106 dB re 1 µPa (Frankel *et al.* 1995, in Perry 1998; Frankel & Clark 2000). Blue whales and Blainville's beaked reduce calling in the presence of mid-frequency sonar (1-8 kHz)

providing evidence that they are receptive to sound in this range (Melcón *et al.* 2012; McCarthy *et al.* 2011), and evidence exists for changes in humpback whale vocalisation in response to low-frequency sonar as much as 200 km away (Miller *et al.* 2000; Risch *et al.* 2012).). Based on the low frequency calls produced by larger toothed whales, and anatomical and paleaontological evidence for baleen whales, it is predicted that these whales hear best in the low frequencies (Fleischer 1976, 1978; McCauley 1994), with hearing likely to be most acute below 1 kHz (Fleischer 1976, 1978; Norris & Leatherwood 1981). The available information demonstrates that the larger toothed whales and baleen whales will be very receptive to the sound produced by seismic airgun arrays and consequently this group may be more affected by this type of disturbance than smaller toothed whales (Morton & Symonds 2002; Nowacek *et al.* 2007).

Overlap between the frequency spectra of seismic shots and the hearing threshold curve with frequency for some toothed whale species, suggests that these may react to seismic shots at long ranges, but that hearing damage from seismic shots is only likely to occur at close range. They will thus not be affected as severely as many fish, and possibly sea turtles and baleen whales that have their greatest hearing sensitivity at low frequencies (McCauley 1994).

Physiological injury and stress

Exposure to high sound levels can result in physiological injury to cetaceans through a number of avenues, including shifts of hearing thresholds (as either PTS or TTS) (Richardson *et al.* 1995; Au *et al.* 1999; Schlundt *et al.* 2000; Finneran *et al.* 2000, 2001, 2002, 2003), tissue damage (Lien *et al.* 1993; Ketten *et al.* 1993), acoustically induced decompression sickness particularly in beaked whales (Crum & Mao 1996; Cox *et al.* 2006), and non-auditory physiological effects including elevated blood pressures, increased heart and respiration rates, and temporary increases in blood catecholamines and glucocorticoids (Bowles & Thompson 1996), which may have secondary impacts on reproduction. Most studies conducted on sound-related injuries in cetaceans, however, investigated the effects of explosive pulses (Bohne *et al.* 1985, 1986; Lien *et al.* 1993; Ketten *et al.* 1993) and mid-frequency sonar pulses (Simmonds & Lopez-Jurado 1991; Crum & Mao 1996; Frantzis 1998; Balcomb & Claridge 2001; Evans & England 2001; Jepson *et al.* 2003; Cox *et al.* 2006), and the results are thus not directly applicable to non-explosive seismic sources such as those from airgun arrays.

Both PTS and TTS represent actual changes in the ability of an animal to hear, usually at a particular frequency, whereby it is less sensitive at one or more frequencies as a result of exposure to sound (Nowacek *et al.* 2007). Southall *et al.* (2007) propose a dual criterion for assessing injury from noise based on the peak sound pressure level (SPL) and sound exposure level (SEL) (a measure of injury that incorporates the sound pressure level and duration), with the one that is exceeded first used as the operative injury criterion. For a pulsed sound source such as that generated during seismic seabed surveys, the maximum levels for PTS are 230 dB re:1 µPa (peak) and 203 re:1 µPa2-s for SPL and SEL respectively for the various marine mammal functional hearing groups (Table 11). For TTS these values are 226 dB re:1 µPa (peak) and 188 dB re:1 µPa2-s for SPL and SEL, respectively. There is thus a range at which permanent or temporary hearing damage might occur, although some hearing damage may already occur when received levels exceed 1 838 dB re:1 µPa2-s SEL. The behavioural disruptive threshold for impulsive noise for all functional groups is root-mean-square (RMS) SPL of 160 dB re 1µPa (NMFS 2013).

Table 11: The Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS) levels for marine mammal functional hearing groups exposed to either single or multiple impulsive noise events within a 24-h period (Southall *et al.* 2019).

Marine mammal hearing group	PTS and TTS threshold levels - impulsive noise events			
	Injury (PTS) onset		TTS onset	
	Pk SPL, dB re 1µPa	Weighted SEL_{24h}, dB re 1µPa²·s	Pk SPL, dB re 1µPa	Weighted SEL_{24h}, dB re 1µPa²·s
Low-frequency cetaceans (mysticetes: southern right, humpback, sei, fin, blue, Bryde's, minke)	219	183	213	168
High-frequency cetaceans (odontocetes: dolphins, toothed, beaked, and bottle nose whales)	230	185	224	170
Very high-frequency cetaceans (Heaviside's dolphins, dwarf and pygmy sperm whales)	202	155	196	140
Sirenians (dugongs, manatees)*	226	203	220	175
Phocid carnivores in water (true seals)*	218	185	212	170
Other marine carnivores in water (sea lions, fur seals)	232	203	226	188

* do not occur in Orange Basin

Based on statistical simulations accounting for uncertainty in the available data and variability in individual hearing thresholds, Gedamke *et al.* (2011) conclude that the possibility of seismic activity leading to TTS in baleen whales must be considered at distances up to several kilometers. As cetaceans are highly reliant on sound, hearing damage leading to TTS and PTS is likely to result in a reduction in foraging efficiency, reproductive potential, social cohesion and ability to detect predators (Weilgart 2007). Results of the sound modelling study for the present survey are presented later.

Noise induced stress resulting from exposure to sources of marine sound can cause detrimental changes in blood hormones, including cortisol (Romano *et al.* 2004). The timing of the stressor relative to seasonal feeding and breeding cycles (such as those observed in migrating baleen whales) may influence the degree of stress induced by noise exposure (Tyack 2008). However, quantifying stress caused by noise in wild populations is difficult as it is not possible to determine the physiological responses of an animal to a noise stressor based on behavioural observations alone (Wright *et al.* 2007). It can, however, negatively affect reproduction, immune systems, growth, health, and other important life functions (Rolland *et al.* 2012; Lemos *et al.* 2021). One recent study was able to identify a reduction in stress-related faecal hormone metabolites (glucocorticoids) in North Atlantic right whales concurrent with a 6 dB reduction in shipping noise. This study provided the first evidence that exposure to low-frequency ship noise may be associated with chronic stress in whales (Rolland *et al.* 2012).

Behavioural disturbance

The factors that affect the response of marine mammals to sounds in their environment include the sound level and other properties of the sound, the physical and behavioural state of the animal and its prevailing acoustic characteristics, and the ecological features of the environment in which the animal encounters the sound. The responses of cetaceans to noise sources are often also dependent on the perceived motion of the sound source, as well as the nature of the sound itself. For example, many whales are more likely to tolerate a stationary source than they are one that is approaching them (Watkins 1986; Leung-Ng & Leung 2003), or are more likely to respond to a stimulus with a sudden onset than to one that is continuously present (Malme *et al.* 1985).

The speed of sound increases with increasing temperature, salinity and pressure (Richardson *et al.* 1995) and stratification in the water column affects the rate of propagation loss of sounds produced by an airgun array. As sound travels, acoustic shadow and convergence zones may be generated as sound is refracted towards areas of slower sound speed. These can lead to areas of high and low noise intensity (shadow zones) so that exposure to different pulse components at distances of 1-13 km from the seismic source does not necessarily lessen (attenuate) with increasing range. In some cases this can lead to received levels at 12 km being as high as those at 2 km (Madsen *et al.* 2006). Depending on the propagation conditions of the water column, animals may need to move closer to the sound source or apply vertical rather than horizontal displacement to reduce their exposure, thus making overall avoidance of the sound source difficult. Although such movement may reduce received levels in the short-term it may prolong the overall exposure time and accumulated SEL (Madsen *et al.* 2006). Results of the sound modelling study for the present survey are presented later.

Typical behavioural response in cetaceans to seismic airgun noise include initial startle responses (Malme *et al.* 1985; Ljungblad *et al.* 1988; McCauley *et al.* 2000), changes in surfacing behaviour (Ljungblad *et al.* 1988; Richardson *et al.* 1985a; McCauley *et al.* 1996, 2000), shorter dives (Ljungblad *et al.* 1988; Robertson *et al.* 2013; Dunlop *et al.* 2015), changes in respiration rate (Ljungblad *et al.* 1988; Richardson *et al.* 1985a, 1985b; Malme *et al.* 1983, 1985,1986), slowing of travel (Malme *et al.* 1983, 1984; Dunlop *et al.* 2015, 2017a, 2017b), and changes in vocalisations (McDonald *et al.* 1993, 1995; Castellote *et al.* 2012; Sarnocińska *et al.* 2020) and call rate (Di Iorio & Clarke 2010; Blackwell *et al.* 2013, 2015). These subtle changes in behavioural measures are often the only observable reaction of whales to reception of anthropogenic stimuli, and there is no evidence that these changes are biologically significant for the animals (see for example McCauley 1994). Possible exceptions are impacts at individual (through reproductive success) and population level through disruption of feeding within preferred areas (Western gray whales: Weller *et al.* (2002); blue whales: Goldbogen *et al.* 2013; Friedlaender *et al.* 2016; sperm whales: Farmer *et al.* 2018; harbour porpoise: Sarnocińska *et al.* 2020). For continuous noise, whales begin to avoid sounds at exposure levels of 110 dB, and more than 80% of species observed show avoidance to sounds of 130 dB re:1µPa. For seismic noise, most whales show avoidance behaviour above 160 dB re:1µPa (Malme *et al.* 1983, 1984; Ljungblad *et al.* 1988; Pidcock *et al.* 2003), with displacement from the noise impacted area potentially persisting for an extended period (Yazvenko *et al.* 2007; Castellote *et al.* 2012).. Behavioural responses are often evident beyond 5 km from the sound source (Ljungblad *et al.* 1988; Richardson *et al.* 1986, 1995; NMFS 2013; Kavanagh *et al.* 2019; Sarnocińska *et al.* 2020), with the most marked avoidance response recorded by Kolski and Johnson (1987) who reported bowhead whales swimming rapidly away from an approaching seismic vessel at a 24 km distance. More recently, basin-wide effects of seismic surveys on cetacean sightings and calling behaviour have been reported (Blackwell *et al.* 2015; Kavanagh *et al.* 2019; Kyhn *et al.* 2019; see also Nieukirk *et al.* 2012).

In an analysis of marine mammals sightings recorded from seismic survey vessels in United Kingdom waters, Stone (2003) reported that responses to large gun seismic activity varied between species, with small odontocetes showing the strongest avoidance response (Stone 2003; Stone & Tasker 2006). Responses of medium and large odontocetes (killer whales, pilot whales and sperm whales) were less marked, with sperm whales showing no observable avoidance effects (see also Rankin & Evans 1998; Davis *et al.* 2000; Madsen *et al.* 2006), but may be affected at greater ranges than currently regulated due to subtle effects on their foraging behaviour (Miller *et al.* 2009; Farmer *et al.* 2018). Baleen whales showed fewer responses to seismic survey activity than small odontocetes, and although there were no effects observed for individual baleen whale species, fin and sei whales were less likely to remain submerged during firing activity. All baleen whales showed changes in behavioural responses further from the survey vessel (see also Ljungblad *et al.* 1988; McCauley 2000; Abgrall *et al.* 2008), and both orientated away from the vessel and altered course more often during shooting activity. The author suggests that different species adopt different strategies in response to seismic survey disturbance, with faster smaller odontocetes fleeing the survey area (e.g. Weir 2008; van Beest *et al.* 2018), while larger slower moving baleen whales orientate away from and move slowly from the firing guns, possibly remaining on the surface as they do so (see also Richardson *et al.* 1985a, 1985b, 1986, 1995). Responses to small airguns were less, and although no difference in distance to firing and non-firing small airguns were recorded, there were fewer sightings of small odontocetes in association with firing airguns. Other reports suggest that there is little effect of seismic surveys on small odontocetes such as dolphins (e.g. Pirotta *et al.* 2014; Thompson *et al.* 2013; van Beest *et al.* 2018), as these have been reported swimming near or riding the bow-waves of operating seismic vessels (Duncan 1985; Evans & Nice 1996; Abgrall *et al.* 2008; but see also Schlundt *et al.* 2000). Recent evidence has, however, shown that for small, localised odontocete populations exhibiting high site fidelity, displacement away from the ensonified area may itself pose a biological risk. Although the consequences of displacement are poorly understood, they likely include increased stress and reduce foraging success, with associated effects on survival and reproduction (Forney *et al.* 2017).

McCauley *et al.* (1996, 2000) found no obvious evidence that humpback whales were displaced by 2D and 3D seismic surveys and no apparent gross changes in the whale's migratory path could be linked to the seismic survey (but see Dunlop *et al.* 2016, 2017). Localised avoidance of the survey vessel during airgun operation was however noted within 4 km of the source at levels over 130 re 1 $\mu Pa^2 s^{-1}$ (Dunlop *et al.* 2017a, 2018) as was a reduction in social interactions among whales (Dunlop *et al.* 2020). Whales which are not migrating but using the area as a calving or nursery ground may be more seriously affected through disturbance of suckling or resting. Potential avoidance ranges of 7-12 km by nursing animals and >4 km for migrating humpbacks have been suggested, although these might differ in different sound propagation conditions (McCauley *et al.* 2000; Dunlop *et al.* 2017a, 2017b; Ellison *et al.* 2018). Base on the noise exposure criteria of RMS SPL 160 dB re 1µPa provided by Popper *et al.* (2014), the sound transmission loss modelling study undertaken for the current project (SLR 2022) identified that for 3D acquisition, the maximum horizontal threshold distance from the source to impact behavioural threshold levels for marine mammals was 3.8 km. Disturbance of mating behaviour (which could involve a high degree of acoustic selection) by seismic noise could be of consequence to breeding animals.

Masking of important environmental or biological sounds

Potential interference of seismic emissions with acoustic communication in cetaceans includes direct masking of the communication signal, temporary or permanent reduction in the hearing capability of the animal through exposure to high sound levels or limited communication due to behavioural

changes in response to the seismic sound source. Masking can both reduce the range over which the signals can be heard and the quality of the signal's information (Weilgart *et al.* 2007). Marked differences occur in the hearing of baleen whales and toothed whales and dolphins. The vocalisation and estimated hearing range of baleen whales (centred at below 1 kHz) overlap the highest peaks of the power spectrum of airgun sounds and consequently these animals may be more affected by disturbance from seismic surveys (Nowacek *et al.* 2007). Whales may respond to masking by calling more frequently, calling louder, calling less frequently (Weilgart *et al.* 2007a, 2007b; Cholewiak *et al.* 2018) or showing no change in calling behaviour (Madsen *et al.* 2002). For example, it has been reported that blue whales called consistently more on days when seismic exploration was taking place, presumably to compensate for the elevated ambient noise levels (Di Iorio & Clarke 2010). More recently, Blackwell *et al.* (2013, 2015) determined that bowhead whales increased calling rates as soon as airgun pulses were detectable, with calling rates leveling off at a received cumulative SEL of ~94 dB re 1 μPa^2, but decreasing once $CSEL_{10\text{-min}}$ exceeded ~127 dB re 1 μPa^2 and ceasing altogether when $CSEL_{10\text{-min}}$ values were above ~160 dB re 1 μPa^2. Similarly, Cerchio *et al.* (2014) reported decreased singing activity in humpbacks off Northern Angola in response to increasing seismic noise, with possible implications on breeding displays by males, which in turn could result in decreased reproductive success).

The masking effect of seismic pulses might be reduced by their intermittent production. However, the length of seismic pulses increases with distance from the source, thereby increasing the potential to cause masking at range (Gordon *et al.* 2004). Toothed whales vocalise at much higher frequencies of between 10 and 100 kHz, and it is likely that clicks are not masked by seismic survey noise (Goold & Fish 1998). However, due to multi-path propagation, receivers (cetaceans) can be subject to several versions of each airgun pulse, which have very different temporal and spectral properties (Madsen *et al.* 2006). High frequency sound is released as a by-product of airgun firing and this can extend into the mid- and high-frequency range (up to and exceeding 15 kHz) so that the potential for masking of these sound sources should also be considered (Madsen *et al.* 2006).

Indirect effects on prey species

Exposure to seismic airguns can cause hearing damage to fish (reviewed in Popper & Schilt 2008) and several studies have linked seismic exploration with short-term reductions in fish abundance and changes in distribution away from the seismic survey area (Engås *et al.* 1995; Slotte *et al.* 2004). The majority of baleen whales will undertake little feeding within breeding ground waters and rely on blubber reserves during their migrations. Therefore they may not be affected by changes in fish distribution. Although the fish and cephalopod prey of toothed whales and dolphins may be affected by seismic surveys, impacts will be highly localised and small in relation to the feeding ranges of cetacean species, but cumulative impacts within species ranges must be considered.

Consequence of Impact

Marked differences occur in the hearing of baleen whales (mysticete cetaceans) and toothed whales and dolphins (odontocete cetaceans). The vocalisation and estimated hearing range of baleen whales (centred at below 1 kHz) overlap the highest peaks of the power spectrum of airgun sounds and consequently these animals may be more affected by disturbance from seismic surveys (Nowacek *et al.* 2007). In contrast, the hearing of toothed whales and dolphins is centred at frequencies of between 10 and 100 kHz, suggesting that these may react to seismic shots at long ranges, but that hearing damage from seismic shots is only likely to occur at close range. Mysticete and odontocete cetaceans are thus assessed separately below.

Physiological injury

There is little information available on the levels of noise that would potentially result in physiological injury to cetaceans, and no permanent threshold shifts have been recorded. Available information suggests that the animal would need to be in close proximity to operating airguns to suffer physiological injury, and being highly mobile it is assumed that they would avoid sound sources at distances well beyond those at which injury is likely to occur. Deep-diving cetacean species (e.g. sperm whales) may, however, be more susceptible to acoustic injury, particularly in the case of seafloor-focussed seismic surveys, where the downward focussed impulses could trap deep diving cetaceans within the survey pulse, as escaping towards the surface would result in exposure to higher sound level pulses.

Due to the high level of impulsive signal emissions from the array source, marine mammals are predicted to experience a PTS at close proximity to the source array due to the immediate exposure to individual pulses. The Underwater Noise Modelling Study undertaken for the proposed 3D survey area in the Orange Basin (SLR 2022) identified that the low-frequency cetaceans expected to occur in the Reconnaissance Permit Area (e.g. southern right, humpback, fin, sei, blue, Bryde's, minke) were predicted to experience PTS effects within approximately 45 m from the 3D source array, at all assessed water depth scenarios, with the the zone of TTS due to a single pulse exposure predicted within approximately 90 m from the source array (Table 12). High-frequency cetaceans (e.g. sperm, killer and beaked whales and the diversity of dolphins) and very high frequency cetaceans (e.g. pygmy sperm whale and dwarf sperm whale) were expected to experience PTS within approximately 21 m from the source array and 325 m from the source array, respectively (Table 12). The maximum threshold distance for TTS onset for very-high frequency cetaceans occurs within 650 m from the array source.

Among marine mammals expected to occur in the Reconnaissance Permit Area, low-frequency cetaceans have the highest zones of PTS and TTS impact from multiple pulses (i.e. the maximum horizontal perpendicular distances from assessed survey lines to cumulative impact threshold levels). The zones of PTS impact are predicted to range up to 340 m from the adjacent survey lines for the typical 24-hour survey operation scenario considered, with the maximum zones of TTS impact for low frequency cetaceans predicted to be around 5 050 m from the adjacent survey lines (Table 12) (SLR 2022). It must be kept in mind that the cumulative zones of impact are conservative, and that being highly mobile, whales and dolphins are thus likely to have moved considerable distances over the cumulative 24-hr period. Cumulative effects would only be expected where the animals do not move away from the area, e.g. from specific coastal areas used as calving sites or from mid-ocean focal sites such as Child's Bank and Tripp Seamount.

For high-frequency cetaceans it was predicted that the cumulative PTS and TTS onset criteria for the 24-hour survey operation scenario would not to be reached (Table 12). In the case of very high frequency cetaceans, the zones of PTS impact for the cumulative scenario are predicted to range up to 40 m from the adjacent 3D survey lines, for the typical 24-hour survey operation scenario considered, with the zones of TTS impact predicted to range to 1 200 m from the adjacent 3D survey lines (Table 12).

The majority of baleen whales migrate to the southern African subcontinent to breed during winter months. Humpback whales migrating north strike the coast at varying places mostly north of St Helena Bay resulting in increasing whale density on shelf waters and into deeper pelagic waters as one moves northwards, but no clear migration 'corridor'. The northern migration would begin passing through

the project area around April, continuing through to September/October when the southern migration begins and continues through to January/February. Southern right whales arrive in coastal waters in June, building up to a maximum in August/September and departing again in November. The Orange Basin thus lies within the migration paths of humpback and southern right whales, but well offshore of inshore coastal areas frequented by southern right whales for mating and breeding. As the survey is proposed for the summer months (December to May) encounters with migrating whales should be minimal, although some humpbacks on their return journey in November/December and those remaining on the summer feeding grounds off Cape Columbine may still be encountered. However, the survey is likely to frequently encounter resident odontocetes such as common dolphin, Risso's dolphin and pilot whales, which are present year-round, and may encounter sperm whales, particularly in winter.

Table 12: Zones of immediate and cumulative impact from single and multiple pulses for PTS and TTS for the marine mammal groups likely to occur in the Orange Basin area (from Lewis 2022).

Marine mammal hearing group	Zones of impact - maximum horizontal distances from source to impact threshold levels (from single 3D pulses)		Zones of impact - maximum horizontal perpendicular distances from assessed 3D survey lines to cumulative impact threshold levels	
	Injury (PTS) onset	TTS onset	Injury (PTS) onset	TTS onset
Low-frequency cetaceans (mysticetes: southern right, humpback, sei, fin, blue, Bryde's, minke)	45 m	90 m	340 m	5050 m
High-frequency cetaceans (odontocetes: dolphins, toothed whales (e.g. sperm), beaked whales, bottle-nose whales)	21 m	27 m	-	-
Very High-Frequency cetaceans (Heaviside's dolphins, pygmy sperm and dwarf sperm whale	325 m	650 m	40 m	1 200 m
Other marine carnivores in water (sea lions, fur seals)	19 m	24 m	-	-

Note: a dash indicates the threshold is not applicable.

Although the current distribution of the offshore population of Bryde's whales is located inshore of the proposed 3D survey area (Harris et al. 2022), it may be encountered in the inshore portions of the survey area in the Orange Basin during the summer survey period as its seasonality on the West Coast is opposite to the majority of the balaenopterids with abundance likely to be highest in the broader project area in January - March.

Assuming the survey is scheduled so as to avoid the key migration period (early June to late November), there would be a low likelihood of encountering migrating humpback and southern right whales, but a high likelihood of encountering offshore Bryde's whales. The impact of potential physiological injury to mysticete and odontocete cetaceans as a result of seismic sounds is thus

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deemed to be of HIGH intensity. Furthermore, as the duration of the impact would be limited to the IMMEDIATE-TERM (1.5 months) and be restricted to the survey area (REGIONAL), the potential for physiological injury is therefore considered to be of MEDIUM consequence for resident mysticetes and odontocetes.

Behavioural disturbance

Avoidance of seismic survey activity by cetaceans, particularly mysticete species, begins at distances where levels of approximately 150 to 180 dB are received. More subtle alterations in behaviour may occur at received levels of 120 dB. The Underwater Noise Modelling Study undertaken for the proposed 3D survey area (SLR 2022) identified that the zones of behavioural disturbance for cetaceans caused by the immediate exposure to individual pulses was within 3.8 km from the 3D array source, assuming a SPL criteria of 160 dB re 1µPa. Although behavioural avoidance of seismic noise in the proposed survey area by baleen whales is highly likely, such avoidance is generally considered of minimal impact in relation to the distances of migrations of the majority of baleen whale species.

The timing of the survey relative to seasonal breeding cycles (such as those observed in migrating baleen whales) may influence the degree of stress induced by noise exposure (Tyack 2008). Displacement from critical habitat is particularly important if the sound source is located at an optimal feeding or breeding ground or areas where mating, calving or nursing occurs. For example, persistent disturbance of foraging behaviour in response to seismic noise can result in reductions in relative fitness of reproductive female Sperm whales leading to abortions and calf abandonment (Farmer *et al.* 2018), with mid-frequency sonars shown to reduced foraging efficiency in blue whales (Goldbogen *et al.* 2013). Species that feed intensively within a season and depend on dense prey concentrations can therefore experience significant population consequences, which in turn may pose significant risks to the recovery rates of endangered populations. Based on this knowledge, Norway has since 2019, recommended that seismic activity be restricted in areas and periods with intensive feeding of baleen whales (Sivle *et al.* 2021).

The survey area overlaps with the migration routes of humpback whales to and from their breeding grounds. The survey area is located well offshore of the coastal migration route for southern right whales. Although encounter rates peak in migration periods, humpback whales are found off the West Coast year round. For other species, the paucity of fine scale data from offshore waters on the distribution and seasonal occurrence of most cetacean species prevents prediction where such critical habitat might be with any certainty. Other baleen whale species are also found year round or have seasonal occurrences, although not well known, but existing data shows year-round presence of mysticetes. However, if the survey is scheduled to occur outside of the main winter northward and southward migration periods (June and November), interactions with migrating whales should be low.

Of greater concern than general avoidance of migrating whales is avoidance of critical breeding habitat or area where mating, calving or nursing occurs. The humpback whales have their winter breeding concentrations off tropical west Africa, between Angola and the Gulf of Guinea and therefore over 1 000 km to the north-east of the proposed 3D survey area in the Orange Basin. Southern right whales currently have their most significant winter concentrations on the South Coast of South Africa between Port Elizabeth and Cape Town but are seen regularly off the southern half of Namibia, and would therefore pass along the West Coast. However, as the survey area is located in excess of 200 km offshore, there should be no overlap with potential coastal nursery areas for this species.

Assuming the survey is scheduled so as to avoid the key northward and southward migration periods (early June and late November, respectively), there is a low likelihood of encountering migrating humpback whales. However, due to the increasing numbers of southern right and humpback whales year round off the southern African West Coast and the Bryde's whales with migration periods opposite to the typical winter migrations, the potential impact of behavioural avoidance of seismic survey areas by mysticete cetaceans is considered to be of HIGH intensity (resident species), across the Reconnaissance Permit Area (REGIONAL) and for the duration of the survey (IMMEDIATE - 1.5 months). Considering the distribution ranges of most species of cetaceans, the impact of seismic surveying in the Orange Basin is considered of MEDIUM consequence for both migrating mysticetes and for resident whales, or Bryde's whales that show seasonality opposite to most balaenopterids.

Information available on behavioural responses of toothed whales and dolphins to seismic surveys is more limited than that for baleen whales. No seasonal patterns of abundance are known for odontocetes occupying the proposed 3D survey area but several species are considered to be year-round residents. Furthermore, a number of toothed whale species have a more pelagic distribution thus occurring further offshore, with species diversity and encounter rates likely to be highest on the shelf slope. The impact of seismic survey noise on the behaviour of toothed whales is considered to be of HIGH intensity across the proposed survey area (REGIONAL) and for the duration of the survey (IMMEDIATE - 1.5 months). The overall consequence will however not vary between species, and will be MEDIUM.

Masking of important environmental or biological sounds

Baleen whales appear to vocalise almost exclusively within the frequency range of the maximum energy of seismic survey noise, while toothed whales vocalise at frequencies higher than these. As the by-product noise in the mid- and high frequency range (up to and exceeding 15 kHz) can travel far (at least 8 km), masking of communication sounds produced by whistling dolphins and blackfish[5] is likely (Madsen *et al.* 2006). In the migratory baleen whale species, vocalisation increases once they reach the breeding grounds and on the return journey in November/December when accompanied by calves. Although most mother-calf pairs tend to follow a coastal route southwards, there is no clear migration corridor and humpbacks can be spread out widely across the shelf and into deeper pelagic waters. Vocalisation of southward migrating whales may thus potentially be regionally comparatively high on commencement of operations in December, reducing thereafter. However, masking of communication signals is likely to be limited by the low duty cycle of seismic pulses. Should the survey overlap with the key migration and breeding period when there is a high likelihood of encountering migrating Humpback whales (including possible mother-calf pairs) and no other mitigation measures are in place, the intensity of impacts on baleen whales is likely to be HIGH (mother-calf pairs) over the survey area (REGIONAL) and IMMEDIATE-TERM duration (1.5 months), and of MEDIUM intensity (species specific) in the case of toothed whales over the survey area (REGIONAL) and duration (IMMEDIATE - 1.5 months). The consequence for both mysticetes and odontocets would be MEDIUM.

Indirect impacts due to effects on prey

As with other vertebrates, the assessment of indirect effects of seismic surveys on resident odontocete cetaceans is limited by the complexity of trophic pathways in the marine environment.

[5] The term blackfish refers to the delphinids: melon-headed whale, killer whale, pygmy killer whale, false killer whale, long-finned pilot whale, short-finned pilot whale

Although the fish and cephalopod prey of toothed whales and dolphins may be affected by seismic surveys, impacts will be highly localised and small in relation to the feeding ranges of cetacean species. Although the majority of baleen whales will undertake little feeding within breeding-ground waters along the southern African west coast and rely on blubber reserves during their migrations there is increasing evidence that some species (fin whales, southern rights and humpbacks) are using upwelling areas off the South African West Coast as summer feeding grounds. The upwelling zone off Cape Columbine has become an important summer feeding area, and baleen whales have been reported to feed inshore of the Reconnaissance Permit area between St Helena Bay and Cape Town. Any indirect effects on their food source would thus be of VERY LOW intensity over the survey area (REGIONAL) and duration (IMMEDIATE - 1.5 months) and therefore of VERY LOW consequence. In the case of odontocetes, the broad ranges of prey species (in relation to the avoidance patterns of seismic surveys of such prey species) suggest that indirect impacts due to effects on prey would similarly be of LOW intensity over the survey area (REGIONAL) and duration (IMMEDIATE - 1.5 months) and therefore of VERY LOW consequence.

Impact Significance

Physiological injury and mortality

The potential impact of seismic noise on physiological injury of mysticetes and odontocetes, considering their high sensitivity, the high probability of the impact occurring and the medium consequence, is deemed to be of **MEDIUM** significance.

Behavioural avoidance

The potential impact of seismic noise on behevioural changes in mysticetes and odontocetes, considering their high sensitivity, the high probability of the impact occurring and the medium consequence, is deemed to be of **MEDIUM** significance.

Masking of Sounds and Communication

The potential impact of seismic noise on the masking of environmental sounds and communications in mysticetes and odontocetes, considering their high sensitivity, the high probability of the impact occurring and the medium consequence, is deemed to be of **MEDIUM** significance.

Indirect impacts due to effects on predators or prey

The potential indirect impact of seismic noise on food sources of mysticetes and odontocetes, considering their high sensitivity, the low likelihood of the impact occurring and the very low consequence, is thus deemed to be of **VERY LOW** significance.

Identification of Mitigation Measures

No.	Mitigation Measure	Classification
1. Survey Planning		
1.1	Plan seismic surveys to avoid movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (June to November inclusive), and their aggregation on the summer feeding grounds between St Helena Bay and Dassen Island from late October to late December and ensure that migration paths are not blocked by seismic operations. If possible the survey should be undertaken from North to South to avoid these feeding aggregations.	Avoid
1.2	Plan survey, as far as possible, so that the first commencement of airgun firing in a new area (including gun tests) is undertaken during daylight hours.	Abate on site
1.3	Prohibit airgun use (including airgun tests) outside of the area of operation (which includes line turns undertaken outside the Reconnaissance Permit area).	Avoid
1.4	Although a seismic vessel and its gear may pass through a declared Marine Protected Area, acoustic sources (airguns) must not be operational during this transit.	Avoid
2. Key Equipment		
2.1	**Passive Acoustic Monitoring (PAM)**	
2.1.1	Ensure the seismic vessel is fitted with Passive Acoustic Monitoring (PAM) technology, which detects some animals through their vocalisations.	Abate on site
2.1.2	As the survey area would largely be in waters deeper than 1 000 m where sperm whales and other deep-diving odontoceres are likely to be encountered, implement the use of PAM 24-hr a day when the sound source are in operation.	Abate on site
2.1.3	Ensure the PAM streamer is fitted with at least four hydrophones, of which two are HF and two LF, to allow directional detection of cetaceans.	Abate on site
2.1.4	Ensure the PAM hydrophone streamer is towed in such a way that the interference of vessel noise is minimised.	Abate on site
2.1.5	Ensure spare PAM hydrophone streamers (e.g. 4 heavy tow cables and 6 hydrophone cables) are readily available in the event that PAM breaks down, in order to ensure timeous redeployment.	Abate on site
2.2	**Acoustic Source**	
2.2.1	Define and enforce the use of the lowest practicable airgun volume for production, and design arrays to maximise downward propagation, minimise horizontal propagation and minimise high frequencies in airgun pulses.	Abate on site
2.2.2	Ensure a display screen for the acoustic source operations is provided to the marine observers. All information relating to the activation of the acoustic source and the power output levels must be readily available to support the observers in real time via the display screen and to ensure that operational capacity is not exceeded.	Abate on site
2.2.3	Ensure the ramp-up noise volumes do not exceed the production volume.	Abate on site

No.	Mitigation measure	Classification
2.3	**Streamers**	
2.3.1	Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'.	Abate on site
2.3.2	Ensure that solid streamers rather than fluid-filled streamers are used to avoid leaks.	Avoid
3.	**Key Personnel**	
3.1	• Make provision for the placing of a qualified MMOs on board the seismic vessel. As a minimum, one must be on watch during daylight hours for the pre-shoot observations and when the acoustic source is active. • The duties of the MMO would be to: – Provide effective regular briefings to crew members, and establish clear lines of communication and procedures for onboard operations; – Record airgun activities, including sound levels, "soft-start" procedures and pre-firing regimes; – Observe and record responses of marine fauna to seismic shooting from optimum vantage points, including seabird, large pelagic fish (e.g. shoaling tuna, sunfish, sharks), turtle, seal and cetacean incidence and behaviour and any mortality or injuries of marine fauna as a result of the seismic survey. Data captured should include species identification, position (latitude/longitude), distance/bearing from the vessel, swimming speed and direction (if applicable) and any obvious changes in behaviour (e.g. startle responses or changes in surfacing/diving frequencies, breathing patterns) as a result of the seismic activities. Both the identification and the behaviour of the animals must be recorded accurately along with current seismic sound levels. Any attraction of predatory seabirds, large pelagic fish or cetaceans (by mass disorientation or stunning of fish as a result of seismic survey activities) and incidents of feeding behaviour among the hydrophone streamers should also be recorded; – Record sightings of any injured or dead marine mammals, large pelagic fish (e.g. sharks), seabirds and sea turtles, regardless of whether the injury or death was caused by the seismic vessel itself. If the injury or death was caused by a collision with the seismic vessel, the date and location (latitude/longitude) of the strike, and the species identification or a description of the animal should be recorded and included as part of the daily report; – Record meteorological conditions at the beginning and end of the observation period, and whenever the weather conditions change significantly; – Request the delay of start-up or temporary termination of the seismic survey or adjusting of seismic shooting, as appropriate. It is important that MMO decisions on the termination of firing are made confidently and expediently, and following dialogue between the observers on duty at the time. A log of all termination decisions must be kept (for inclusion in both daily and "close-out" reports);	Abate on site

No.	Mitigation measure	Classification
	– Use a recording spreadsheet (e.g. JNCC, 2017) in order to record all the above observations and decisions; and – Prepare daily reports of all observations, to be forwarded to the necessary authorities as required, in order to ensure compliance with the mitigation measures.	
3.2	• Make provision for placing of a qualified PAM operator on board the seismic vessel. As a minimum, one must be on "watch" during the pre-shoot observations and when the acoustic source is active. • The duties of the PAM operator would be to: – Provide effective regular briefings to crew members, and establish clear lines of communication and procedures for onboard operations; – Ensure that the hydrophone cable is optimally placed, deployed and tested for acoustic detections of marine mammals; – Confirm that there is no marine mammal activity within 500 m of the airgun array prior to commencing with the "soft-start" procedures; – Record species identification, position (latitude/longitude), distance and bearing from the vessel and acoustic source, where possible; – Record general environmental conditions; – Record airgun activities, including sound levels, "soft-start" procedures and pre-firing regimes; and – Request the delay of start-up and temporary termination of the seismic survey, as appropriate.	Abate on site
3.3.	Ensure MMOs and PAM operators are briefed on the area-specific sensitivities and on the seismic survey planning (including roles and responsibilities, and lines of communication).	Abate on site
4. Airgun testing		
4.1	Maintain a pre-shoot watch of 60-minutes before any instances of airgun testing. If only a single lowest power airgun is tested, the pre-shoot watch period can be reduced to 30 minutes.	Avoid / Abate on site
4.2	Implement a "soft-start" procedure if testing multiple higher powered airguns. • The "soft-start" should be carried out over a time period proportional to the number of guns being tested and not exceed 20 minutes; airguns should be tested in order of increasing volume. • If testing all airguns at the same time, a 20 minute "soft-start" is required. • If testing a single lowest power airgun a "soft-start" is not required.	Avoid / Abate on site

No.	Mitigation measure	Classification
5. Pre-Start Protocols		
5.1	Implement a dedicated MMO and PAM pre-shoot watch of at least 60 minutes (to accommodate deep-diving species in water depths greater than 200 m).	Avoid / Abate on site
5.2	Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source if: • during daylight hours it is confirmed: – visually by the MMO during the pre-shoot watch (60 minutes) that there are no cetaceans within 500 m of the seismic source, and – by PAM technology that there are no vocalising cetaceans detected in the 500 m mitigation zone. • during times of poor visibility or darkness it is confirmed by PAM technology that no vocalising cetaceans are present in the 500 m[6] mitigation zone during the pre-shoot watch (60 minutes).	Avoid / Abate on site
5.3	Delay "soft-starts" if cetaceans are observed within the mitigation zone. • A "soft-start" should not begin until 30 minutes after cetaceans depart the 500 m mitigation zone or 30 minutes after they are last seen or acoustically detected by PAM in the mitigation zone.	Avoid / Abate on site
5.4	As noted above for planning, when arriving at the survey area for the first time, survey activities should, as far as possible, only commence during daylight hours with good visibility. However, if this is not possible due to prolonged periods of poor visibility (e.g. thick fog) or unforeseen technical issue which results in a night-time start, the initial acoustic source activation (including gun tests) may only be undertaken if the normal 60-minute PAM pre-watch and "soft-start" procedures have been followed.	Avoid / Abate on site
5.5	Schedule 'soft-starts' so as to minimise, as far as possible, the interval between reaching full power operation and commencing a survey line. The period between the end of the soft start and commencing with a survey line must not exceed 20 minutes. If it does exceed 20 minutes, refer to breaks in firing below.	Abate on site

[6] As noted in the text above, the cumulative effects would only be expected where the animals are known to congregate and do not move away from the area, e.g. from specific coastal areas used as calving sites or from mid-ocean focal sites such as Tripp Seamount. As Tripp Seamount is approximately 50 km to the north of the survey area cumulative effects from multiple pulses would not be expected. Thus, the discussion here focuses on the maximum zone of impact from a single seismic pulse. Although for the most sensitive hearing group (very high frequency cetaceans) the maximum zone of impact from a single seismic pulse is 270 m for PTS onset and 500 m for TTS onset, the recommended mitigation zone is 500 m. This is due to the VHF signal attenuating rapidly and the likelihood of picking up VHF on PAM at a distance of beyond 500 m is very low. Thus, although VHF cetaceans may experience TTS at a distance of up to 500 m at full power, this is unlikely when implementing the soft-start procedure, where the airgun source is under reduced operating pressure conditions, and consequently has lower noise emissions, thereby providing animals the opportunity to leave the area. As such, the zones of impact during the soft start process are predicted to be less than the full-power operation condition. As an example, under a reduced operating pressure of 1 000 PSI, the noise emissions from the airgun array source are approximately 6 dB lower than from the full-power operation, and the resulted zones of impact are estimated to be approximately half of those zones assessed under the full-power operation condition (SLR 2022).

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No.	Mitigation measure	Classification
6. Line turns		
6.1	If line changes are expected to take longer than 40 minutes: • Terminate airgun firing at the end of the survey line and implement a pre-shoot search (60 minutes) and "soft-start" procedure (20 minutes) when approaching the next survey line. • If line turn is shorter than 80 minutes (i.e. shorter than a 60-minute pre-shoot watch and 20-minute "soft-start" combined), the pre-shoot watch can commence before the end of the previous survey line.	Abate on site
6.2	If line changes are expected to take less than 40 minutes, airgun firing can continue during the line change if: • The power is reduced to 180 cubic inches (or as close as is practically feasible) at standard pressure. Airgun volumes of less than 180 cubic inches can continue to fire at their operational volume and pressure; • The Shot Point Interval (SPI) is increased to provide a longer duration between shots, with the SPI not to exceed 5 minutes; • The power is increased and the SPI is decreased in uniform stages during the final 10 minutes of the line change (or geophone repositioning), prior to data collection re-commencing (i.e. a form of mini soft start); and • Normal MMO and PAM observations continue during this period when reduced power airgun is firing.	Abate on site
7. Shut-Downs		
7.1	Terminate seismic shooting on: • observation and/or detection of cetaceans within the 500 m mitigation zone. • observation of any obvious mortality or injuries to cetaceans when estimated by the MMO to be as a direct result of the survey.	Abate on site
7.2	• For cetaceans, terminate shooting until such time as there has been a 30 minute delay from the time the animal was last sighted within the mitigation zone before the commencement of the normal soft start procedure.	Abate on site
8. Breaks in Airgun Firing		
8.1	If after breaks in firing, airguns can be restarted within 5 minutes, no soft-start is required and firing can recommence at the same power level provided no marine mammals have been observed or detected in the mitigation zone during the break-down period.	Abate on site
8.2	For all breaks in airgun firing of longer than 5 minutes, but less than 20 minutes, implement a "soft-start" of similar duration, assuming there is continuous observation by the MMO and PAM operator during the break.	Abate on site
8.3	For all breaks in firing of 20 minutes or longer, implement a 60-minute pre-shoot watch and 20-minute "soft-start" procedure prior to the survey operation continuing.	Abate on site
8.4	For planned breaks, ensure that there is good communication between the seismic contractor and MMOs and PAM operators in order for all parties to be aware of these breaks and that early commencement of pre-watch periods can be implemented to limit delays.	Abate on site

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No.	Mitigation measure	Classification
9. PAM malfunctions		
9.1	If the PAM system malfunctions or becomes damaged during night-time operations or periods of low visibility, continue operations for 30 minutes without PAM if no marine mammals were detected by PAM in the mitigation zones in the previous 2 hours, while the PAM operator diagnoses the issue. If after 30 minutes the diagnosis indicates that the PAM gear must be repaired to solve the problem, reduce power to 180 cubic inches. Firing of the reduced power gun may continue for 30 minutes while PAM is being repaired, the last 10 minutes of which is a ramp up to full power (mini "soft-start"). If the PAM diagnosis and repair will take longer than 60 minutes, stop surveying until such time as a functional PAM system can be redeployed and tested.	Abate on site
9.2	If the PAM system breaks down during daylight hours, continue operations for 20 minutes without PAM, while the PAM operator diagnoses the issue. If the diagnosis indicates that the PAM gear must be repaired to solve the problem, operations may continue for an additional 2 hours without PAM monitoring as long as: • No marine mammals were detected by PAM in the mitigation zones in the previous 2 hours; • Two MMOs maintain watch at all times during operations when PAM is not operational; and • The time and location in which operations began and stop without an active PAM system is recorded.	Abate on site

Residual Impact Assessment

The potential impacts cannot be eliminated due to the nature of the seismic sound source required during surveying. The proposed mitigation measures, which are essentially designed to keep animals out of the immediate area of impact and thereby reduce the risk of deliberate injury to marine mammals would reduce the intensity of most impacts to medium, and the residual impacts will reduce to low consequence and LOW significance, except for the effects on prey which remains of VERY LOW significance.

Potential impact of seismic noise to mysticete and odontocete cetaceans

1	*Impacts of seismic noise on mysticetes and odontocetes*	
Project Phase:	**Operation**	
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Sensitivity of Receptor	**High**	
	Pre-Mitigation Impact	**Residual Impact**
Consequence	**MEDIUM**	**LOW**
Intensity	**High**	**Medium**
Extent	**Regional**	**Regional**
Duration	**Immediate**	**Immediate**
Significance	**MEDIUM**	**LOW**
Probability	**Highly Likely**	**Possible**
Confidence	**High**	**High**
Reversibility	**Fully Reversible**	**Fully Reversible**
Loss of Resources	**Moderate**	**Low**
Mitigation Potential		**Medium**
Cumulative potential	**Unlikely**	**Unlikely**

4.3.2 Impacts of Seismic Noise on Seals

Source of Impact

The project activities that will result in impacts to seals are listed below.

Project phase	activity
Mobilisation	**N/A**
Operation	**Seismic acquisition/ firing of airguns**
Demobilisation	**N/A**

These activities and their associated aspects are described below:

- Noise generated by airguns during seismic acquisition.

Impact Description

The potential impact of seismic survey noise on seals could include physiological injury to individuals, behavioural avoidance of individuals (and subsequent displacement from key habitat), masking of important environmental or biological sounds and indirect effects due to effects on predators or prey. The Cape fur seal that occurs off the West Coast forages over the continental shelf to depths of over 200 m and is thus unlikely to be encountered in the Reconnaissance Permit Area (see Figure 37).

FCDS

Project Controls

The operator will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques.

Sensitivity of Receptors

Seals occur at numerous breeding and non-breeding sites on the mainland, namely at Buchu Twins and Cliff Point near Alexander Bay, Robeiland near Kleinzee, Strandfontein Point, Elephant Rocks, at various emergent reefs around Cape Columbine, Robbesteen near Duynefontein and at Duikerklip and Seal Island on the Cape Peninsula. Seals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles (~220 km) offshore, with bulls ranging further out to sea than females. Seals are therefore unlikely to be encountered in the proposed 3D survey area. Their sensitivity to the proposed seismic operations is considered to be LOW. However, considering the recent mass mortality of seals along much of the South and West Coasts, every precaution should be taken to avoid further stresses to these populations.

Consequence of Impact

Physiological injury or mortality

Underwater behavioural audiograms have been obtained for two species of Otariidae (sea lions and fur seals), but no audiograms have been measured for Cape fur seals. Extrapolation of these audiograms to below 100 Hz would result in hearing thresholds of approximately 140-150 dB re 1 µPa for the California sea lion and well above 150 dB re 1 µPa for the Northern fur seal. The range of greatest sensitivity in fur seals lies between the frequencies of 2-32 kHz (McCauley 1994). Underwater critical ratios have been measured for two northern fur seals and averaged ranged from 19 dB at 4 kHz to 27 dB at 32 kHz. The audiograms available for otariid pinnipeds suggest they are less sensitive to low frequency sounds (<1 kHz) than to higher frequency sounds (>1 kHz). The range of low frequency sounds (30-100 Hz) typical of seismic airgun arrays thus falls below the range of greatest hearing sensitivity in fur seals. This generalisation should, however, be treated with caution as no critical ratios have been measured for Cape fur seals.

Seals produce underwater sounds over a wide frequency range, including low frequency components. Although no measurement of the underwater sounds have been made for the Cape fur seal, such measurements have been made for a con-generic species *Arctocephalus philippii*, which produced narrow-band underwater calls at 150 Hz. Aerial calls of seals range up to 6 Hz, with the dominant energy in the 2-4 kHz band. However, these calls have strong tonal components below 1 kHz, suggesting some low frequency hearing capability and therefore some susceptibility to disturbance from the higher frequency components of seismic airgun sources (Goold & Fish 1998; Madsen *et al.* 2006).

The physiological effects of loud low frequency sounds on seals are not well documented, but include cochlear lesions following rapid rise time explosive blasts (Bohne *et al.* 1985; 1986), TTS following exposure to octave-band noise (frequencies ranged from 100 Hz to 2000 Hz, octave-band exposure levels were approximately 60-75 dB, while noise-exposure periods lasted a total of 20-22 min) (Kastak *et al.* 1999), with recovery to baseline threshold levels within 24 h of noise exposure. Due to the high level of impulsive signal emissions from seismic arrays, seals are predicted to experience a PTS at close proximity to the sound source due to the immediate exposure to individual pulses.

Using measured discomfort and injury thresholds for humans, Greenlaw (1987) modelled the pain threshold for seals and sea lions and speculated that this pain threshold was in the region of 185 - 200 dB re 1 µPa. The impact of physiological injury to seals from seismic noise is deemed to be low as it is assumed that highly mobile creatures such as fur seals would avoid severe sound sources at levels below those at which discomfort occurs. However, noise of moderate intensity and duration may be sufficient to induce TTS under water in pinniped species (Kastak *et al.* 1999), as individuals did not appear to avoid the survey area. Reports of seals swimming within close proximity of firing airguns should thus be interpreted with caution in terms of the impacts on individuals as such individuals may well be experiencing hearing threshold shifts. Their tendency to swim at or near the surface will, however, expose them to reduced sound levels when in close proximity to an operating airgun array.

The Underwater Noise Modelling Study undertaken for the current project (Lewis 2022) identified that for seals (Other Marine Carnivores in water) PTS and TTS were predicted to occur within only 19 m and 24 m of the 3D array, respectively (Table 12). Maximum threshold distance for recoverable injury and TTS from multiple pulses was not reached.

The potential impact of physiological injury to seals as a result of seismic noise is deemed to be of HIGH intensity and would be limited to the survey area (REGIONAL), although injury could extend beyond the survey duration. As seals are known to forage up to 120 nautical miles (~220 km) offshore, the proposed 3D survey area falls well to the west of the foraging range of seals from all of the West Coast colonies. Furthermore, as the duration of the impact would be limited to the IMMEDIATE-TERM (1.5 months) and be restricted to the survey area (REGIONAL), the potential physiological injury is therefore considered to be of MEDIUM consequence.

Behavioural avoidance

Information on the behavioural response of fur seals to seismic exploration noise is lacking (Richardson *et al.* 1995; Gordon *et al.* 2004). Reports of studies conducted with Harbour and Grey seals include initial startle reaction to airgun arrays, and range from partial avoidance of the area close to the vessel (within 150 m) (Harris *et al.* 2001) to fright response (dramatic reduction in heart rate), followed by a clear change in behaviour, with shorter erratic dives, rapid movement away from the noise source and a complete disruption of foraging behaviour (Gordon *et al.* 2004). In most cases, however, individuals quickly reverted back to normal behaviour once the seismic shooting ceased and did not appear to avoid the survey area. Seals seem to show adaptive responses by moving away from airguns and reducing the risk of sustaining hearing damage. Potential for long-term habitat exclusion and foraging disruption over longer periods of exposure (i.e. during full-scale surveys conducted over extended periods) is however a concern.

Cape fur seals generally appear to be relatively tolerant to noise pulses from underwater explosives, which are probably more invasive than the slower rise-time seismic sound pulses. There are also reports of Cape fur seals approaching seismic survey operations and individuals biting hydrophone streamers (CSIR 1998). This may be related to their relative insensitivity to sound below 1 kHz and their tendency to swim at or near the surface, exposing them to reduced sound levels. It has also been suggested that this attraction is a learned response to towed fishing gear being an available food supply.

Although partial avoidance (to less than 250 m) of operating airguns has been recorded for some seal species, Cape fur seals appear to be relatively tolerant to loud noise pulses and, despite an initial startle reaction, individuals quickly reverted back to normal behaviour. The potential impact of seal foraging behaviour changing in response to seismic surveys is thus considered to be of VERY LOW

intensity as they are known to show a tolerance to loud noises. Furthermore, as the duration of the impact would be limited to the IMMEDIATE-TERM (1.5 months) and be restricted to the survey area (REGIONAL), the potential for behavioural avoidance of seals is considered to be of VERY LOW consequence.

Masking of environmental sounds and communication

The use of underwater sounds for environmental interpretation and communication by Cape fur seals is unknown, although masking is likely to be limited by the low duty cycle of seismic pulses (37.5 m interval between consecutive shot-points for 3D). The potential impact of masking of sounds and communication in seals due to seismic surveys is considered to be of VERY LOW intensity as they are known to show a tolerance to loud noises. As the duration of the impact would be limited to the IMMEDIATE-TERM (1.5 months) and be restricted to the survey area (REGIONAL), the potential for masking of sounds is considered to be of VERY LOW consequence.

Indirect effects due to the effects of seismic sounds on prey species

As with other vertebrates, the assessment of indirect effects of seismic surveys on Cape fur seals is limited by the complexity of trophic pathways in the marine environment. The impacts are difficult to determine, and would depend on the diet make-up of the species (and the flexibility of the diet), and the effect of seismic surveys on the diet species. Seals typically forage on small pelagic shoaling fish prey species that occur inshore of the 200 m depth contour or associated with oceanic features such as Child's Bank. Furthermore, the broad ranges of fish prey species (in relation to the avoidance patterns of seismic surveys of such prey species) and the extended foraging ranges of Cape fur seals suggest that indirect impacts due to effects on predators or prey would be of VERY LOW intensity, would be limited to the IMMEDIATE-TERM (1.5 months) and be restricted to the survey area (REGIONAL). The potential for effects of seismic surveys on prey species is thus considered to be of VERY LOW consequence.

Impact Significance

Physiological injury and mortality

The potential impact of seismic noise on physiological injury or mortality of seals, considering their low sensitivity, the very low likelihood of the impact occurring and the medium consequence, is deemed to be of LOW significance.

Behavioural avoidance

The potential impact of seismic noise on behavioural changes in seals, considering their low sensitivity, the very low likelihood of the impact occurring and the very low consequence, is deemed to be of VERY LOW significance.

Masking of Sounds and Communication

The potential impact of seismic noise on the masking of environmental sounds and communications in seals, considering their low sensitivity, the very low likelihood of the impact occurring and the very low consequence, is deemed to be of VERY LOW significance.

Indirect impacts due to effects on predators or prey

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The potential indirect impact of seismic noise on food sources of seals, considering their low sensitivity, the very low likelihood of the impact occurring and the very low consequence, is thus deemed to be of VERY LOW significance.

Identification of Mitigation Measures

In addition to the mitigation measures recommended for cetaceans, the following is recommended for seals:

No	Mitigation measure	Implementation
1	Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source if during daylight hours it is confirmed visually by the MMO during the pre-shoot watch (60 minutes) that there are no seals within 500 m of the seismic source.	Avoid / Abate on site
2	In the case of fur seals being observed within the mitigation zone, which may occur commonly around the vessel, delay "soft-starts" for at least 10 minutes until it has been confirmed that the mitigation zone is clear of all seal activity. However, if after a period of 10 minutes seals are still observed within 500 m of the airguns, the normal "soft-start" procedure should be allowed to commence for at least a 20-minute duration. Seal activity should be carefully monitored during "soft-starts" to determine if they display any obvious negative responses to the airguns and gear or if there are any signs of injury or mortality as a direct result of the seismic activities.	Avoid / Abate on site
3	Terminate seismic shooting on observation of any obvious mortality or injuries to seals when estimated by the MMO to be as a direct result of the survey.	Abate on site

Residual Impact Assessment

With the implementation of the typical 'soft-start' procedures, the residual impacts of physiological injury and mortality reduce to VERY) LOW significance. All other impacts on seals would all remain NEGLIGIBLE.

2	*Impacts of seismic noise on seals*	
Project Phase:	**Operation**	
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Sensitivity of Receptor	**Low**	
	Pre-Mitigation Impact	**Residual Impact**
Consequence	**MEDIUM**	**LOW**
Intensity	High	Medium
Extent	Regional	Regional
Duration	Immediate	Immediate
Significance	**LOW**	**VERY LOW**

	Pre-Mitigation Impact	Residual Impact
Probability	Unlikely	Unlikely
Confidence	High	High
Reversibility	Fully Reversible	Fully Reversible
Loss of Resources	Low	Low
Mitigation Potential	-	Medium
Cumulative potential	Unlikely	Unlikely

4.3.3 Impacts of Seismic Noise on Turtles

Source of Impact

The project activities that will result in impacts to turtles are listed below.

Project phase	Activity
Mobilisation	N/A
Operation	Seismic acquisition/ firing of airguns
Demobilisation	N/A

These activities and their associated aspects are described below:

- Noise generated by airguns during seismic acquisition;

Impact Description

The potential effects of seismic surveys on turtles include:

- Physiological injury (including disorientation) or mortality from seismic noise;
- Behavioural avoidance of seismic survey areas;
- Masking of environmental sounds and communication; and
- Indirect impacts due to effects on predators or prey.

Project Controls

The seismic contractor will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques.

Sensitivity of Receptors

The leatherback and loggerhead turtles that occur in offshore and coastal waters around southern Africa, and likely to be encountered in the Reconnaissance Permit area are considered regionally 'Critically Endangered' and 'Endangered', respectively, in the List of Marine Threatened or Protected Species (TOPS) as part of the NEMBA. Following nesting in December-January, loggerhead turtles migrate back to their foraging grounds along the East and South Coasts (Harris *et al.* 2018). Hatchlings of both species emerge from their nests from mid-January to mid-March with most dispersing south-westward within the Agulhas Current (Le Gouvello *et al.* 2020). The Agulhas Current migration corridor will therefore be very active with migrating sea turtles between January and April (Harris *et al.* 2018), some of which may be distributed along the West Coast through mass transport of Agulhas

Current water into the southeast Atlantic by warm core rings (Figure 47). Despite their extensive distributions and feeding ranges, the numbers of adult and neonate turtles encountered in the Reconnaissance Permit Area may therefore be seasonally high, particularly in the Child's Bank and Orange Shelf Edge MPAs, and the Orange Seamount and Canyon Complex transboundary EBSA, which may be frequented by leatherbacks on their migrations. Consequently, the sensitivity of turtles to seismic noise is considered to be HIGH, particularly neonates and juveniles as they are unable to actively avoid seismic sounds and consequently are more susceptible to seismic noise.

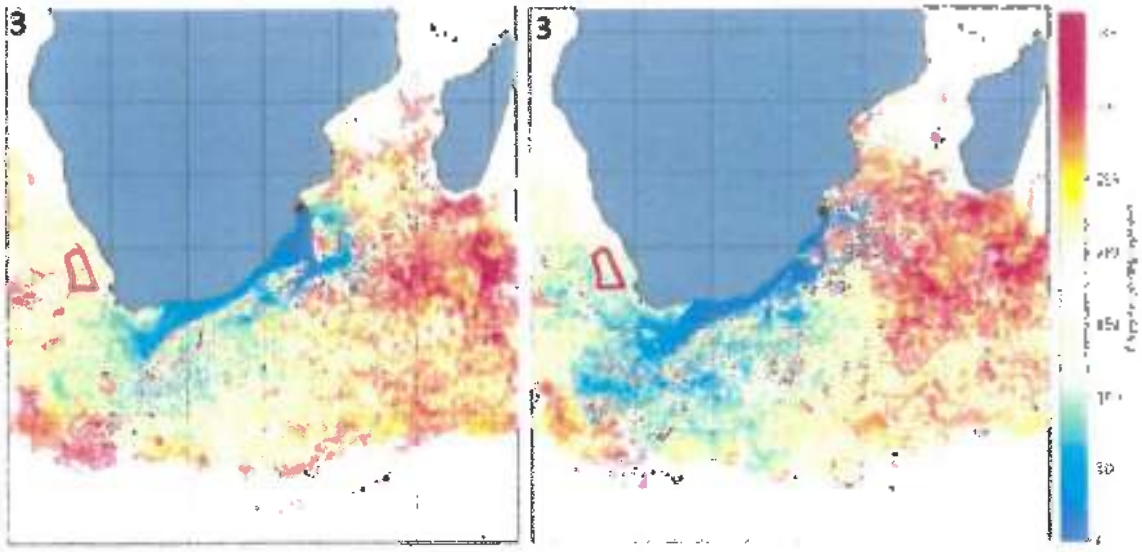

Figure 47: Virtual hatchling trajectories for loggerhead (left) and leatherback (right) turtles after 365 days (48 hr @0.15 m/s then no swim) in relation to Reconnaissance Permit Area (red polygon) (adapted from Le Gouvello *et al.* 2020).

Consequence of Impact

Available data on marine turtle hearing is limited, but suggest highest auditory sensitivity at frequencies of 250 - 700 Hz, and some sensitivity to frequencies at least as low as 60 Hz (Ridgway *et al.* 1969; Wever *et al.* 1978, in McCauley 1994; O'Hara & Wilcox, 1990; Moein-Bartol *et al.* 1999). More recent studies using electrophysiological and behavioural techniques have found that turtles can detect frequencies between 50 Hz and 1 600 Hz (Bartol & Ketten 2006; Lavender *et al.* 2014; Martin *et al.* 2012; Dow-Piniak *et al.* 2012a, 2012b; Papale *et al.* 2020), indicating that their hearing ranges overlap with the peak amplitude, low frequency sound emitted by seismic airguns (10-500 Hz; DeRuiter & Larbi Doukara 2012; Parente *et al.* 2006). The overlap of this hearing sensitivity with the higher frequencies produced by airguns, suggest that turtles may be considerably affected by seismic noise (see review by Nelms *et al.* 2016), although what effect this may have on their fitness or survival is not known.

Physiological injury (including disorientation) or mortality

Due to a lack of research, it is not known what levels of sound exposure (or frequencies) would cause permanent or temporary hearing loss or what effect this may have on the fitness or survival of turtles (DeRuiter & Larbi Doukara 2012), although Eckert *et al.* (1998) assumed physiological effects at levels of 190 dB re 1 µPa ref 1 m, while Popper *et al.* (2014) have predicted that mortality or potential

mortal injury will occur at peak sound pressure levels of over 207 dB re 1 µPa. Evidence, however, suggests that turtles only detect airguns at close range (<10 m) or are not sufficiently mobile to move away from approaching airgun arrays (particularly if basking). Initiation of a sound source at full power in the immediate vicinity of a diving, swimming or basking turtle would thus be expected to result in physiological injury. This applies particularly to hatchlings and juveniles as they are unable to avoid seismic sounds whilst being transported in the ocean currents, and consequently are more susceptible to seismic noise. For the first few months following emergence, hatchlings are reported to spend most of their time in the upper 5 m of the water column (Salmon *et al.* 2004; Howell *et al.* 2010; Mansfield *et al.* 2014). Juveniles in contract appear to spend most of their time diving to depths, spending only 43% of their time at the surface during the day and 29% of the time at the surface during the night (Freitas *et al.* 2018, 2019). Both hatchlings and juveniles would therefore be particularly susceptible to airguns at close range.

If subjected to seismic sounds at close range, temporary or permanent hearing impairment may result, but it is unlikely to cause death or life-threatening injury. As with other large mobile marine vertebrates, it is assumed that adult turtles will avoid seismic noise at levels/distances where the noise is a discomfort. Juvenile turtles may be unable to avoid seismic sounds in the open ocean, and consequently may be more susceptible to seismic noise.

The noise exposure criteria for turtles were established in 2004 under the ANSI-Accredited Standards Committee S3/SC 1: Animal Bioacoustics sponsored by the Acoustical Society of America. The criteria for seismic airguns were subsequently provided by Popper *et al.* (2014) (Table 13).

Table 13: Noise exposure criteria in turtles for seismic airguns (after Popper *et al.* 2014).

Animal	Zones of impact – maximum horizontal distances from source to impact threshold levels (from single 3D pulses)		Zones of impact – maximum horizontal perpendicular distances from assessed 3D survey lines to cumulative impact threshold levels	
	Injury (PTS) onset Pk SPL re 1 µPa	TTS onset Pk SPL	Injury (PTS) onset Weighted SEL_{24h} re 1 $\mu Pa^2 \cdot s$	TTS onset Weighted SEL_{24h} re 1 $\mu Pa^2 \cdot s$
Sea turtles	232 m	226 m	204 m	189 m

Using the peak sound pressure level of 232 dB re 1 µPa, the Underwater Noise Modelling Study undertaken for the current project (SLR 2022) identified that the maximum horizontal distance from the seismic source to impact threshold levels leading to mortality or potential mortal injury in turtles was 19 m and therefore highly localised at any one time. The maximum horizontal distance from the seismic source to impact threshold levels leading to recoverable injury (TTS) was 24 m. The zones of cumulative impact from multiple pulses (i.e. the maximum horizontal perpendicular distances from assessed survey lines to cumulative impact threshold levels), was estimated as 10 m for mortality and potential mortal injury. Maximum threshold distances for recoverable injury and TTS from multiple pulses was estimated at 500 m. It must be kept in mind that the cumulative zones of impact are

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conservative, as any turtles likely to be encountered in the Orange Basin area are the highly migratory, and are likely to have moved considerable distances over the cumulative 24-hr period.

As the breeding areas for Leatherback turtles in Gabon occur over 1 500 km to north of the proposed 3D survey area, and on the northeast coast of South Africa, turtles encountered during the survey are likely to be adults migrating to foraging grounds, and dispersing neonates and juveniles. Although turtles have extensive distributions and feeding ranges, the number of turtles encountered in the survey area is expected to be low. Despite their low numbers in the survey area, the intensity of potential physiological injury would be thus rated as **HIGH**. However, the duration of the impact on the population would be limited to the **IMMEDIATE-TERM** (1.5 months) and be restricted to the survey area (**REGIONAL**). The potential physiological injury or mortality of turtles is considered to be of **MEDIUM consequence**.

Behavioural avoidance

Behavioural changes in response to anthropogenic sounds have been reported for some sea turtles. Controlled exposure experiments on captive turtles found an increase in swim speed and erratic behaviour indicative of avoidance, at received airgun sound levels of 160 - 176 dB re 1 µPa (O'Hara & Wilcox 1990; Eckert *et al.* 1998; McCauley *et al.* 2000). Sounds of frequency of 250 and 500 Hz resulted in a startle response from a loggerhead turtle (Lenhardt *et al.* 1983; Lenhardt 1994), and avoidance by 30 m of operating airguns where the received level would have been in the order of 175 - 176 dB re 1 µPa (O'Hara & Wilcox 1990). McCauley (1994), however, pointed out that these results may have been influenced by echo associated with the shallow environment in which the test was undertaken.

Further trials carried out on caged loggerhead and green turtles indicated that significant avoidance response occurred at received levels ranging between 172 and 176 dB re 1 µPa at 24 m, and repeated trails several days later suggest either temporary reduction in hearing capability or habituation with repeated exposure. Hearing however returned after two weeks (Moein *et al.* 1994; Lenhardt *et al.* 1994; McCauley *et al.* 2000). McCauley *et al.* (2000) reported that above levels of 166 dB re 1 µPa turtles increased their swimming activity compared to periods when airguns were inactive. Above 175 dB re 1 µPa turtle behaviour became more erratic possibly reflecting an agitated behavioural state at which unrestrained turtles would show avoidance response by fleeing an operating sound source. These would correspond to distances of 2 km and 1 km from a seismic vessel operating in 100 - 120 m of water, respectively. The behavioural threshold of 166 dB re 1 µPa for sea turtles as established by McCauley *et al.* (2000) was subsequently adopted by the National Marine Fisheries Services (NMFS) (NSF 2011).

Observations of marine turtles during a ten-month seismic survey in deep water (1 000-3 000 m) off Angola found that turtle sighting rate during guns-off (0.43 turtles/h) was double that of full-array seismic activity (0.20/h) (Weir 2007). These results should be treated with caution, however, since a large proportion of the sightings occurred during unusually calm conditions and during peak diurnal abundance of turtles when the airguns were inactive (Weir 2007). In contrast, Parente *et al.* (2006), working off Brazil found no significant differences in turtle sightings with airgun state. It is possible that during deep water surveys turtles only detect airguns at close range or are not sufficiently mobile to move away from approaching airgun arrays (particularly if basking for metabolic purposes when they may be slow to react) (Weir 2007). This is in marked contrast to previous assessments that assumed that the impact of seismic noise on behaviour of adult turtles in the open ocean environment is of low significance given the mobility of the animals (CSIR 1998; CCA & CMS 2001). In the study by

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Weir (2007) a confident assessment of turtle behaviour in relation to seismic status was hindered, however, by the apparent reaction of individual animals to the survey vessel and towed equipment rather than specifically to airgun sound. As these reactions occurred at close range (usually <10 m) to approaching objects, they appeared to be based principally on visual detection.

Information on how individuals might respond behaviourally to seismic sounds thus remains inconclusive and may be species specific (Pirniak *et al.* 2012, 2016; van der Wal *et al.* 2016). Acoustic disturbance could potentially lead to exclusion from key habitats, interruption of breeding, foraging or basking behaviours, or may incite responses which may compromise the turtle's energy budgets (e.g. changes to foraging duration, swim speed, dive depth and duration, and restricting access to the surface to breath) (DeRuiter & Larbi Doukara 2012). Such changes could lead to a reduction in individual fitness (through changes to reproductive outputs or foraging rates), potentially causing detrimental effects at a population level.

Using the RMS SPL criteria of 175 dB re 1 µPa, the Underwater Noise Modelling Study undertaken for the current project (SLR 2022) identified that the maximum threshold distance for behavioural disturbance for turtles caused by the immediate exposure to individual pulses was predicted to be within 1 300 m from the 3D array. Turtles can therefore hear seismic sounds at a considerable distance and may respond by altering their swimming/basking behaviour or alter their migration route. However, as the number of turtles encountered during the proposed 3D survey is expected to be low, the impact of seismic sounds on turtle behaviour would be of LOW intensity, and would persist only for the duration of the survey (IMMEDIATE - 1.5 months), and be restricted to the survey area (REGIONAL). The impact of seismic noise on turtle behaviour is thus deemed to be of VERY LOW consequence.

Masking of environmental sounds and communication

Breeding adults of sea turtles undertake large migrations between distant foraging areas and their nesting sites (within the summer months October to March, with peak nesting during December and January). Although Lenhardt *et al.* (1983) speculated that turtles may use acoustic cues for navigation during migrations, information on turtle communication is lacking. The effect of seismic noise in masking environmental cues such as surf noise (150-500 Hz), which overlaps the frequencies of optimal hearing in turtles (McCauley 1994), is unknown and speculative.

As the breeding areas for Leatherback turtles occur over 1 500 km to north of the survey area in Gabon, and on the north-east coast of South Africa, turtles encountered during the survey are likely to be migrating vagrants. Their low abundance in the survey area would suggest that the impact (should it occur) would be of VERY LOW intensity. As the impact would persist only for the duration of the survey (IMMEDIATE - 1.5 months), and be restricted to the survey area (REGIONAL), the impact is deemed to be of VERY LOW consequence.

Indirect impacts due to effects on prey

As with other vertebrates, the assessment of indirect effects of seismic surveys on turtles is limited by the complexity of trophic pathways in the marine environment. The leatherback turtles eat pelagic prey, primarily jellyfish. The low numbers and the broad ranges of potential prey species and extensive ranges over which most turtles feed suggest that indirect impacts would be of VERY LOW intensity, persisting only for the duration of the survey (IMMEDIATE - 1.5 months), and restricted to the survey area (REGIONAL). The impact would therefore be of VERY LOW consequence.

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Impact Significance

Physiological injury and mortality

The potential impact of seismic noise on physiological injury or mortality of turtles, considering their high sensitivity and medium consequence, is deemed to be of **MEDIUM** significance. In the case of hatchlings and juveniles, the impact can be considered of **MEDIUM** significance due to their high sensitivity and the potentially high intensity of the impact.

Behavioural avoidance

The potential impact of seismic noise on behavioural changes in turtles, considering their medium sensitivity, the medium probability of the impact occurring and the very low consequence, is deemed to be of **VERY LOW** significance.

Masking of Sounds and Communication

The potential impact of seismic noise on the masking of environmental sounds and communications in turtles, considering their medium sensitivity, the medium probability of the impact occurring and the very low consequence, is deemed to be of **VERY LOW** significance.

Indirect impacts due to effects on predators or prey

The potential indirect impact of seismic noise on food sources of turtles, considering their medium sensitivity, the very low likelihood of the impact occurring and the very low consequence, is thus deemed to be of **VERY LOW** significance.

Identification of Mitigation Measures

Van der Wal *et al.* (2016) report on innovative measures for mitigating potential impacts on turtles during seismic surveys. They point out that the standard mitigation measures developed for marine mammals ("soft-starts", MMOs) may be less effective for sea turtles as these have a shorter surface presence per unit time and a much lower surfacing profile than do marine mammals. This makes turtles increasingly difficult to detect by MMOs in sea states greater than Beaufort 2. The following mitigation measures are recommended for sea turtles:

No.	Mitigation measure	Classification
1	Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source if during daylight hours it is confirmed visually by the MMO during the pre-shoot watch (60 minutes) that there are no turtles within 500 m of the seismic source.	Avoid / Abate on site
2	In the case of turtles being observed within the mitigation zone, delay the "soft-start" until animals are outside the 500 m mitigation zone.	Avoid / Abate on site
3	Terminate seismic shooting on: – Observation of turtles within the 500 m mitigation zone. – observation of any obvious mortality or injuries to turtles when estimated by the MMO to be as a direct result of the survey. For turtles, terminate shooting until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required).	Abate on site
4	Avoid surveying within 100 m of critical foraging habitats (e.g. seamounts or convergence zones)	Avoid

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Residual Impact Assessment

With the implementation of the mitigation measures above, the residual impact on potential physiological injury would reduce to LOW. The other impacts would remain of VERY LOW significance.

3	*Impacts of seismic noise on turtles*	
Project Phase:	Operation	
Type of Impact	Direct	
Nature of Impact	Negative	
Sensitivity of Receptor	High	
	Pre-Mitigation Impact	Residual Impact
Consequence	MEDIUM	LOW
Intensity	High	Medium
Extent	Regional	Regional
Duration	Immediate	Immediate
Significance	MEDIUM	LOW
Probability	Likely	Possible
Confidence	High	High
Reversibility	Fully Reversible	Fully Reversible
Loss of Resources	Low	Low
Mitigation Potential	-	Medium
Cumulative potential	Unlikely	Unlikely

4.3.4 Impacts of Seismic Noise on Seabirds

Source of Impact

The project activities that will result in impacts to seabirds are listed below.

[illegible]	[illegible]
Mobilisation	N/A
Operation	Seismic acquisition/ firing of airguns
Demobilisation	N/A

These activities and their associated aspects are described below:

- Noise generated by airguns during seismic acquisition.

Impact Description

Potential impacts of seismic pulses to diving birds could include physiological injury, behavioural avoidance of seismic survey areas and indirect impacts due to effects on prey. The seabird species

are all highly mobile and would be expected to flee from approaching seismic noise sources at distances well beyond those that could cause physiological injury, but initiation of a sound source at full power in the immediate vicinity of diving seabirds could result in injury or mortality where feeding behaviour override a flight response to seismic survey sounds. The potential for physiological injury or behavioural avoidance in non-diving seabird species, being above the water and thus not coming in direct contact with the seismic pulses, is considered NEGLIGIBLE and will not be discussed further here.

Project Controls

The seismic contractor will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques.

Sensitivity of Receptors

Among the marine avifauna occurring along the West Coast of South Africa, it is only the diving birds, or birds which rest on the water surface, that may be affected by the underwater noise of seismic surveys. The African Penguin (*Spheniscus demersus*), which is flightless and occurs along the southwestern Cape coastline, would be particularly susceptible to impacts from underwater seismic noise. Similarly, Cape Gannets dive for their pelagic prey and would be susceptible to seismic noise. Penguins from the Robben Island colony have been tracked feeding up to 70 km offshore of the island (Campbell 2016), and Cape Gannets are known to forage within 200 km offshore (Dundee 2006; Ludynia 2007; Grémillet *et al.* 2008) and both species therefore unlikely to be encountered in the proposed 3D survey area. Both species are considered 'Endangered' on a national and global scale. Of the pelagic seabirds likely to occur in the offshore regions characterising the Orange Basin, many are considered regionally 'Vulnerable' (e.g. White-chinned Petrel), 'Endangered' (e.g. Black-browed Albatross, Atlantic Yellow-nosed Albatross, Subantarctic Skua) and 'Critically Endangered' (Leach's Storm Petrel). Pelagic seabirds spend a significant proportion of their lives on the open ocean diving or skimming the surface for food and resting on the water surface, returning to Southern Ocean islands only to breed. Tripp Seamount is located approximately 50 km to the north of the proposed 3D survey area, which is an important feature because it attracts an abundance of marine life and is a productive fishing ground. Despite their extensive distributions and feeding ranges, the proposed survey area overlaps with core usage areas for Yellow-nosed Albatross and Wandering Albatross (see Figure 27). The numbers of individuals encountered during the survey may thus not be insignificant, particularly in the vicinity of the Child's Bank and Orange Shelf Edge MPAs and associated with Tripp Seamount. Consequently, the sensitivity for both coastal and pelagic seabirds is considered to be MEDIUM.

Consequence of Impact

Birds are well known for their acoustic communication and hearing abilities, but psychophysical or behavioural data on how birds hear or react to sound underwater is currently lacking (Dooling 2012).

Recent studies on the in-air and underwater hearing in the great cormorant (*Phalacrocorax carbo sinensis*) identified that their greatest sensitivity was at 2 kHz, with an underwater hearing threshold of between 71 - 79 dB re 1 µPa rms (Johansen *et al.* 2016; Hansen *et al.* 2017; Larsen *et al.* 2020) suggesting that the species is better at hearing underwater than in air, with hearing thresholds in the frequency band 1-4 kHz comparable to those of seals and toothed whales. This opens up the possibility of cormorants and other aquatic birds having special adaptations for underwater hearing

and making use of underwater acoustic cues from conspecifics, their surroundings, as well as prey and predators.

In African Penguins the best hearing is in the 600 Hz to 4 kHz range with the upper limit of hearing at 15 kHz and the lower limit at 100 Hz (Wever *et al.* 1969). Compared to other birds (Necker 2000), African Penguins were considered to be relatively insensitive to sounds both in terms of frequency and intensity (Wever *et al.* 1969). No critical ratios have, however, been measured. Principal energy of vocalisation of African penguins was found at <2 kHz, although some energy was measured at up to 6 kHz (Wever *et al.* 1969). Penguins are known to respond to underwater vocalisations of predators (Frost *et al.* 1975). Recently underwater vocalisations have been recorded in King, Gentoo and Macaroni penguins with a frequency of maximum amplitude averaging 998 Hz, 1097 Hz and 680 Hz, respectively (Thiebault *et al.* 2019).

Physiological injury

The continuous nature of the intermittent seismic survey pulses suggest that diving birds would hear the sound sources at distances where levels would not induce mortality or injury, and consequently be able to flee an approaching sound source. Available evidence, although scant, therefore suggests that most diving seabirds would be able to hear seismic sounds at considerable distances, and consequently be able to flee an approaching sound source at distances where levels would not induce injury or mortality. The potential for physiological injury to seabirds from seismic surveys in the open ocean is thus deemed to be low (see also Stemp 1985, in Tumpenny & Nedwell 1994), particularly given the extensive feeding range of the potentially affected seabird species.

Of the plunge diving species that occur along the West Coast, the Cape Gannet regularly feeds as far offshore as 100 km, the rest foraging in nearshore areas up to 40 km from the coast, although Cape Cormorants have been reported up to 80 km from their colonies. The nearest Cape Gannet nesting grounds are at Lambert's Bay and Malgas Island, 300 km and 285 km inshore and to the southeast of the eastern boundary of the Reconnaissance Permit area, respectively. The nearest African Penguin nesting sites are similarly at Lambert's Bay, on the Saldanha Bay Islands and at Robben Island. This species forages at sea with most birds being found within 20 km of the coast, although individuals have been recorded as far as 70 km offshore. As the survey area is situated well beyond the foraging ranges of these coastal species, encounters with both Cape Gannets and African penguins are unlikely during 3D seismic acquisition in offshore waters. In the offshore environment, pelagic seabirds that dive for their prey may, however, be encountered, particularly in the portions of the survey area closest to Tripp Seamount.

Should an encounter with diving pelagic seabirds occur, the potential physiological impact on individual pelagic and coastal diving birds would be of HIGH intensity, but as the likelihood of encountering large numbers of diving seabirds is low, due to their extensive distributions and feeding ranges the intensity is considered MEDIUM. Furthermore, the duration of the impact on the population would be limited to the IMMEDIATE-TERM (1.5 months) and be restricted to the survey area (REGIONAL). The potential for physiological injury is therefore considered to be of LOW consequence.

Behavioural avoidance

Diving birds would be expected to hear seismic sounds at considerable distances as they have good hearing at low frequencies (which coincide with seismic shots). Response distances are speculative, however, as no empirical evidence is available. Evidence from studies at Bird and St Croix Islands in Algoa Bay, South Africa on the behavioural response of African Penguins to seismic operations within

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100 km of their colonies found that they showed a strong avoidance of their preferred foraging areas during seismic activities. Birds were reported to forage significantly further from the survey vessel when in operation, while increasing their overall foraging effort. Although maximum foraging distance to the colony increased during seismic activity, this increase was not significant relative to outside of seismic activity, with mean maximum distances in the order of 28 km. The birds reverted to normal foraging behaviour when the seismic operations ceased (Pichegru *et al.* 2017). For penguins who spend considerable time underwater while hunting, the impact zone for behavioural disturbance may, however, be larger than for plunge diving species that undertake short dives only before returning to the sea surface.

Due to the extensive distribution and feeding ranges of pelagic seabirds, the impact for pelagic seabirds would thus be of LOW intensity within the survey area (REGIONAL) over the duration of the survey period (IMMEDIATE - 1.5 months). For African Penguins and Cape Gannets, the impact for would thus be of HIGH intensity, but as the likelihood of encountering large numbers in offshore areas is low, the intensity is considered MEDIUM. Similarly, for pelagic seabirds the impact would be of HIGH intensity, but due to their extensive distributions and feeding ranges, the likelihood of encountering significant numbers is low, and the intensity is therefore considered MEDIUM. The duration of the impact on the population would be limited to the IMMEDIATE-TERM (1.5 months) and be restricted to the survey area (REGIONAL). The behavioural avoidance of feeding areas by diving seabirds is thus considered to be of VERY LOW consequence and for coastal diving seabirds to be of LOW consequence.

Indirect impacts due to effects on prey

As with other vertebrates, the assessment of indirect effects of seismic surveys on diving seabirds is limited by the complexity of trophic pathways in the marine environment. The impacts are difficult to determine, and would depend on the diet make-up of the bird species concerned and the effect of seismic surveys on the diet species. With few exceptions, most plunge-diving birds forage on small shoaling fish prey species that typically occur relatively close to the shore (<200 m depth) or associated with oceanic features such as the Child's Bank and Tripp Seamount. Cape Gannets vocalise regularly while at sea to maintain group cohesion and avoid collision, and rely on visual observation of other (diving) gannets as a cue to find food (Thiebault *et al.* 2014, 2016), while African Penguins have been reported to hunt cooperatively larger groups (25 165) to corral shoaling fish to the surface, where they subsequently become more accessible to other avian predators such as Cape gannets and cormorants (McInnes *et al.* 2017).

Other than the report of Pichgru *et al.* (2017) for penguins at the Algoa Bay Islands no information is available on the feeding success of seabirds in association with seismic survey noise. Although seismic surveys have been reported to affect fish catches up to 30 km from the sound source, with effects persisting for a duration of up to 10 days, for the current project relatively low behavioural risks are expected for fish species at far-field distances (1 000s of metres) (Lewis 2022). This could have implications for plunge-diving seabirds such as African Penguins that forage in restricted areas within a given radius of their breeding sites. Similarly, pelagic seabirds that feed around seamounts may also be affected. As the survey area is located beyond the foraging range of African penguins and Cape gannets, and Tripp Seamount is located ~50 km north of the proposed survey area, seismic effects on the prey species of coastal seabirds, or pelagic seabirds that feed around seamounts is not expected. The impact on potential food sources for pelagic and coastal diving seabirds would thus be of VERY LOW intensity within the survey area (REGIONAL) over the duration of the survey period

(IMMEDIATE - 1.5 months). The broad ranges of potential fish prey species (in relation to potential avoidance patterns of seismic surveys of such prey species) and extensive ranges over which most seabirds feed suggest that indirect impacts would be of VERY LOW consequence.

The impact on potential food sources for pelagic seabirds would thus be of VERY LOW intensity within the survey area (LOCAL) over the duration of the survey period (1.5 months). The broad ranges of potential fish prey species (in relation to potential avoidance patterns of seismic surveys of such prey species) and extensive ranges over which most seabirds feed suggest that indirect impacts would be of VERY LOW consequence.

Impact Significance

Physiological injury and mortality

The potential impact of seismic noise on physiological injury or mortality of pelagic seabirds, considering their medium sensitivity, the medium likelihood of the impact occurring and low consequence, is deemed to be of LOW significance.

Behavioural avoidance

The potential impact of seismic noise on behavioural changes in pelagic seabirds, considering their medium sensitivity the medium likelihood of the impact occurring and very low to low consequence, is deemed to be of VERY LOW to LOW significance.

Indirect impacts due to effects on predators or prey

The potential indirect impact of seismic noise on food sources for pelagic seabirds, considering their medium sensitivity, the very low likelihood of the impact occurring and the very low consequence, is thus deemed to be of VERY LOW significance.

Identification of Mitigation Measures

As the proposed survey area is located far offshore, it is not deemed necessary to implement mitigation measures to avoid the pre- and postmoult periods for African penguins. In addition to the mitigation measures recommended for cetaceans, the following is recommended for feeding aggregations of diving seabirds:

No.	Mitigation measure	Classification
1	Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source if during daylight hours it is confirmed visually by the MMO during the pre-shoot watch (60 minutes) that there are no penguins or feeding aggregations of diving seabirds within 500 m of the seismic source.	Avoid / Abate on site
2	In the case of penguins or feeding aggregations of diving seabirds being observed within the mitigation zone, delay the 'soft-start' until animals are outside the 500 m mitigation zone.	Avoid / Abate on site
3	Terminate seismic shooting on observation of penguins and feeding aggregations of diving seabirds within the 500 m mitigation zone. For penguins and feeding aggregations of diving seabirds, terminate shooting until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required).	Abate on site

Residual Impact Assessment

With the implementation of the mitigation measures above, the residual impact on potential physiological injury or behavioural avoidance by seabirds, masking of sounds and indirect impacts on food sources would remain VERY LOW.

4	*Impacts of seismic noise on diving seabirds*	
Project Phase:	Operation	
Type of Impact	Direct	
Nature of Impact	Negative	
Sensitivity of Receptor	Medium	
	Pre-Mitigation Impact	Residual Impact
Consequence	LOW	VERY LOW
Intensity	Medium	Low
Extent	Regional	Regional
Duration	Immediate	Immediate
Significance	LOW	VERY LOW
Probability	Likely	Possible
Confidence	High	High
Reversibility	Fully Reversible	Fully Reversible
Loss of Resources	Low	Low
Mitigation Potential	-	Medium
Cumulative potential	Unlikely	Unlikely

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4.3.5 Impacts of Seismic Noise on Fish

Source of Impact

The project activities that will result in impacts to fish are listed below.

Project phase	Activity
Mobilisation	N/A
Operation	Seismic acquisition/ firing of airguns
Demobilisation	N/A

These activities and their associated aspects are described below:

- Noise generated by airguns during seismic acquisition.

Impact Description

Fish hearing has been reviewed by numerous authors including Popper and Fay (1973), Hawkins (1973), Atema *et al.* (1988), Hawkins & Popper (2018) and Slabbekoorn *et al.* (2019) (amongst others). Fish have two different systems to detect sounds namely 1) the ear (and the otolith organ of their inner ear) that is sensitive to sound pressure and 2) the lateral line organ that is sensitive to particle motion. Certain species utilise separate inner ear and lateral line mechanisms for detecting sound; each system having its own hearing threshold (Tavolga & Wodinsky 1963), and it has been suggested that fish can shift from particle velocity sensitivity to pressure sensitivity as frequency increases (Cahn *et al.* 1970, in Turl 1993). More recently, Popper & Hawkins (2018) determined that most fish (and all elasmobranchs) primarily detect particle motion.

In fish, the proximity of the swim-bladder to the inner ear is an important component in the hearing as it acts as the pressure receiver and vibrates in phase with the sound wave. Vibrations of the otoliths, however, result from both the particle velocity component of the sound as well as stimulus from the swim-bladder. The resonant frequency of the swim-bladder is important in the assessment of impacts of sounds as species with swim-bladders of a resonant frequency similar to the sound frequency would be expected to be most susceptible to injury. Although the higher frequency energy of received seismic impulses needs to be taken into consideration, the low frequency sounds of seismic surveys would be most damaging to swim-bladders of larger fish. The lateral line is sensitive to low frequency (between 20 and 500 Hz) stimuli through the particle velocity component of sound and would thus be sensitive to the low frequencies of airguns, which most energy at 20-150 Hz.

The sound waves produced during seismic surveys are low frequency, with most energy at 20-150 Hz (although significant contributions may extend up to 500 Hz) (Hirst & Rodhouse 2000), and overlap with the range at which fish hear well (Dalen & Naested 2008). A review of the available literature suggests that potential impacts of seismic pulses to fish (including sharks) species could include physiological injury and mortality, behavioural avoidance of seismic survey areas, reduced reproductive success and spawning, masking of environmental sounds and communication, and indirect impacts due to effects on predators or prey (Popper & Hawkins 2018).

Project Controls

The seismic contractor will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques.

Sensitivity of Receptors

Most species of fish and elasmobranchs are able to detect sounds from well below 50 Hz (some as low as 10 or 15 Hz) to upward of 500 - 1 000 Hz (Popper & Fay 1999; Popper 2003; Popper *et al.* 2003), with hearing specialists able to detect sounds to 4 000 Hz (Ladich & Fay 2013). Consequently, fish can detect sounds within the frequency range of most widely occurring anthropogenic noises. Within the frequency range of 100 - 1 000 Hz at which most fish hear best, hearing thresholds vary considerably (50 and 110 dB re 1 µPa). They are able to discriminate between sounds, determine the direction of a sound, and detect biologically relevant sounds in the presence of noise (Popper & Hawkins 2019). In addition, some clupeid fish can detect ultrasonic sounds to over 200 kHz (Popper & Fay 1999; Mann *et al.* 2001; Popper *et al.* 2004). Fish that possess a coupling between the ear and swim-bladder have probably the best hearing of fish species (McCauley 1994). Consequently, there is a wide range of susceptibility among fish to seismic sounds, with those with a swim-bladder will be more susceptible to anthropogenic sounds than those without this organ (Popper & Hawkins 2019). Such species may suffer physiological injury or severe hearing damage and adverse effect may intensify and last for a considerable time after the termination of the sound source. Fish without swim bladders include jawless fishes, elasmobranchs (sharks, skates and rays), some flatfishes, some gobies, and some tuna and other pelagic and deep-sea species (Popper *et al.* 2014). As hearing thresholds differ greatly among species, the impacts of seismic sounds are therefore species specific.

The greatest risk of physiological injury from seismic sound sources is for species that establish home ranges on shallow- or deep-water reefs or congregate in areas to spawn or feed, and those displaying an instinctive alarm response to hide on the seabed or in the reef rather than flee. Such species would be associated with the seabed (at >1 500 m) or with Child's Bank or Tripp Seamount. The fish most likely to be encountered on the shelf, beyond the shelf break and in the offshore waters of the proposed 3D survey area are the large migratory pelagic species. In many of the large pelagic species, the swim-bladders are either underdeveloped or absent, and the risk of physiological injury through damage of this organ is therefore lower. However, many of the large pelagic fish and shark species likely to occur in the offshore regions characterising the Orange Basin are considered globally 'Vulnerable' (e.g. bigeye tuna, blue marlin, Oceanic Whitetip shark, dusky shark, great white shark, longfin mako), 'Endangered' (e.g. shortfin mako, whale shark) and 'Critically Endangered' (Southern bluefin tuna). However, the numbers of individuals encountered during the survey are likely to be low, even when these species are *en route* to or from recognised feeding grounds associated with Tripp Seamount or Child's Bank where greater concentrations of pelagic fish can be expected. The sensitivity of fish to seismic noise is considered to be HIGH sensitivity.

Consequence of Impact

The physiological effects of seismic sounds from airgun arrays will mainly affect the younger life stages of fish such as eggs, larvae and fry, many of which form a component of the meroplankton and thus have limited ability to escape from their original areas in the event of various influences. These have been dealt with under section 4.3.7 below.

Physiological injury and mortality

Studies have shown that fish can be exposed directly to the sound of seismic survey without lethal effects, outside of a very localised range of physiological effects. Exposure of fishes to very high intensity low and mid-frequency sonars resulted in no mortality (Halvorsen *et al.* 2013; Popper *et al.* 2007), nor did exposure to seismic airguns (Popper *et al.* 2005; Popper *et al.* 2016). Physiological effects of impulsive airgun sounds on fish species include swim-bladder damage (Falk & Lawrence 1973), transient stunning (Hastings 1990, in Turnpenney & Nedwell 1994), short-term biochemical variations in different tissues typical of primary and secondary stress response (Santulli *et al.* 1999; Smith *et al.* 2004; Nedelec *et al.* 2015; Sierra-Flores *et al.* 2015), and temporary hearing loss (TTS) due to destruction of the hair cells in the hearing maculae (Enger 1981; Lombarte *et al.* 1993; Hastings *et al.* 1996; McCauley *et al.* 2000; Scholik & Yan 2001, 2002; McCauley *et al.* 2003; Popper *et al.* 2005; Smith *et al.* 2006; Smith & Monroe 2016) and haemorrhaging, eye damage and blindness (Hirst & Rodhouse 2000; Halvorsen *et al.* 2012). Although TTS has been demonstrated in a number of species from a diverse array of sounds (Smith & Monroe 2016), in all cases it only occurred after multiple exposures to intense sounds (<190 dB re 1 µPa rms) or as a result of long-term exposure to less intense sounds (Popper & Hawkins 2019).

Physical damage may lead to delayed mortality as reduced fitness is associated with higher vulnerability to predators and decreased ability to locate prey (Hirst & Rodhouse 2000; McCauley *et al.* 2003; Popper *et al.* 2005). Reduced heart rate (bradycardia) in response to the particle motion component of the sound from the airgun, indicative of an initial flight response has also been reported (Davidsen *et al.* 2019). Popper (2008) concludes that as the vast majority of fish exposed to seismic sounds will in all likelihood be some distance from the source, where the sound level has attenuated considerably, only a very small number of animals in a large population will ever be directly killed or damaged by sounds from seismic airgun arrays. Consequently, direct physical damage from exposure to high level sound from airguns was not considered an issue that required special mitigation (Gausland 2003).

The noise exposure criteria for fish were established in 2004 under the ANSI-Accredited Standards Committee S3/SC 1: Animal Bioacoustics sponsored by the Acoustical Society of America. The exposure criteria for seismic airguns were subsequently provided by Popper *et al.* (2014) (Table 14).

Child's Bank and Tripp Seamount lie ~30 km east and ~25 km north of the proposed 3D survey area, and any demersal species associated with these important fishing banks would receive the seismic noise within the far-field range, and outside of distances at which physiological injury or avoidance would be expected. Impacts on demersal species are thus deemed of VERY LOW intensity across the survey area (REGIONAL) and for the survey duration (IMMEDIATE) and are considered to be of VERY LOW consequence.

Table 14: Noise exposure criteria in fish for seismic airguns (after Popper *et al.* 2014).

Type of animal	Mortality and potential mortal injury	Impairment			Behaviour
		Recovery injury	TTS	Masking	
Fish: no swim bladder (particle motion detection)	>219 dB SEL_{24hr} or >213 dB Pk SPL	>216 dB SEL_{24hr} or >213 dB Pk SPL	>>186 dB SEL_{24hr}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: swim bladder is not involved in hearing (particle motion detection)	210 dB SEL_{24hr} or >207 dB Pk SPL	203 dB SEL_{24hr} or >207 dB Pk SPL	>>186 dB SEL_{24hr}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: swim bladder involved in hearing (primarily pressure detection)	207 dB SEL_{24hr} or >207 dB Pk SPL	203 dB SEL_{24hr} or >207 dB Pk SPL	186 dB SEL_{24hr}	(N) Low (I) Low (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae	>210 dB SEL_{24hr} or >207 dB Pk SPL	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Notes: peak sound pressure levels (Pk SPL) dB re 1 µPa; Cumulative sound exposure level (SEL_{24hr}) dB re 1 $\mu Pa^2 \cdot s$. All criteria are presented as sound pressure even for fish without swim bladders since no data for particle motion exist. Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

Given the high mobility of most fish that occur offshore of the 200 m isobath, particularly the highly migratory pelagic species likely to be encountered in deeper water, it is assumed that the majority of fish species would avoid seismic noise at levels below those where physiological injury or mortality would result. Possible injury or mortality in pelagic species could occur on initiation of a sound source at full pressure in the immediate vicinity of fish, or where reproductive or feeding behaviour override a flight response to seismic survey sounds. Many of the pelagic sharks and tunas likely to be encountered in offshore waters also do not have a swim bladder and are thus less susceptible to seismic sounds than those species that do have swim bladders.

The underwater noise modelling study undertaken for the current survey (SLR 2022) identified that the maximum horizontal distance from 3D seismic source to impact threshold levels leading to mortality or potential mortal injury was 90 m, for fish lacking swim bladders (e.g. some tunas, sharks and most mesopelagic species) and 180 m for fish with swim bladders. Zones of immediate impact from single pulses for recovery injury were the same. The zones of potential mortal injuries for fish species without a swim bladder were not reached for the cumulative 24-hour survey operation scenario considered, whereas for fish with swim bladders this distance is 30 m from the adjacent survey lines for 3D sound sources. For recoverable injury, the zones of cumulative impact from multiple pulses were again not reached, but were predicted to be within 80 m from the adjacent survey lines for fish with a swim bladder. The zones of TTS effect for fish species with and without swim bladders are predicted to be within 2 900 m for the cumulative scenario. It must be kept in mind that the cumulative zones of impact are conservative as most fish likely to be encountered in the Orange Basin are the highly migratory pelagic sharks, tunas and billfish, and are likely to have moved considerable distances over the cumulative 24-hr period.

Should an encounter occur, the potential physiological impact on individual migratory pelagic fish, would be of HIGH intensity. Furthermore, the duration of the impact on the population would be

limited to the IMMEDIATE-TERM (1.5 months) and be restricted to the survey area (REGIONAL). The impact is therefore considered to be of MEDIUM consequence.

Behavioural avoidance

When interpreting the results of the many studies on potential behavioural effects of sounds on fish one must be cautious of results obtained in tanks or large enclosures and keep in mind that that the responses of fishes may vary with their age and condition, under different environmental conditions and when the level of the sound received by the animal differs (Popper & Hawkins 2019). Behavioural responses to impulsive sounds are varied and include leaving the area of the noise source (Suzuki *et al.* 1980; Dalen & Raknes 1985; Dalen & Knutsen 1987; Løkkeborg 1991; Skalski *et al.* 1992; Løkkeborg & Soldal 1993; Engås *et al.* 1996; Wardle *et al.* 2001; Engås & Løkkeborg 2002; Hassel *et al.* 2004), changes in vertical and horizontal distribution (Chapman & Hawkins 1969; Dalen 1973; Pearson *et al.* 1992; Slotte *et al.* 2004; Løkkeborg *et al.* 2012; Davidsen *et al.* 2019), spatial changes in schooling behaviour (Slotte *et al.* 2004), and startle response to short range start up or high level sounds (Pearson *et al.* 1992; Wardle *et al.* 2001; Paxton *et al.* 2017). Behavioural responses such as avoidance of seismic survey areas and changes in feeding behaviours of some fish to seismic sounds have been documented at received levels of a between 130 and 180 dB re 1 µPa, with disturbance ceasing at noise levels below this (Slabbekoorn *et al.* 2019). In some cases behavioural responses were observed at up to 5 km distance from the firing airgun array (Santulli *et al.* 1999; Hassel *et al.* 2004; Dalen *et al.* 2007; Fewtrell & McCauley 2012), with Paxton *et al.* (2017) demonstrating a 78% decline in multispecies presence at a site 7.9 km away from the survey path during active seismic surveying. In contrast, Miller & Cripps (2013) found no effect of seismic survey on the fish species composition of a coral reef in northern Australia, and Meekan *et al.* (2020, 2021) reported no short-term (days) or long-term (months) effects of seismic exposure on the composition, abundance, size structure, behaviour, or movement of demersal fish fauna on the North West Shelf of Western Australia.

Based on the noise exposure criteria provided by Popper *et al.* (2014), relatively high to moderate behavioural risks are expected at near to intermediate distances (tens to hundreds of meters) from the source location. Relatively low behavioural risks are expected for fish species at far field distances (thousands of meters) from the source location. Behavioural effects are generally short-term, however, with duration of the effect being less than or equal to the duration of exposure, although these vary between species and individuals, and are dependent on the properties of the received sound. Although changes in fish distribution have been reported during and after airgun operations, they generally returned to the original site within hours or days after the end of the seismic operation (Engås *et al.* 1996; Engås & Løkkeborg 2002). In some cases behaviour patterns returned to normal within minutes of commencement of surveying indicating habituation to the noise (Davidsen *et al.* 2019) or showed no reaction at all (Peña *et al.* 2013; Miller & Cripp 2013; Meekan *et al.* 2021). Disturbance of fish is believed to cease at noise levels below 160 dB re 1µPa. The ecological significance of such effects is therefore expected to be low, except in cases where they influence reproductive activity, interfere with foraging or feeding, disruption of migrations and habitat selection or result in delayed mortality (Hirst & Rodhouse 2000; Popper & Hawkins 2019; Soudijn *et al.* 2020). Sub-lethal impacts of acoustic disturbance such as changes in activity patterns and energy budgets can result in altered food intake and growth rates, indirectly affecting the age at sexual maturity, survival and fecundity, thereby ultimately leading to population level consequences (Bruce *et al.* 2018; Cox *et al.* 2018; Slabbekoorn *et al.* 2019; Soudijn *et al.* 2020; van der Knaap *et al.* 2021). As hearing sensitivity can vary with life-cycle stage, season, locality and duration of shooting (Hirst &

Rodhouse 2000), it is difficult to determine with accuracy the impact of seismic sound on the behaviour of fish (Gausland 2003).

Changes in spawning, migration and feeding behaviour of fishes in response to seismic shooting could indirectly affect fisheries through reduced catches resulting from changes in feeding behaviour, abundance and vertical distribution (Skalski *et al.* 1992; Hirst & Rodhouse 2000; Gausland 2003). Such behavioural changes could lead to changes in commercial catch rates if fish move out into or out of important fishing grounds (Engås *et al.* 1996; Hirst & Rodhouse 2000; Dalen & Næsted 2008; Streever *et al.* 2016; Bruce *et al.* 2018). Reports on observed declines in catch rates differ considerably between studies, between target species and gear types used, ranging from no apparent reduction to an 83% reduction in bycatch in a shrimp trawl (Løkkeborg & Soldal 1993) and typically persisting for a relatively short duration only (12 hours to up to 10 days).

The distance from the seismic sound source at which reductions in catch rates were measured also varied substantially between studies ranging from no significant effects in trawl, trammel net and hydraulic dredging fisheries (La Bella *et al.* 1996), through approximately 8 km to as much as 36 km (Hirst & Rodhouse 2000; see also Cochrane & Wilkinson 2015). The potential effects of seismic surveys on fisheries are discussed in more detail in the Commercial Fisheries Impact Assessment (Japp & Wilkinson 2022). Airgun noise related changes to prey and predator species of commercially important species could also play a role in affecting catch rates (Hirst & Rodhouse 2000). Information on feeding success of fish (or larger predators) in association with seismic survey noise is lacking.

Seismic activities have been predicted to possibly affect the migration patterns of tuna leading to substantially reduced catches of albacore and southern bluefin tuna in southern Namibia and the Great Australian Bight, respectively. In the Benguela region it has been suggested that the seasonal movement of longfin tuna northwards from the west coast of South Africa into southern Namibia may be disrupted by the noise associated with seismic surveys. Longfin and other tuna species migrations are known to be highly variable from year to year and are associated with prey availability and also favourable oceanographic conditions. While the potential exists to disrupt the movement of longfin tuna in the Benguela, this disruption, if it occurs, would be localised spatially and temporarily and would be compounded by environmental variability. Similar uncertainty has been expressed for southern bluefin tuna in the Great Australian Bight, and there too there is much uncertainty and any changes in movement and or availability of bluefin tuna was compounded by inter-annual variability and no direct cause and effect could yet be attributed to seismic surveys (Evans *et al.* 2018). As there is currently a dearth of information on the impacts of seismic noise on truly pelagic species such as swordfish and tuna (Evans *et al.* 2018; Webster *et al.* 2018), links between changes in migration patterns and subsequent catches thus remains speculative.

Behavioural responses such as deflection from migration paths or avoidance of seismic survey areas and changes in feeding behaviours of some fish to seismic sounds have been documented at received levels of about 130 - 180 dB re 1 µPa. Behavioural effects are generally short-term, however, with duration of the effect being less than or equal to the duration of exposure, although these vary between species and individuals, and are dependent on the properties of the received sound. The potential impact on individual fish behaviour could therefore be of HIGH intensity (particularly in the near-field of the airgun array). Impacts to behavioural responses would be limited to the survey duration (IMMEDIATE), and the survey area (REGIONAL). Consequently it is considered to be of MEDIUM consequence.

Reproductive success / spawning

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Although the effects of airgun noise on spawning behaviour of fish have not been quantified to date, it is predicted that if fish are exposed to powerful external forces on their migration paths or spawning grounds, they may be disturbed or even cease spawning altogether (de Jong *et al.* 2020). The deflection from migration paths may be sufficient to disperse spawning aggregations and displace spawning geographically and temporally, thereby affecting recruitment to fish stocks. The magnitude of effect in these cases will depend on the biology of the species and the extent of the dispersion or deflection. Depending on the physical characteristics of the area, the range of the impact may extend beyond 30 km (Dalen *et al.* 2007), and could thus potentially affect subsequent recruitment to fish stocks if spawning is displaced geographically or temporally. Dalen *et al.* (1996), however, recommended that in areas with concentrated spawning or spawning migration seismic shooting be avoided at a distance of ~50 km from these areas, particularly areas subjected to repeated, high intensity surveys (see also Gausland 2003). In Norway, legislation has now been put in place ensuring that areas supporting high densities of spawning fish are sometimes closed to seismic surveys as a measure both to avoid scaring away the spawning adults and to avoid direct mortality of early life stages (Boertmann *et al.* 2009; Sivle *et al.* 2021). A buffer of 20 nautical miles around Norwegian spawning grounds has now been recommended to be closed for 3D seismic surveys (Sivle *et al.* 2021). To effectively protect spawning areas, however, thorough knowledge of the actual spawning areas and periods of the species involved is crucial.

The spawning areas of the small pelagic shoaling species are distributed on the continental shelf and along the shelf edge from Lambert's Bay to Mossel Bay, with the major spawning grounds for most species (anchovy, round herring, horse mackerel, chub mackerel) located east of Cape Point and hake spawning occurring on the western Agulhas Bank. There is therefore no overlap of the proposed 3D survey area with the migration routes and spawning areas of these commercially important species (see Figure 17). If behavioural responses to seismic noise result in deflection from coastal migration routes or disturbance of spawning, further impacts may occur that may affect recruitment to fish stocks. The intensity of effect in these cases will depend on the biology of the species and the extent of the dispersion or deflection. Despite the current low biomass of sardine, particularly west of Cape Agulhas, recent successive years of low recruitment and the dependence of future recruitment on successful West Coast spawning (Shabangu *et al.* 2019b) the intensity of the potential impact of the 3D survey can be considered VERY LOW for the duration of the survey (IMMEDIATE) as the survey area lies well offshore of these West Coast spawning areas and is not known to be a spawning area for large pelagic species. The impact is thus considered to be of VERY LOW consequence.

Masking of environmental sounds and communication

While some nearshore reef species are known to produce isolated sounds or to call in choruses, communication and the use of environmental sounds by fish off the South African West Coast are unknown. Demersal species in abyssal and continental slope habitats or associated with Child's Bank or Tripp Seamount would receive the seismic noise in the far field and vocalisation, should it occur, is unlikely to be masked. Impacts arising from masking of sounds are thus expected to be of VERY LOW intensity due to the duty cycle of seismic surveys in relation to the more continuous biological noise. Such impacts would occur across the survey area (REGIONAL) and for the duration of the survey (1.5 months). The impact is thus considered to be of VERY LOW consequence.

Indirect impacts due to effects on predators or prey

The assessment of indirect effects of seismic surveys on fish is limited by the complexity of trophic pathways in the marine environment. The impacts are difficult to determine, and would depend on

the diet make-up of the fish species concerned and the effect of seismic surveys on the diet species. Indirect impacts of seismic surveying could include attraction of predatory species such as sharks, tunas or diving seabirds to pelagic shoaling fish species stunned by seismic noise. In such cases, where feeding behaviour overrides a flight response to seismic survey sounds, injury or mortality could result if the seismic sound source is initiated at full power in the immediate vicinity of the feeding predators. Little information is available on the feeding success of large migratory fish species in association with seismic survey noise. The pelagic shoaling species that constitute the main prey item of migratory pelagic species typically occur inshore of the 200 m depth contour. Although large pelagic species are known to aggregate around seamounts to feed, considering the extensive range over which large pelagic fish species can potentially feed in relation to the survey area, and the low abundance of pelagic shoaling species that constitute their main prey across most of the 3D survey area the intensity of the impact would be LOW, restricted to the survey area (REGIONAL) and persisting over the IMMEDIATE-TERM only (1.5 months). The impact would thus be of VERY LOW consequence.

Impact Significance

Physiological injury and mortality

The potential impact of seismic noise on physiological injury or mortality of fish, considering their high sensitivity and medium consequence, is thus deemed to be of MEDIUM significance.

Behavioural avoidance

The potential impact of seismic noise on behavioural changes in large migratory pelagic fish, considering the high sensitivity, the low to medium likelihood of the impact occurring and medium consequence, is deemed to be of MEDIUM significance.

Reproductive success / spawning

The potential impact of seismic noise on the reproductive success and spawning of nearshore commercial fish species, considering their high sensitivity, the low to medium likelihood of the impact occurring and the very low consequence, is deemed to be of LOW significance.

Masking of environmental sounds and communication

The potential impact of seismic noise on the masking of sounds of fish, considering the high sensitivity, the low likelihood of the impact occurring and the very low consequence is thus deemed to be of LOW significance.

Indirect impacts due to effects on predators or prey

The potential indirect impact of seismic noise on food sources for fish, considering their high sensitivity, the low likelihood of the impact occurring and the very low consequence, is thus deemed to be of LOW significance.

Identification of Mitigation Measures

As the proposed survey area is located far offshore, it is not deemed necessary to implement mitigation measures to avoid the key spring spawning periods for most commercially important fish species. Furthermore, TGS has agreed to avoid the key "ring fenced" fishing and spawning areas identified during previous consultation with the commercial fishing sector. In addition to the mitigation measures recommended for cetaceans, the following is recommended for fish:

No.	Mitigation measure	Classification
1	Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source if during daylight hours it is confirmed visually by the MMO during the pre-shoot watch (60 minutes) that there are no shoaling large pelagic fish within 500 m of the seismic source.	Avoid / Abate on site
2	Undertake the survey from North to South to avoid the spring and summer spawning along the shelf edge and on the continental shelf south of St Helena Bay.	Avoid / Abate on site
3	In the case of shoaling large pelagic fish being observed within the mitigation zone, delay the "soft-start" until animals are outside the 500 m mitigation zone.	Avoid / Abate on site
4	Terminate seismic shooting on – Observation of slow swimming large pelagic fish (including whale sharks, basking sharks and manta rays) within the 500 m mitigation zone. – Observation of any obvious mass mortalities of fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO to be as a direct result of the survey. For slow swimming large pelagic fish, terminate shooting until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required).	Abate on site

Residual Impact Assessment

The potential impacts cannot be eliminated due to the nature of the seismic sound source required during surveying. The location of the proposed survey area well to the west of the 'ring-fenced' area and proposed mitigation measures, which are essentially designed to keep animals out of the immediate area of impact and thereby reduce the risk of deliberate injury to fish, reduces the intensity of the impacts relating to physiological injury / mortality to medium, the residual impact will reduce to low consequence and be of LOW significance. All other impacts on fish remain of LOW significance.

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5	*Impacts of seismic noise to pelagic fish*	
Project Phase:	Operation	
Type of Impact	Direct	
Nature of Impact	Negative	
Sensitivity of Receptor	High	
	Pre-Mitigation Impact	Residual Impact
Consequence	MEDIUM	LOW
Intensity	High	Medium
	Low: demersal & small pelagic species; High: large pelagic species	Low: demersal & small pelagic species; Medium: large pelagic species
Extent	Regional	Regional
Duration	Immediate	Immediate
Significance	MEDIUM	LOW
Probability	Likely (large pelagic) Unlikely (demersal & small pelagic species)	Possible
Confidence	High	High
Reversibility	Fully Reversible	Fully Reversible
Loss of Resources	Low	Low
Mitigation Potential	-	Medium
Cumulative potential	Unlikely	Unlikely

4.3.6 Impacts of Seismic Noise on Marine Invertebrates

Source of Impact

The project activities that will result in impacts to marine invertebrates are listed below.

Project phase	Activity
Mobilisation	N/A
Operation	Seismic acquisition/ firing of airguns
Demobilisation	N/A

These activities and their associated aspects are described below:

- Noise generated by airguns during seismic acquisition.

Impact Description

Many marine invertebrates have tactile organs or hairs (termed mechanoreceptors), which are sensitive to hydro-acoustic near-field disturbances, and some have highly sophisticated statocysts, which have some resemblance to the ears of fishes (Offutt 1970; Hawkins & Myrberg 1983; Budelmann 1988, 1992; Packard *et al.* 1990; Popper *et al.* 2001) and are thought to be sensitive to the particle acceleration component of a sound wave in the far-field. Potential impacts of seismic pulses on invertebrates would include physiological injury or mortality in the immediate vicinity of the airgun

sound source, and behavioural avoidance. Masking of environmental sounds and indirect impacts due to effects on predators or prey have not been documented and are highly unlikely and are thus not discussed further here.

Project Controls

The seismic contractor will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques.

Sensitivity of Receptors

The proposed 3D survey area lies well offshore where the ecosystem threat status is considered of 'Least concern'. The proposed 3D acquisition area lies well offshore where the deepwater habitat types are comparatively uniform and cover large areas. The benthic fauna of the abyss, lower and upper continental slope and outer shelf (beyond ~450 m depth) are very poorly known and there are no species of commercial value occurring that far offshore. Sensitive deep-water coral communities would be expected with topographic features such as Tripp Seamount and Childs Bank, which lie ~25 km to the north and 30 km east of the survey area, respectively, but are unlikely to occur in the survey area. Furthermore, most ecosystem types outside the offshore MPAs are either poorly protected or not protected at all (see Figure 41). Pelagic invertebrates that may occur in the Orange Basin are the giant squid, which is a deep dwelling species confined to the continental slopes. This species could thus potentially occur in the survey area, although the likelihood of encounter is extremely low.

The sensitivity of benthic invertebrates is considered to be VERY LOW, whereas for neritic and pelagic invertebrates the sensitivity can be considered LOW. Following the precautionary principle, the LOW sensitivity will be assumed in determining the significance.

Consequence of Impact

Information on hearing by invertebrates, and noise impacts on them is sparse (reviewed in Moriyasu *et al.* 2004; Carroll *et al.* 2017). Although many invertebrates cannot sense the pressure of a sound wave or the lower amplitude component of high frequency sounds, low frequency high amplitude sounds may be detected *via* the mechanoreceptors, particularly in the near-field of such sound sources (McCauley 1994). Sensitivity to near-field low-frequency sounds or hydroacoustic disturbances has been recorded for the lobster *Homarus americanus* (Offut 1970; Day *et al.* 2016a; Fitzgibbon *et al.* 2017), cephalopods (Kaifu *et al.* 2008; Hu *et al.* 2009; Mooney *et al.* 2010, 2012; André *et al.* 2011; Fewtrell & McCauley 2012; Samson *et al.* 2014; Mooney *et al.* 2016), scallops (Day *et al.* 2016; Day *et al.* 2017), and various other invertebrate species (Horridge 1965, 1966; Horridge & Boulton 1967; Moore & Cobb 1986; Packard *et al.* 1990; Tumpenney & Nedwell 1994).

Physiological injury

Recent field-based methods on scallop beds (*Pecten fumatus* and *Mimachlamys asperrima*) in the Bass Strait, Australia, showed no evidence of scallop mortality attributable to seismic surveying, although sub-lethal effects could not be excluded (Przeslawski *et al.* 2016, 2018; see also Parry *et al.* 2002; Harrington *et al.* 2010). Another study on exposure of scallops from transplanted populations to an airgun operated in shallow water (<12 m), however, found evidence of seismic impacts (increased

mortality, inability to maintain homeostasis, reflex changes, depressed immune response) (Day *et al.* 2016, 2017).

No other quantitative records of invertebrate mortality from seismic sound exposure under field operating conditions have been reported, although lethal and sub-lethal effects have been observed under experimental conditions where invertebrates were exposed to airguns at close range (reviewed by Carroll *et al.* 2017). These include reduced growth and reproduction rates, compromised nutritional condition and immunological capacity, and behavioural changes in crustaceans (DFO 2004; McCauley 1994; McCauley *et al.* 2000; Day *et al.* 2016; Fitzgibbon *et al.* 2017). The effects of seismic survey energy on snow crab (*Chionoecetes opilio*) on the Atlantic coast of Canada, for example ranged from no physiological damage (Lee-Dadswell 2009), but effects on developing fertilized eggs at 2 m range (Christian *et al.* 2003) to possible bruising of the heptopancreas and ovaries, delayed embryo development, smaller larvae, and indications of greater leg loss but no acute or longer term mortality and no changes in embryo survival or post hatch larval mobility (DFO 2004). In contrast, Day *et al.* (2016, 2019, 2021) demonstrated delayed righting time, which was correlated to damage to statocysts in adult rock lobster (*Jasus edwardsii*) persisting up to a year after exposure to airgun sounds, despite larval stages showing no adverse effects (Day *et al.* 2017, 2019). Impairments in righting behaviour were found to extend to at least 500 m form the airgun discharge, with those closest to the source demonstrating both persistent righting impairment and an increased intermoult duration (Day *et al.* 2019, 2021). The ecological significance of sub-lethal or physiological effects could thus range from trivial to important depending on their nature. It must be kept in mind, however, that assessing seismic impacts using experimental cages or tanks is challenging due to experimental artefacts (Gray *et al.* 2016; Rogers *et al.* 2016) that may lead to misinterpretation of impact in field settings (e.g. DeSoto *et al.* 2013) who reported developmental delays in scallop (*Pecten novaezelandiae*) larvae exposed to playbacks of seismic pulses).

Other field-based studies on adult invertebrate populations revealed no evidence of increased mortality in response to airgun exposure in scallops, clams or lobsters, a variety of reef-associated invertebrates, snowcrabs and shrimp (reviewed in Carroll *et al.* 2017). Day *et al.* (2016a), however, reported dose-dependent increased mortality in transplanted scallops reared in suspended lantern nets four months after exposure to an airgun.

More recently, some studies have also been undertaken on invertebrates that lack statocysts to determine potential non-auditory impacts. Hastings (2008) suggested that at high levels (~260 dB re 1 µPa) hydroacoustic force could potentially cause skeletal and tissue damage in corals. Direct mortality of invertebrates from hydroacoustic force has been considered unlikely (Department of Fisheries and Oceans Canada 2004; Massey & Forde 2015). In a structured infield before-after/control-impact study, no measurable effects on skeletal integrity, physiological damage or stress, and no evidence of a behavioural response in adult scleractinian corals in 30 - 70 m depth at Scott Reef, northwest Australia, were detected immediately after and up to four months following a 3D seismic survey (maximum SEL of 204dB re 1µPa^2) (Battershill *et al.* 2007, 2008; Heyward *et al.* 2018). Heyward *et al.* (2018) point out that the study did not, however, consider sub-lethal or incipient damage to corals or their habitat, such as reduced reproduction, behavioural or physiological changes and slower growth.

Although causative links to seismic surveys have not been established with certainty, giant squid strandings coincident with seismic surveys have been reported (Guerra *et al.*, 2004; Leite *et al.* 2016). The animals examined by Guerra *et al.* (2004) following two incidents of multiple strandings in the

Bay of Biscay showed no external damage, but all had severe internal injuries (including disintegrated muscles and unrecognisable organs) indicative of having ascended from depth too quickly. Similarly, exposure of various species of caged Mediterranean cephalopods to low frequency sounds revealed lesions in the statocysts, consistent with a massive acoustic trauma (André *et al.* 2011; Solé *et al.* 2013a, 2013b).

Behavioural avoidance

Behavioural responses of invertebrates to particle motion of low frequency stimulation have been measured by numerous researchers (reviewed in McCauley 1994). Again a wide range of responses are reported ranging from no avoidance by free ranging invertebrates (crustaceans, echinoderms and molluscs) of reef areas subjected to pneumatic airgun fire (Wardle *et al.* 2001), and no reduction in catch rates of shrimp (Webb & Kempf 1998; Andriguetto-Filho *et al.* 2005), prawns (Steffe & Murphy 1992, in McCauley, 1994) or rock lobsters (Parry & Gason 2006) or snow crab (Courtenay *et al.* 2009; Cote *et al.* 2020) in the near-field during or after seismic surveys. Startle responses and alarm behaviour in decapods occurred only when the animals were <0.10 m away from the sound source (Goodall *et al.* 1990). Day *et al.* (2017), however, demonstrated a reduction in classic behaviours and the development of a nonclassic velar 'flinch' of scallops in response to airgun signals. Branscomb & Rittschof (1984), however, reported that low frequency noise was successful in deterring barnacle larvae from settling on ship hulls. Changes in predator avoidance behaviours may, however, have population-level implications if predation rates increase due to sound-induced behavioural changes in prey (reviewed in Carroll *et al.* 2017; see also Day *et al.* 2019). Solan *et al.* (2016) showed that exposure to underwater broadband sound fields altered sediment-dwelling invertebrate contributions to fluid and particle transport. Thus despite the effects of the sound not being lethal, it could have significant functional, fitness and ecological consequences by affecting key processes in benthic nutrient cycling).

Cephalopods, in contrast, may be receptive to the far-field sounds of seismic airguns, with reported responses to frequencies under 400Hz including alarm response (e.g. jetting of ink), changes in behaviour (aggression and spawning), position in the water column and swimming speeds (Kaifu *et al.* 2008; Hu *et al.* 2009; Mooney *et al.* 2010, 2012; Fewtrell & McCauley 2012; Samson *et al.* 2014; Mooney *et al.* 2016). Squid responded to sounds from 80 to 1 000 Hz pure tone and at sound levels above 140 dB re. 1 µPa rms, with response rates diminishing at the higher and lower end of this range (Samson *et al.* 2014; Mooney *et al.* 2016). In contrast Maniwa (1976) reported attraction at 600 Hz pure tone. Behavioural responses, however, typically involved startle responses at received levels of 174 dB re 1 µPa, to increase levels of alarm responses once levels had reached 156 - 161 dB re 1 µPa (McCauley *et al.* 2000; Fewtrell & McCauley 2012), which is well below the maximum range of 230-255 dB re 1µPa at 1 m for airgun arrays. The results of caged experiments suggest that squid would significantly alter their behaviour at an estimated 2 - 5 km from an approaching large seismic source, although recent research has shown that gradual increase in signal intensity and prior exposure to air gun noise would decrease the severity of the alarm responses, suggesting that animals became accustomed to the noise at low levels (McCauley *et al.* 2000; Fewtrell & McCauley 2012; Samson *et al.* 2014). Limited avoidance of airgun sounds by mobile neritic and pelagic invertebrates can, however, therefore be expected.

As the proposed 3D survey area is located in waters in excess of 500 m depth, the received noise by benthic invertebrates at the seabed would be within the far-field range, and outside of distances at which physiological injury would be expected. The impact is therefore deemed of VERY LOW intensity

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across the survey area (REGIONAL) and for the four-month survey duration (IMMEDIATE) and is therefore considered to be of VERY LOW consequence.

The potential impact of seismic noise on physiological injury or mortality and behavioural avoidance of pelagic cephalopods could potentially be of high intensity to individuals, but as distribution of mobile neritic and pelagic squid is naturally spatially highly variable and the numbers of giant squid likely to be encountered is low, the intensity would be considered LOW across the survey area (REGIONAL) and for the survey duration (IMMEDIATE - 1.5 months) resulting in a VERY LOW consequence.

Impact Significance

The potential impact of 3D seismic noise on benthic, and neritic and pelagic invertebrates, considering the low sensitivity, the low likelihood of the impact occurring is thus deemed to be of NEGLIGIBLE significance.

Identification of Mitigation Measures

The following mitigation measure is however recommended:

No.	[illegible]	[illegible]
1	Terminate seismic shooting on observation of any obvious mass mortalities of squid when estimated by the MMO to be as a direct result of the survey.	Abate on site

Residual Impact Assessment

With the implementation of the typical 'soft-starts', the residual impact on potential behavioural avoidance by cephalopods would remain of NEGLIGIBLE significance.

6	*Impacts of seismic noise to marine invertebrates*	
Project Phase:	**Operation**	
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Sensitivity of Receptor	Low	
	Pre-Mitigation Impact	**Residual Impact**
Consequence	**VERY LOW**	**VERY LOW**
Intensity	Low	**Minor**
Extent	Regional	**Regional**
Duration	Immediate	**Immediate**
Significance	**NEGLIGIBLE**	**NEGLIGIBLE**
Probability	**Unlikely - Possible (squid)**	**Unlikely**
Confidence	**Medium**	**Medium**
Reversibility	**Fully Reversible**	**Fully Reversible**
Loss of Resources	**Low**	**Low**
Mitigation Potential	-	**Low**
Cumulative potential	**Unlikely**	**Unlikely**

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4.3.7 Impacts of Seismic Noise on Plankton (including Ichthyoplankton)

Source of Impact

The project activities that will result in impacts to plankton are listed below.

Project phase	Activity
Mobilisation	N/A
Operation	Seismic acquisition/ firing of airguns
Demobilisation	N/A

These activities and their associated aspects are described below:

- Noise generated by airguns during seismic acquisition.

Impact Description

As the movement of phytoplankton, zooplankton and ichthyoplankton is largely limited by currents, they are not able to actively avoid the seismic vessel and thus are likely to come into close contact with the sound sources, potentially experiencing multiple exposures during acquisition of adjacent lines. Potential impacts of seismic pulses on plankton would include physiological injury or mortality in the immediate vicinity of the airgun sound source.

Project Controls

The seismic contractor will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques.

Sensitivity of Receptors

The proposed 3D survey area lies offshore of the the Namaqua and Cape Columbine upwelling cells (see Figure 7a), in the warmer oceanic waters. Phytoplankton and zooplankton abundance in the clear offshore waters of the Benguela Current are thus expected to be low, although seasonal peaks may occur associated with Child's Bank and Tripp Seamount.

The major spawning areas of the small pelagic shoaling species are on the continental shelf and along the shelf edge from Lambert's Bay to Mossel Bay. Hake, snoek and round herring also move to the western Agulhas Bank and southern west coast to spawn, generally in late winter and early spring, although hake are reported to spawn year round. The eggs and larvae are carried around Cape Point and up the West Coast in northward flowing surface waters, except hake whose eggs rise slowly through the water column, remain entrained in the upwelling circulation and are drawn shorewards at depth until just before hatching. At the start of winter every year, the juveniles recruit in large numbers into coastal waters across broad stretches of the shelf between the Orange River and Cape Columbine to utilise the shallow shelf region as nursery grounds before gradually moving southwards in the inshore southerly flowing surface current, towards the major spawning grounds east of Cape Point. There is therefore no overlap of the proposed 3D survey area with the northward egg and larval drift of commercially important species, and the return migration of recruits (see Figure 17).

Phytoplankton are not known to be affected by seismic surveys and are unlikely to show any significant effects of exposure to airgun impulses outside of a 1 m distance (Kosheleva 1992; McCauley 1994). Although subject to nutrient availability, the regeneration time of phytoplankton is rapid so that an

area vacated by mortality through exposure to airgun blasts would be rapidly recolonized. Furthermore, the fast current speeds would ensure rapid displacement and replacement of damaged or dead plankton within the survey area.

Zooplankton comprises meroplankton (organisms which spend a portion of their life cycle as plankton, such as fish and invertebrate larvae and eggs) and holoplankton (organisms that remain planktonic for their entire life cycle, such as siphonophores, nudibranchs and barnacles). The abundance and spatial distribution of zooplankton is highly variable and dependent on factors such as fecundity, seasonality in production, tolerances to temperature, length of time spent in the water column, hydrodynamic processes and natural mortality. Zooplankton densities are therefore generally patchily distributed.

Invertebrate members of the plankton that have a gas-filled flotation aid, may be more receptive to the sounds produced by seismic airgun arrays, and the range of effects may extend further for these species than for other plankton.

Phytoplankton, zooplankton and ichthyoplankton abundances across most of the survey area are thus expected to be comparatively low, and (if they occur) have a highly patchy distribution and seasonally high abundances. Although plankton distribution is naturally temporally and spatially variable and natural mortality rates are high, the overall sensitivity is considered **MEDIUM** due to the potentially reduced reproductive success in some of the small pelagic species.

Consequence of Impact

The amount of exposure that plankton can withstand due to the influence of seismic sound is dependent on a wide range of variables namely 1) the presence of gas-filled flotation aids, 2) temporal and spatial variability in occurrence, and 3) proximity to the sound source. Potential impacts of seismic pulses on plankton, and fish eggs and larvae would include mortality or physiological injury in the immediate vicinity of the airgun sound source

Due to their importance in commercial fisheries, numerous studies have been undertaken experimentally exposing the eggs and larvae of various zooplankton and ichthyoplankton species to airgun sources (Kostyuchenko 1971; Dalen & Knutsen 1987; Holliday *et al.* 1987; Booman *et al.* 1992; Kosheleva 1992; McCauley 1994; Popper *et al.* 2005; and reviewed in Carroll *et al.* 2017 and Shie *et al.* 2021). These studies generally identified that for a large seismic array, mortalities and physiological injuries occurred at very close range (<5 m) only. For example, increased mortality rates for fish eggs were proven out to ~5 m distance from the air guns. A mortality rate of 40-50% was recorded for yolk sac larvae (particularly for turbot) at a distance of 2-3 m (Booman *et al.* 1996), although mortality figures for yolk sac larvae of anchovies at the same distances were lower (Holliday *et al.* 1987). Yolk sac larvae of cod experienced significant eye injuries (retinal stratification) at a distance of 1 m from an air gun array (Matishov 1992), and Booman *et al.* (1996) report damage to brain cells and lateral line organs at <2 m distance from an airgun array. Increased mortality rates (10-20%) at later stages (larvae, post-larvae and fry) were proven for several species at distances of 1-2 m. Changes have also been observed in the buoyancy of the organisms, in their ability to avoid predators and effects that affect the general condition of larvae, their growth rate and thus their ability to survive. Temporary disorientation juvenile fry was recorded for some species (McCauley 1994). McCauley (1994) concluded that when compared with total population sizes or natural mortality rates of planktonic organisms, the relative influence of seismic sound sources on these populations can be considered insignificant. The wash from ships propellers and bow waves can be

expected to have a similar, if not greater, volumetric effect on plankton than the sounds generated by airgun arrays.

More recently, however, McCauley *et al.* (2017) demonstrated significant declines in zooplankton abundance within a maximum range of 1.2 km of the airguns' passage (see also Tollefson 2017) and suggested that seismic surveys may result in significant and unacknowledged impacts on ocean ecosystem function and productivity. A follow-up publication by Richardson *et al.* (2017), however, queried the robustness of the McCauley *et al.* (2017) study on the grounds of insufficient sample size. Richardson *et al.* (2017) estimated that while zooplankton populations declined 22% within the survey area and 14% within 15 km of the survey area, biomass recovery occurred within 3 days following survey completion and any effects on zooplankton by seismic noise would endure in the very short term only. The time required for recolonisation of the water column by zooplankton (and ichthyoplankton) would depend on a number of variables, including seasonality of zooplankton spawning, water movement, vertical migration of plankton species and proximity of breeding adult populations. The authors stressed that impacts in areas of dynamic ocean circulation (as would be the case in the offshore reaches of the Benguela Current, are likely to be even less. A more recent study by Fields *et al.* (2019) reported that there was significantly higher immediate mortality of the copepod *Calanus finmarchicus* at distances of 5 m from the airguns compared to controls, but that increased mortality did not exceed 30% at any distance from airgun blasts. Whether it was the sound pulse itself, the large-scale fluid motion generated by the airgun blasts, or other effects such as the bubble cloud that caused the higher mortality in the copepods, however, remains unknown.

From a fish resource perspective, these effects may potentially contribute to a certain diminished net production in fish populations, both directly through mortality of ichthyoplankton, as well as indirectly through reduction in plankton that serves as a food source. However, Sætre & Ona (1996) calculated that under the "worst case" scenario, the number of larvae killed during a typical seismic survey was 0.45% of the total larvae population. When more realistic "expected values" were applied to each parameter of the calculation model, the estimated value for killed larvae during one run was equal to 0.03% of the larvae population. If the same larval population was exposed to multiple seismic runs, the effect would add up for each run. For species such as cod, herring and capelin, the natural mortality is estimated at 5-15% per day of the total population for eggs and larvae. This declines to 1-3% per day once the species reach the 0 group stage *i.e.* at approximately 6 months (Sætre & Ona 1996). Consequently, Dalen *et al.* (1996) concluded that seismic-created mortality is so low that it can be considered to have an inconsequential impact on recruitment to the populations. Furthermore, due to the rate at which airguns are discharged, and the fact that the vessel is continuously moving, it is highly unlikely that eggs and larvae will be repeatedly exposed to harmful sound waves (Dalen & Raastad 2008). In Norway, where until 1996 recommendations limiting seismic surveys in areas with drifting eggs and larvae had been in place, these were reviewed to allow surveying in areas of high ichthyoplankton abundance. However, restrictions for spawning areas and areas with spawning migrations, remained in place (Sivle *et al.* 2021)..

A peak SPL of >207 dB has been established for mortality and potential mortal injury of fish eggs and larvae (see Table 14). Based on the noise exposure criteria provided by Popper *et al.* (2014), the Underwater Noise Modelling Study undertaken for the survey (SLR 2022) identified that the maximum horizontal distance from the seismic source to impact threshold levels for fish eggs and larvae leading to mortality or potential mortal injury was 180 m. The zones of cumulative impact from multiple pulses (i.e. the maximum horizontal perpendicular distances from assessed survey lines to cumulative impact threshold levels), was estimated at 10 m. Maximum threshold distances for recoverable injury

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and temporary threshold shifts (TTS) for fish eggs and larvae were not reached. Impacts will thus be of high intensity at close range.

As the 3D survey is scheduled for the summer survey window (start December to end May), there will be some temporal overlap with the peak spawning products of commercially important species. However, as plankton distribution is naturally temporally and spatially variable and natural mortality rates are high, and the survey area lies west of the West Coast northward egg and larval drift and return migration of recruits, any impacts would be of LOW intensity for phytoplankton and zooplankton, but of MEDIUM intensity for ichthyoplankton. Although the impact is restricted to within a few hundred metres of the airguns, it would extend over the entire survey area (REGIONAL). Should impacts occur, they would persist over the IMMEDIATE-TERM (days) in the case of phytoplankton and zooplankton only due to the rapid natural turn-over rate of these plankton communities, but would persist over the SHORT-term in the case of ichthyoplankton (particularly the sardine stock, which is experiencing successive years of low recruitment). The consequence of the impact would therefore be VERY LOW for phytoplankton and zooplankton but MEDIUM for ichthyoplankton. As plankton abundances in the offshore waters of the proposed 3D survey area will be negligible, the consequence of the impact would be VERY LOW.

Impact Significance

The potential impact of seismic noise on phytoplankton and zooplankton, considering the medium sensitivity and very low consequence, is thus deemed to be of VERY LOW significance both with and without mitigation. Due to the medium consequence and medium sensitivity of ichthyoplankton, but the low likelihood of the impact occurring in offshore waters, the impacts are deemed to be of MEDIUM significance.

Identification of Mitigation Measures

As the proposed survey area is located far offshore, it is not deemed necessary to implement mitigation measures to avoid the key spring spawning periods thereby mitigating potential impacts on plankton to some degree. In addition, TGS has agreed to avoid the key "ring fenced" fishing and spawning areas in the south-east of the reconnaissance permit area identified during previous consultation with the commercial fishing sector. No other direct mitigation measures for potential impacts on plankton and fish egg and larval stages are feasible or deemed necessary.

Residual Impact Assessment

This potential impact cannot be eliminated due to the nature of the seismic sound source required during surveying. With the implementation of the above mitigation measure, the residual impact would reduce to VERY LOW significance.

7	*Impacts of seismic noise to plankton and ichthyoplankton*	
Project Phase:	**Operation**	
Type of Impact	Direct	
Nature of Impact	Negative	
Sensitivity of Receptor	Medium	
	Pre-Mitigation Impact	Residual Impact
Consequence	**MEDIUM**	VERY LOW
Intensity	Medium	Low
Extent	Regional	Regional
Duration	Short	Immediate
Significance	**MEDIUM**	VERY LOW
Probability	Possible	Possible
Confidence	High	High
Reversibility	Fully Reversible	Fully Reversible
Loss of Resources	Medium	Low
Mitigation Potential	Low	Medium
Cumulative potential	Unlikely	Unlikely

4.3.8 Impacts of Seismic Noise at Ecosystem Level

Figure 48 provides a simplified conceptual model for the nearshore and offshore receiving environment on the West and South-West Coasts illustrating key variables, processes, linkages, relationships, dependencies and feed-back-loops.

The upwelling of nutrients in the southern Benguela is the main driver that supports substantial seasonal phytoplankton production, which in turn serves as the basis for a rich food chain up through zooplankton, pelagic fish, cephalopods, and marine mammals, as well as demersal species and benthic fauna. High phytoplankton productivity in the upper layers again depletes the nutrients in these surface waters, resulting in a wind-related cycle of plankton production, mortality, sinking of detritus and eventual nutrient enrichment and remineralisation through the microbial loops active in the water column and on the seabed. The natural annual input of millions of tons of organic material onto the seabed provides most of the food requirements of the particulate and filter-feeding benthic communities, resulting in the high organic content of the muds in the region. Organic detritus not directly consumed enters the seabed decomposition cycle, potentially resulting in the depletion of oxygen in deeper waters and the formation of hydrogen sulphide by anaerobic bacteria.

In the offshore oceanic environment in the vicinity of a seamount, similar processes of decomposition and remineralisation, upwelling of nutrients and enhanced localised primary and secondary production would apply, thereby serving as focal points for higher order consumers. The cold-water corals typically associated with seamounts and canyons also add structural complexity to otherwise uniform seabed habitats thereby creating areas of high biological diversity and the development of detritivore-based food-webs, which in turn lead to the presence of seamount scavengers and predators. Seamounts also provide an important habitat for commercial deepwater fish stocks.

Figure 48: Simplified network diagram indicating the interaction between the key ecosystem components off the West Coast.

Ecosystem functions of the offshore deep water environment include the support of highly productive fisheries, the dissolution of CO_2 from the atmosphere and subsequent sequestering of carbon in seabed sediments, as well as waste absorption and detoxification.

The structure and function of these nearshore and offshore marine ecosystems is influenced both by natural environmental variation (e.g. El Niño Southern Oscillation (ENSO)) and multiple human uses, such as hydrocarbon developments and the harvest of marine living resources. The review provided in the impact assessment illustrates that the impacts of anthropogenic noise, at various scales surrounding the stressor, have been recorded in a diverse range of faunal groups. Studies on acoustic impacts, however, largely deal with effects upon individual animals or species, with impacts across large spatial scales, cumulative effects (both of ocean noise and factors other than sound pollution) or multiple species and/or food web levels having rarely been considered.

Below follows a brief discussion of potential population-level and ecosystem-wide effects of disturbance and the application of the integrated ecosystem assessment framework for evaluating the cumulative impacts of multiple pressures on multiple ecosystem components.

With growing evidence of the ecosystem-wide effects of seismic noise (Nieukirk *et al.* 2012; Kavanagh *et al.* 2019; Kyhn *et al.* 2019) and the potential consequences of sub-lethal anthropogenic sounds affecting marine animals at multiple levels (e.g. behaviour, physiology, and in extreme cases survival), there is increasing recognition for the need to consider the effects of anthropogenic noise at population and ecosystem level. The sub-lethal effects of sound exposure may seem subtle, but

small changes in behaviour can lead to significant changes in feeding behaviour, reductions in growth and reproduction of individuals (Pirotta *et al.* 2018), but can have effects that go beyond a single species and may cause changes in food web interactions (Francis *et al.* 2009; Hubert *et al.* 2018; Slabbekoorn & Halfwerk 2009).

For example, the intensified upwelling events associated with the Cape Canyon, provide highly productive surface waters, which power feeding grounds for cetaceans and seabirds (www.environment.gov.za/dearesearchteamreturnfromdeepseaexpedition). Roman & McCarthy (2010) demonstrated the importance of marine mammal faecal matter in replenishing nutrients in the euphotic zone, thereby locally enhancing primary productivity in areas where whales and/or seals gather to feed (see also Kanwisher & Ridgeway 1983; Nicol *et al.* 2010). Surface excretion may also extend seasonal plankton productivity after a thermocline has formed, and where diving and surfacing of deep-feeding marine mammals (e.g. pilot whales, seals) transcends stratification, the vertical movement of these air-breathing predators may act as a pump bringing nutrients below the thermocline to the surface thereby potentially increasing the carrying capacity for other marine consumers, including commercial fish species and pelagic and coastal seabirds (Roman & McCarthy 2010). Behavioural avoidance of marine mammals from such seasonal feeding areas in response to increasing anthropogenic disturbance may thus alter the nutrient fluxes in these zones, with possible ecosystem repercussions.

Likewise, long-lived, slow-reproducing species play important stabilizing roles in the marine ecosystem, especially through predation, as they play a vital role in balancing and structuring food webs, thereby maintaining their functioning and productivity. Should such predators be impacted by hydrocarbon exploration at population level (either directly on individuals or indirectly through loss of prey) and this have repercussions across multiple parts of a food web, top-down trophic cascades in the marine ecosystem could result (Ripple *et al.* 2016).

At the other end of the scale, significant impacts on plankton by anthropogenic sources can have significant bottom-up ripple effects on ocean ecosystem structure and health as phytoplankton and their zooplankton grazers underpin marine productivity. Healthy populations of fish, top predators and marine mammals are not possible without viable planktonic productivity. Furthermore, as a significant component of zooplankton communities comprises the egg and larval stages of many commercial fisheries species, large-scale disturbances (both natural and anthropogenic) on plankton communities can therefore have knock-on effects on ecosystem services across multiple levels of the food web.

Due to the difficulties in observing population-level and/or ecosystem impacts, numerical models are needed to provide information on the extent to which sound or other anthropogenic disturbances may affect the structure and functioning of populations and ecosystems. Attempts to model noise-induced changes in population parameters were first undertaken for marine mammals using the population consequences of acoustic disturbance (PCAD) or Population Consequences of Disturbance (PCoD) approach (NRC 2005). The PCAD/PCoD framework assesses how observed behavioural responses on the health of an individual translates into changes in critical life-history traits (e.g. growth, reproduction, and survival) to estimate population-level effects. Since then various frameworks have been developed to enhance our understanding of the consequences of behavioural responses of individuals at a population level. This is typically done through development of bio-energetics models that quantify the reduction in bio-energy intake as a function of disturbance and assess this reduction against the bio-energetic need for critical life-history traits (Costa *et al.* 2016; Keen *et al.* 2021). The

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consequences of changes in life-history traits on the development of a population are then assessed through population modelling. These frameworks are usually complex and under continual development, but have been successfully used to assess the population consequences and ecosystem effects of disturbance in real-life conditions both for marine mammals (Villegas-Amtmann 2015, 2017; Costa *et al.* 2016; Ellison *et al.* 2016; McHuron *et al.* 2018; Pirotta *et al.* 2018; Dunlop *et al.* 2021), fish (Slabbekoorn & Halfwerk 2009; Hawkins *et al.* 2014; Slabbekoorn *et al.* 2019) and invertebrates (Hubert *et al.* 2018). The PCAD/PCoD models use and synthesize data from behavioural monitoring programs, ecological studies on animal movement, bio-energetics, prey availability and mitigation effectiveness to assess the population-level effects of multiple disturbances over time (Bröker 2019).

Ecosystem-based management is a holistic living resource management approach that concurrently addresses multiple human uses and the effect such stressors may have on the ability of marine ecosystems to provide ecosystem services and processes (e.g. recreational opportunities, consumption of seafood, coastal developments) (Holsman *et al.* 2017; Spooner *et al.* 2021). Within complex marine ecosystems, the integrated ecosystem assessment framework, which incorporates ecosystem risk assessments, provides a method for evaluating the cumulative impacts of multiple pressures on multiple ecosystem components (Levin *et al.* 2009, 2014; Holsman *et al.* 2017; Spooner *et al.* 2021). It therefore has the potential to address cumulative impacts and balance multiple, often conflicting, objectives across ocean management sectors and explicitly evaluate tradeoffs. It has been repeatedly explored in fisheries management (Large *et al.* 2015) and more recently in marine spatial planning (Hammar *et al.* 2020; Carlucci et al. 2021; Jonsson *et al.* 2021; Harris *et al.* 2022).

However, due primarily to the multi-dimensional nature of both ecosystem pressures and ecosystem responses, quantifying ecosystem-based reference points or thresholds has proven difficult (Large *et al.* 2015). Ecosystem thresholds occur when a small change in a pressure causes either a large response or an abrupt change in the direction of ecosystem state or function. Complex numerical modelling that concurrently identifies thresholds for a suite of ecological indicator responses to multiple pressures is required to evaluate ecosystem reference points to support ecosystem-based management (Large *et al.* 2015).

The required data inputs into such models are currently limited in southern Africa. Slabbekoorn *et al.* (2019) point out that in such cases expert elicitation would be a useful method to synthesize existing knowledge, potentially extending the reach of explicitly quantitative methods to data-poor situations.

4.4 Other Impacts of Seismic Surveys on Marine Fauna

4.4.1 Impact of Vessel and Helicopter Noise on Marine Fauna

Source of Impact

The project activities that will result in an increase in noise impacts on marine fauna are listed below.

Project phase	Activity
Mobilisation	Transit of vessels to survey area
Operation	Operation of survey vessels
	Operation of helicopters
Demobilisation	Survey vessels leave survey area and transit to port or next destination

These activities and their associated aspects are described below:

- The presence and operation of the seismic vessel and support vessels during transit to the survey area, during the proposed survey and during demobilisation will introduce a range of underwater noises into the surrounding water column that may potentially contribute to and/or exceed ambient noise levels in the area.
- Crew transfers by helicopter from Cape Town or a suitable location nearby to the survey vessel, if required (preferred alternative is via the support vessel) will generate noise in the atmosphere that may disturb coastal species such as seabirds and seals. Noise source levels from helicopters are expected to be around 109 dB re 1µPa at the most noise-affected point (SLR Consulting Australia 2019).

Impact Description

Elevated underwater and aerial noise can affect marine fauna, including cetaceans, by:

- causing direct physical injury to hearing;
- masking or interfering with other biologically important sounds (e.g. communication, echolocation, signals and sounds produced by predators or prey);
- causing disturbance to the receptor resulting in behavioural changes or displacement from important feeding or breeding areas.

Project Controls

The seismic contractor will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques.

Sensitivity of Receptors

The vessel and aircraft noise described above would primarily take place in the survey area and along the route taken by the support vessels and helicopters between the survey area and Cape Town, which has both a commercial port and airport with existing high daily levels of ambient noise. Depending on the location of the seismic vessel at the time of the crew transfer, the flight path between the survey area and Cape Town would potentially cross over offshore and coastal MPAs, and any sensitive coastal receptors (e.g. key faunal breeding/feeding areas, bird or seal colonies and nursery areas for commercial fish stocks). In addition, migratory pelagic species transiting through the survey area

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may also be directly affected. Tripp Seamount, which is located approximately 25 km to the north of the survey area in Namibian waters, is also an important feature because it attracts an abundance of marine life and is a productive fishing ground. Tripp Seamount falls outside of any possible flight path or vessel route.

The taxa most vulnerable to disturbance by underwater noise are turtles, and large migratory pelagic fish and marine mammals. Some of the species potentially occurring in the survey area, are considered regionally or globally 'Critically Endangered' (e.g. southern bluefin tuna, leatherback turtles and blue whales), 'Endangered' (e.g. Black-Browed and Yellow-Nosed Albatross, Subantarctic Skua, whale shark, shortfin mako shark, fin and sei whales), 'Vulnerable' (e.g. bigeye tuna, blue marlin, loggerhead turtles, oceanic whitetip shark, dusky shark, great white shark, longfin mako and sperm whale, Bryde's and humpback whales) or 'Near Threatened' (e.g. striped marlin, blue shark, longfin tuna/albacore and yellowfin tuna). Although species listed as 'Critically Endangered' or 'Endangered' may potentially occur in the survey area, due to their extensive distributions their numbers are expected to be low. Based on the low numbers of listed species, the sensitivity is considered to be **MEDIUM**.

Consequence of Impact

Vessel Noise

The ocean is a naturally noisy place and marine animals are continually subjected to both physically produced sounds from sources such as wind, rainfall, breaking waves and natural seismic noise, or biologically produced sounds generated during reproductive displays, territorial defence, feeding, or in echolocation (see references in McCauley 1994). Such acoustic cues are thought to be important to many marine animals in the perception of their environment as well as for navigation purposes, predator avoidance, and in mediating social and reproductive behaviour. Anthropogenic sound sources in the ocean can thus be expected to interfere directly or indirectly with such activities thereby affecting the physiology and behaviour of marine organisms (NRC 2003). Natural ambient noise will vary considerably with weather and sea state, ranging from about 80 to 120 dB re 1 µPa for the frequency range 10 - 10k Hz (Croft & Li 2017). Of all human-generated sound sources, the most persistent in the ocean is the noise of shipping (Erbe *et al.* 2018, 2019). Depending on size and speed, the sound levels radiating from vessels range from 160 to 220 dB re 1 µPa at 1 m (NRC 2003). Especially at low frequencies between 5 to 100 Hz, vessel traffic is a major contributor to noise in the world's oceans, and under the right conditions, these sounds can propagate 100s of kilometres thereby affecting very large geographic areas (Coley 1994, 1995; NRC 2003; Pidcock *et al.* 2003). In the South African EEZ shipping stressors and climate-related stressors are increasing more rapidly than other stressors (Purdon *et al.* 2020b), however, despite these stressors being more pronounced along the shelf and shelf edge of the West Coast, this area boasts the highest cetacean species richness in the oceans around South Africa (Purdon *et al.* 2020b). Consequently, shipping impacts need to be appropriately managed to avoid effects on the population growth rates of the species concerned.

As the proposed survey area falls within with the main offshore shipping routes that pass around southern Africa (see Figure 46), the shipping noise component of the ambient noise environment is expected to be the dominant component within and around the survey area (OceanMind Limited 2020). Shabangu *et al.* (2022) determined that the noise of vessel traffic dominates the soundscape below 500 Hz off the West Coast, while wind-generated noise increased with wind speed above 5 m/s and dominates the soundscape above 500 Hz. Given the significant local shipping traffic and relatively

strong metocean conditions specific to the area, ambient noise levels are expected to be 90 - 130 dB re 1 µPa for the frequency range 10 Hz - 10 kHz (SLR Consulting Australia 2019). The noise generated by the survey vessel, thus falls within the hearing range of most fish and marine mammals, and would be audible for considerable ranges before attenuating to below threshold levels. However, unlike the noise generated by the sound source, underwater noise from vessels is not considered to be of sufficient amplitude to cause direct harm to marine life, even at close range. Due to their extensive distributions, the numbers of pelagic species (large pelagic fish, turtles and cetaceans) encountered during the proposed seismic surveys is expected to be low and consequently the intensity of potential physiological injury or behavioural disturbance as a result of vessel noise would be rated as LOW. Furthermore, the duration of the impact on the populations would be limited to the IMMEDIATE-TERM (1.5 months) and extend REGIONALLY between the survey area and the logistics base. The potential physiological injury or behavioural disturbance as a result of vessel noise would thus be of VERY LOW consequence.

Aircraft Noise

The dominant low-frequency components of aircraft engine noise (10-550 Hz) penetrate the water only in a narrow (26° for a smooth water surface) sound cone directly beneath the aircraft, with the angle of the cone increasing in Beaufort wind force >2 (Richardson *et al.* 1995). The peak sound level received underwater is inversely related to the altitude of the aircraft. More recently, Erbe *et al.* (2018) established that commercial passenger airplanes in a coastal underwater soundscape exhibited broadband received levels of 84-132 dB re 1 µPa rms, detectable at between 12 Hz and 10 kHz and exceeding underwater ambient levels by up to 36 dB. Underwater noise from commercial airplanes would thus be audible to a variety of marine fauna, including seals and dolphins.

Available data indicate that the expected frequency range and dominant tones of sound produced by smaller fixed-wing aircraft and helicopters overlap with the hearing capabilities of most odontocetes and mysticetes (Richardson *et al.* 1995; Ketten 1998; Erbe *et al.* 2017). Determining the reactions of cetaceans to over flights is difficult, however, since most observations are made from either the disturbing aircraft itself (Richardson & Würsig 1997), or from a small nearby vessel. Reactions to aircraft flyovers vary both within and between species, and range from no or minimal observable behavioural response (Belugas: Stewart *et al.* 1982, Richardson *et al.* 1991; Sperm: Clarke 1956, Gambell 1968, Green *et al.* 1992), to avoidance by diving, changes in direction or increased speed of movement away from the noise source (Gray: Withrow 1983; Belugas: Richardson *et al.* 1991; Patenaude *et al.* 2002; Sperm: Clarke 1956; Fritts *et al.* 1983; Mullin *et al.* 1991; Würsig *et al.* 1998; Minke: Leatherwood *et al.* 1982; Bowhead: Patenaude *et al.* 2002; Humpbacks: Smultea *et al.* 1995), separation of cow-calf pairs (Gray: Withrow 1983), increased surface intervals (Belugas: Awbrey & Stewart 1983; Stewart *et al.* 1982; Patenaude *et al.* 2002), changes in vocalisation (Sperm whales: Watkins & Schevill 1977; Richter *et al.* 2003, 2006) and dramatic behavioural changes including breaching and lobtailing (Minke: Leatherwood *et al.* 1982; Sperm: Fritts *et al.* 1983; Bowhead: Patenaude *et al.* 2002; Beluga: Patenaude *et al.* 2002), and active and tight clustering behaviour at the surface (Sperm: Smultea *et al.* 2008).

Most authors established that the reactions resulted from the animals presumably receiving both acoustic and visual cues (the aircraft and/or its shadow). As would be expected, sensitivity of whales to disturbance by an aircraft generally lessened with increasing distance, or if the flight path was off to the side and downwind, and if its shadow did not pass directly over the animals (Watkins 1981; Smultea *et al.* 2008). Smultea *et al.* (2008) concluded that the observed reactions of whales to brief

over flights were short-term and isolated occurrences were probably of no long-term biological significance and Stewart *et al.* (1982) suggested that disturbance could be largely eliminated or minimised by avoiding flying directly over whales and by maintaining a flight altitude of at least 300 m. However, repeated or prolonged exposures to aircraft over flights have the potential to result in significant disturbance of biological functions, especially in important nursery, breeding or feeding areas (Richardson *et al.* 1995).

The reaction of pinnipeds to aircraft noise was reviewed by Richardson *et al.* (1995). As the frequency of aircraft engine noise overlaps with the hearing ranges of seals, these will likely similarly receive both acoustic and visual cues from aircraft flyovers. Richardson *et al.* (1995), however, point out that in very few cases was it determined that responses were specifically to aircraft noise as opposed to visual cues. Furthermore, most reported observations relate to pinnipeds on land or ice, with few data specifically on the reactions of pinnipeds in water to either airborne or waterborne sounds from aircraft. Reactions to flyovers vary between species, ranging from stampeding into the water, through temporary abandonment of pupping beaches to alertness at passing aircraft. When in the water, seals have been observed diving when the aircraft passes overhead. Pinnipeds thus exhibit varying intensities of a startle response to airborne noise, most appearing moderately tolerant to flyovers and habituating over time (Richardson *et al.* 1995; Laws 2009). The rates of habituation also vary with species, populations, and demographics (age, sex). Any reactions to over flights would thus be short-term, except for cases where commercial airports are located close to the coast and overflights are frequent (Erbe *et al.* 2018), and isolated occurrences around the survey vessel would unlikely be of any long-term biological significance or have population-level effects.

The hazards of aircraft activity to birds include direct strikes as well as disturbance, the degree of which varies greatly. The negative effects of disturbance of birds by aircraft were reviewed by Drewitt (1999) and include loss of usable habitat, increased energy expenditure, reduced food intake and resting time and consequently impaired body condition, decreased breeding success and physiological changes. Nesting birds may also take flight and leave eggs and chicks unattended, thus affecting hatching success and recruitment success (Zondrillo 1992). Differences in response to different types of aircraft have also been identified, with the disturbance effect of helicopters typically being higher than for fixed-wing aeroplanes. Results from a study of small aircraft flying over wader roosts in the German Wadden Sea showed that helicopters disturbed most often (in 100% of all potentially disturbing situations), followed by jets (84 %), small civil aircraft (56 %) and motor-gliders (50 %) (Drewitt 1999).

Sensitivity of birds to aircraft disturbance are not only species specific, but generally lessened with increasing distance, or if the flight path was off to the side and downwind. However, the vertical and lateral distances that invoke a disturbance response vary widely, with habituation to the frequent loud noises of landing and departing aircraft without ill effects being reported for species such as gulls, lapwings, ospreys and starlings, amongst others (reviewed in Drewitt 1999). Further work is needed to examine the combined effects of visual and acoustic stimuli, as evidence suggests that in situations where background noise from natural sources (e.g. wind and surf) is continually high, the visual stimulus may have the greater effect.

During the northern migration, animals strike the coast at varying places north of St Helena Bay, resulting in increasing whale density on shelf waters and into deeper pelagic waters as one moves northwards, but no clear migration 'corridor'. Humpbacks could therefore potentially transit through the entire Orange Basin area on their northwards migration. On the southward migration, many

humpbacks follow the Walvis Ridge offshore then head directly to high latitude feeding grounds, while others follow a more coastal route (including the majority of mother-calf pairs) possibly lingering in the feeding grounds off Cape Columbine in summer. Humpback whales are thus likely to be the most frequently encountered baleen whale in the project area, ranging from the coast out beyond the shelf, with year round presence but numbers peaking in July - February and a smaller peak with the southern breeding migration around September - October but with regular encounters until February associated with subsequent feeding in the Benguela ecosystem. Southern Right whales migrate to the southern Africa subcontinent to breed and calve, where they tend to have an extremely coastal distribution mainly in sheltered bays. Winter concentrations have been recorded all along the West Coast extending northwards into southern Namibia. Southern right whales have been recorded off the West Coast in all months of the year, but with numbers peaking in winter (June - September). While in local waters, Southern Rights are found in groups of 1-10 individuals, with cow-calf pairs predominating in inshore nursery areas. Smaller cetaceans in the area include the common dolphin and Heaviside's dolphin, which tend to occur further inshore on the shelf but may be encountered in the shallower portions of the proposed survey area. The level of disturbance of cetaceans by aircraft depends on the distance and altitude of the aircraft from the animals (particularly the angle of incidence to the water surface) and the prevailing sea conditions.

Noise generated by helicopters undertaking crew transfers between the logistics base and the survey vessel could affect seabirds and seals in breeding colonies and roosts on the mainland coast. The nearest seabird colonies to Saldanha airport are on the Saldanha Bay Islands and on the emergent reefs off Cape Columbine. These colonies would fall within the potential flight path between the Saldanha Bay airport and the centre of the proposed 3D survey area. The seal colonies falling within the potential flight paths would similarly be at Cape Columbine. If Cape Town International Airport is used as the logistics base for crew transfers, the flight path would not cross any seabird or seal colonies.

Indiscriminate low altitude flights over whales, seals, seabird colonies and turtles by helicopters used to support the seismic vessel could thus have an impact on behaviour and breeding success. The intensity of disturbance would depend on the distance and altitude of the aircraft from the animals (particularly the angle of incidence to the water surface) and the prevailing sea conditions and could range from low to high intensity for individuals but of LOW intensity for the populations as a whole. As such impacts would be PROVINCIAL (although temporary in nature - a few minutes while the helicopter passes overhead) to the flight path and IMMEDIATE-TERM (1.5 months), impacts would be of VERY LOW consequence.

Impact Significance

Vessel Noise

The potential impact of vessel noise causing physiological injury to, or behavioural avoidance by, pelagic and coastal sensitive species, is deemed to be of VERY LOW significance.

Aircraft Noise

The potential impact of aircraft noise causing physiological injury to, or behavioural avoidance by, pelagic and coastal sensitive species, is deemed to be of LOW significance.

Identification of Mitigation Measures

Recommendations for mitigation include:

No	[illegible]	[illegible]
1	Pre-plan flight paths to ensure that no flying occurs over coastal seal colonies and seabird nesting areas	Avoid / abate on site
2	Avoid extensive low-altitude coastal flights by ensuring that the flight path is perpendicular to the coast, as far as possible	Avoid/ abate on site
3	Brief all pilots on the ecological risks associated with flying at a low level along the coast or above marine mammals	Avoid

Residual Impact Assessment

The generation of noise from helicopters cannot be eliminated if helicopters are required for crew changes. Similarly, the generation of vessel noise cannot be eliminated. The proposed mitigation, specifically maintaining the regulated altitude over the coastal zone and MPAs and flying perpendicular to the coast would reduce the intensity of the impact to very low, but the residual impact will remain of very low consequence and of LOW significance. Without mitigation measures for vessel noise, the residual impact of vessel noise would remain VERY LOW.

Aircraft and vessel noise would, however, likely contribute to the growing suite of cumulative acoustic impacts to marine fauna in the area, but assessing the population level consequences of multiple smaller and more localised stressors (see for example Booth *et al.* 2020; Derous *et al.* 2020) is difficult.

8	*Disturbance and behavioural changes in seabirds, seals, turtles and cetaceans due to vessel noise*	
Project Phase:	**Mobilisation, Operation and Decommissioning**	
Type of Impact	Direct	
Nature of Impact	Negative	
Sensitivity of Receptor	Medium	
	Pre-Mitigation Impact	**Residual Impact**
Consequence	**VERY LOW**	**VERY LOW**
Intensity	Low	**Low**
Extent	Provincial	**Provincial**
Duration	Immediate	**Immediate**
Significance	VERY LOW	VERY LOW
Probability	Possible	Possible
Confidence	High	High
Reversibility	Fully Reversible	Fully Reversible
Loss of Resources	Low	Low
Mitigation Potential	-	Very Low
Cumulative potential	**Likely**	**Likely**

9	*Disturbance and behavioural changes in seabirds, seals, turtles and cetaceans due to noise of support aircraft*	
Project Phase:	**Operation**	
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Sensitivity of Receptor	**High**	
	Pre-Mitigation Impact	**Residual Impact**
Magnitude/Consequence	**VERY LOW**	**VERY LOW**
Intensity	Low	Very Low
Extent	Provincial	Provincial
Duration	Immediate	Immediate
Significance	**LOW**	**LOW**
Probability	Possible	Unlikely
Confidence	High	High
Reversibility	Fully Reversible	Fully Reversible
Loss of Resources	Low	Low
Mitigation Potential	-	Very Low
Cumulative potential	Unlikely	Unlikely

4.4.2 Impact of Survey Vessel Lighting on Pelagic Fauna

Source of Impact

The project activities that will result in an increase in noise impacts on marine fauna are listed below.

Mobilisation	Transit of vessels to survey area
Operation	Operation of survey vessel and support vessel
Demobilisation	Survey vessels leave survey area and transit to port or next destination

These activities and their associated aspects are described further below.

- Transit and operation of the survey vessel and support vessels. The operational lighting of survey/support vessels during transit and seismic acquisition can be a significant source of artificial light in the offshore environment increasing the ambient lighting in offshore areas.

Impact Description

The survey activities would be undertaken in the offshore marine environment, more than 100 km offshore, far removed from any sensitive coastal receptors (e.g. bird or seal colonies), but could still directly affect migratory pelagic species (pelagic seabirds, turtles, marine mammals and fish) transiting through the Reconnaissance Permit Area. The strong operational lighting used to illuminate the survey vessel at night may disturb and disorientate pelagic seabirds feeding in the area. Operational lights may also result in physiological and behavioural effects of fish and cephalopods as

these may be drawn to the lights at night where they may be more easily preyed upon by other fish and seabirds.

Project Controls

The seismic contractor will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques.

Sensitivity of Receptors

The taxa most vulnerable to ambient lighting are pelagic seabirds, although turtles (particularly hatchlings and neonates), large migratory pelagic fish, and both migratory and resident cetaceans transiting through the survey area may also be attracted by the lights. Some of the species potentially occurring in the survey area, are considered regionally or globally 'Critically Endangered' (e.g. southern bluefin tuna, leatherback turtles and blue whales), 'Endangered' (e.g. Black-Browed and Yellow-Nosed Albatross, whale shark, shortfin mako shark, fin and sei whales), 'Vulnerable' (e.g. bigeye tuna, blue marlin, loggerhead turtles, oceanic whitetip shark, dusky shark, great white shark, longfin mako and sperm, Bryde's and humpback whales) or 'Near Threatened' (e.g. striped marlin, blue shark, longfin tuna/albacore and yellowfin tuna). Although species listed as 'Critically Endangered' or 'Endangered' may potentially occur in the survey area, due to their extensive distributions their numbers are expected to be low. Based on the low numbers of listed species, the sensitivity is considered to be **MEDIUM**.

Consequence of Impact

Although little can be done on the survey vessel to prevent seabird collisions, reports of collisions or death of seabirds on vessels are rare. Should they occur, the light impacts would primarily take place in the survey area and along the route taken by the support vessels between the survey area and Saldanha Bay/Cape Town. Most of the seabird species breeding along the West Coast feed relatively close inshore (10-30 km), with African Penguins recorded as far as 60 km offshore and Cape Gannets up to 140 km offshore. Pelagic species occurring further offshore would be unfamiliar with artificial lighting and may be attracted to the survey vessel. Fish and squid may also be attracted to the light sources potentially resulting in increased predation on these species by higher order consumers. It is expected, however, that seabirds and marine mammals in the area would become accustomed to the presence of the survey vessel within a few days. Since the survey area is located within the main traffic routes that pass around southern Africa, which experience high vessel traffic, animals in the area should be accustomed to vessel traffic.

Operational lights may also result in physiological and behavioural effects of turtles fish and cephalopods, as these may be drawn to the lights at night where they may be more easily preyed upon by other fish, marine mammals and seabirds. The dispersal of turtle hatchlings is reported to be disrupted by light, causing them to linger, become disoriented in the nearshore and expend energy swimming against ocean currents (Wilson *et al.* 2018). Although seals are known to forage up to 120 nautical miles (~220 km) offshore, the offshore location of the proposed survey area fall to the west of the foraging range of seals from the West Coast colonies. Odontocetes are also highly mobile, supporting the notion that various species are likely to occur in the Reconnaissance Permit Area and thus potentially attracted to the area.

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Due to their extensive distributions, the numbers of pelagic species (large pelagic fish, turtles and cetaceans) encountered during the proposed 3D survey is expected to be low. Due to anticipated numbers and the proximity of survey area to the main traffic routes, the increase in ambient lighting in the offshore environment would be of LOW intensity and REGIONAL in extent (although limited to the area in the immediate vicinity of the vessel) over the IMMEDIATE-TERM (1.5 months). For support vessels travelling from Saldanha Bay/Cape Town increase in ambient lighting would likewise be restricted to the immediate vicinity of the vessel over the short-term. The potential for behavioural disturbance as a result of vessel lighting would thus be of VERY LOW consequence.

Impact Significance

The potential for collision of birds with the survey vessel due to lighting or behavioural disturbance by vessel lighting is deemed to be of VERY LOW significance, due to the medium sensitivity of the receptors, the low likelihood of the impact occurring and the very low consequence.

Identification of Mitigation Measures

The use of lighting on the seismic vessel cannot be eliminated due to safety, navigational and operational requirements. Recommendations for mitigation include:

No		
1	The lighting on the survey and support vessels should be reduced to a minimum compatible with safe operations whenever and wherever possible. Light sources should, if possible and consistent with safe working practices, be positioned in places where emissions to the surrounding environment can be minimised	Reduce at Source
2	Keep disorientated, but otherwise unharmed, seabirds in dark containers for subsequent release during daylight hours. Ringed/banded birds should be reported to the appropriate ringing/banding scheme (details are provided on the ring)	Repair or Restore

Residual Impact Assessment

With the implementation of the mitigation measures above, the residual impact would remain VERY LOW.

10	*Disturbance and behavioural changes in pelagic fauna due to vessel lighting*	
Project Phase:	Mobilisation, Operation & Demobilisation	
Type of Impact	Direct	
Nature of Impact	Negative	
Sensitivity of Receptor	Medium	
	Pre-Mitigation Impact	Residual Impact
Consequence	VERY LOW	VERY LOW
Intensity	Low	Minor
Extent	Regional	Regional
Duration	Immediate	Immediate
Significance	VERY LOW	VERY LOW

	Pre-mitigation Impact	Residual Impact
Probability	Possible	Possible
Confidence	High	High
Reversibility	Fully Reversible	Fully Reversible
Loss of Resources	Low	Low
Mitigation Potential	-	Very Low
Cumulative potential	Unlikely	Unlikely

4.4.3 Impact of Hull Fouling and Ballast Water Discharge

Source of Impact

The project activities that will result in the discharge of ballast water and potential introduction of alien invasive species are listed below.

Project phase	Activity
Mobilisation	Transit of vessels to survey area
	Discharge of ballast water by seismic vessel and/or support vessels
Operation	n/a
Demobilisation	n/a

These activities and their associated aspects are described further below:

- Larvae, cysts, eggs and adult marine organisms are frequently firmly attached to artificial structures such as vessel hulls and infrastructure that have been in the sea for any length of time. Vessels and the transportation of infrastructure from one place to another in the ocean also provide the potential for translocation of introduced or alien species.
- De-ballasting of the survey vessel once at the survey area could introduce non-native species into the area.

Impact Description

Artificial structures deployed at sea serve as a substrate for a wide variety of larvae, cysts, eggs and adult marine organisms. The transportation of equipment from one part of the ocean to another would therefore also facilitate the transfer of the associated marine organisms. Survey vessels, seismic equipment and support vessels are used and relocated all around the world. Similarly, the ballasting and de-ballasting of these vessels may lead to the introduction of exotic species and harmful aquatic pathogens to the marine ecosystems (Bax *et al.* 2003).

The marine invertebrates that colonize the surface of vessels can easily be introduced to a new region, where they may become invasive by outcompeting and displacing native species. Marine invasive species are considered primary drivers of ecological change in that they create and modify habitat, consume and outcompete native fauna, act as disease agents or vectors, and threaten biodiversity. Once established, an invasive species is likely to remain in perpetuity (Bax *et al.* 2003).

Project Controls

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Ballast water is discharged subject to the requirements of the International Maritime Organisation's (IMO) 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments. The Convention aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments. The Convention stipulates that all ships are required to implement a Ballast Water Management Plan and that all ships using ballast water exchange will do so at least 200 nautical miles from nearest land in waters of at least 200 m deep; the absolute minimum being 50 nautical miles from the nearest land. Project vessels would be required to comply with this requirement.

Sensitivity of Receptors

The discharge of ballast water from the survey and support vessels would take place in the vicinity of the survey area, which is located more than 40 km offshore, far removed from any sensitive coastal receptors (e.g. sessile benthic invertebrates, endemic neritic and demersal fish species). In addition, due to the water depths in the survey area (~500 m up to nearly 4 000 m), colonisation by invasive species on the seabed is considered unlikely. Thus, the sensitivity of benthic receptors in the offshore waters of the Orange Basin is therefore considered VERY LOW.

Consequence of Impact

The most important pathways in the transfer of marine alien species have always been related to shipping (Hewitt *et al.* 1999; Ruiz *et al.* 2000; Ruiz & Carlton 2003), with primary introduction events arising mainly from ships moving between major international ports and secondary local spread occurring via regional vessels (Wasson *et al.* 2001; Lacoursière-Roussel *et al.* 2012).

The principal vectors responsible for transfer of alien invasive species are ballast water and external hull fouling (Carlton 1987, 1999; Hewitt *et al.* 2009). Following the prohibition of harmful organotins, such as tributyltin (TBT), in anti-fouling paints (IMO 2001), hull fouling remains responsible for a large proportion of current alien introductions. More than half of the recognised marine alien species in the United Kingdom have been associated with shipping, with the main vector being fouling (Eno 1996), with Australia demonstrating a similar pattern (Thresher 1999).

In South Africa the first review of marine alien species was published in 1992, and listed 15 introduced species (Griffiths *et al.* 1992). This number has grown rapidly since with the National Biodiversity Assessment (Sink *et al.* 2019) reporting 96 introduced marine species including 55 that are considered to be invasive. Invasive species were more prevalent on rocky shores than in other broad ecosystem group, and in the Southern Benguela than in other ecoregions. Shipping activity has been responsible for 86% of these marine introductions, 48% of which are due to fouling (Mead *et al.* 2011).

Alien species have the potential to displace native species, cause the loss of native genotypes, modify habitats, change community structure, affect food web properties and ecosystem processes, impede the provision of ecosystem services, impact human health and cause substantial economic losses (Katsanevakis *et al.* 2014).

The survey vessel, and possibly the support / escort vessels, will more than likely have spent time outside of South Africa's EEZ prior to surveying. This exposure to foreign water bodies and possible loading of ballast water increases the risk of introducing invasive or non-indigenous species into South African waters. The risk of this impact is, however, significantly reduced due by the implementation of ballast water management measures in accordance with the IMO guidelines. The risk is further

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reduced due to the far offshore location of the survey area. Since the survey area is far removed from the coast, which together with the dominant wind and current direction, will ensure that any invasive species drift mainly in a north-westerly direction away from the coast. In addition, the water depths in the survey area (~500 m up to nearly 4 000 m) will ensure that colonisation of invasive species on the seabed is unlikely. De-ballasting in the survey area will thus not pose an additional risk to the introduction of invasive species.

In terms of hull fouling, the survey area is located along one of the main traffic routes that pass around southern Africa. Thus, the introduction of invasive species into South African waters due to hull fouling of project vessels is unlikely to add to the current risk that exists due to the numerous vessels that operate in or pass through South African coastal waters, through and inshore of the survey area, on a daily basis.

Considering the location of the survey area and compliance with the IMO guidelines for ballast water, the impact related to the introduction of alien invasive marine species is considered to be of MEDIUM intensity (due to it having a minimal effect on receptors) in the IMMEDIATE-TERM (due to invasive species not able to establish) and of REGIONAL extent. Thus, the consequence is, therefore, considered to be LOW.

Impact Significance

The potential for introductions of non-native marine species through hull fouling or ballast water discharge is deemed to be VERY LOW, due to the very low sensitivity of the offshore receptors, the low likelihood of the impact occurring and the low consequence.

Identification of Mitigation Measures

This potential impact cannot be eliminated due to the necessity of bringing survey vessels and seismic equipment to the survey area from other parts of the world, and the need for de-ballasting these once on site. In addition to the Project Controls, recommendations for mitigation include:

No.	Mitigation recommended	Type of mitigation
1	Avoid the unnecessary discharge of ballast water.	Reduce at source
2	Use filtration procedures during loading in order to avoid the uptake of potentially harmful aquatic organisms, pathogens and sediment that may contain such organisms	Avoid/reduce at source
3	Ensure that routine cleaning of ballast tanks to remove sediments is carried out, where practicable, in mid-ocean or under controlled arrangements in port or dry dock, in accordance with the provisions of the ship's Ballast Water Management Plan	Avoid/reduce at source
4	Ensure all infrastructure (e.g. arrays, streamers, tail buoys etc) that has been used in other regions is thoroughly cleaned prior to deployment	Avoid/Reduce at Source

Residual Impact Assessment

With the implementation of the mitigation measures above, the residual impact would reduce to NEGLIGIBLE.

11	*Impacts of marine biodiversity through the introduction of non-native species in ballast water and on ship hulls*

Project Phase:	Mobilisation	
Type of Impact	Indirect	
Nature of Impact	Negative	
Sensitivity of Receptor	Very Low	
	Pre-Mitigation Impact	Residual Impact
Consequence	VERY LOW	VERY LOW
Intensity	Medium	Low
Extent	Regional	Regional
Duration	Immediate	Immediate
Significance	VERY LOW	NEGLIGIBLE
Probability	Unlikely	Unlikely
Confidence	Medium	Medium
Reversibility	Irreversible	Irreversible
Loss of Resources	Low	Low
Mitigation Potential	-	Very Low
Cumulative potential	Unlikely	Unlikely

4.4.4 Impacts of Waste Discharges to Sea

Source of Impact

The project activities that will result in a reduction of water quality from routine discharges to the sea from vessels are listed below.

Project phase	Activity
Mobilisation	Transit of vessels to survey area
Operation	Operation of survey vessels and transit of support vessels between the survey area and the logistics base
Demobilisation	Survey vessels leave survey area and transit to port or next destination

These activities and their associated aspects are described further below:

- Deck drainage: all deck drainage from work spaces is collected and piped into a sump tank on board the seismic vessel to ensure MARPOL compliance (15 ppm oil in water). The fluid would be analysed and any hydrocarbons skimmed off the top prior to discharge. The oily substances would be added to the waste (oil) lubricants and disposed of at a suitable facility onshore.
- Grey Water and Sewage: sewage discharges will be comminuted and disinfected. In accordance with MARPOL Annex IV, the effluent must not produce visible floating solids in, nor causes discolouration of, the surrounding water. The treatment system must provide primary settling, chlorination and dechlorination before the treated effluent can be discharged into the sea. The treated sanitary effluents discharged into the sea are estimated at around 10 000 litres per day for the duration of the seismic study based on 140-150 litres per 70-80 persons. The discharge depth is variable, depending upon the draught of the seismic vessel / support vessel at the time, but would be in accordance with MARPOL Annex IV.

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- **Vessel machinery spaces, mud pit wash residue and ballast water:** the concentration of oil in discharge water from vessel machinery space or ballast tanks may not exceed 15 ppm oil in water (MARPOL Annex I). If the vessel intends to discharge bilge or ballast water at sea, this is achieved through use of an oily-water separation system. Oily waste substances must be shipped to land for treatment and disposal.
- **Food (galley) wastes:** food wastes may be discharged after they have been passed through a comminuter or grinder, and when the seismic vessel is located more than 3 nautical miles from land. Discharge of food wastes not comminuted is permitted beyond 12 nautical miles. The ground wastes must be capable of passing through a screen with openings <25 mm. The daily volume of discharge from a standard seismic vessel is expected to be <0.2 m^3.
- **Cooling Water and drinking water surplus:** The cooling water and surplus generated by the drinking water supply system are likely to contain a residual concentration of chlorine (generally less than 0.5 mg/l for drinking water supply systems, seismic vesselSuch water would be tested prior to discharge and would comply with relevant Water Quality Guidelines.

Impact Description

The discharge of wastes to sea could create local reductions in water quality, both during transit to and within the survey area. Deck and machinery space drainage may result in small volumes of oils, detergents, lubricants and grease, the toxicity of which varies depending on their composition, being introduced into the marine environment. Sewage and gallery waste will place a small organic and bacterial loading on the marine environment, resulting in an increased biological oxygen demand.

These discharges will result in a local reduction in water quality, which could impact marine fauna in a number of different ways:

- Physiological effects: Ingestion of hydrocarbons, detergents and other waste could have adverse effects on marine fauna, which could ultimately result in mortality.
- Increased food source: The discharge of galley waste and sewage will result in an additional food source for opportunistic feeders, speciality pelagic fish species.
- Increased predator - prey interactions: Predatory species, such as sharks and pelagic seabirds, may be attracted to the aggregation of pelagic fish attracted by the increased food source.

Project Controls

The operator will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and in compliance with the applicable requirements in MARPOL 73/78, as summarised below.

- The discharge of biodegradable wastes from vessels is regulated by MARPOL 73/78 Annex V, which stipulates that:
  - No disposal to occur within 3 nm (± 5.5 km) of the coast.
  - Disposal between 3 nm (± 5.5 km) and 12 nm (± 22 km) needs to be comminuted to particle sizes smaller than 25 mm.
  - Disposal overboard without macerating can occur greater than 12 nm from the coast when the vessel is sailing.
- Discharges of oily water (deck drainage, bilge and mud pit wash residue) to the marine environment are regulated by MARPOL 73/78 Annex I, which stipulates that vessels must have:

  - A Shipboard Oil Pollution Emergency Plan (SOPEP).
  - A valid International Oil Pollution Prevention Certificate, as required by vessel class.
  - Equipment for the control of oil discharge from machinery space bilges and oil fuel tanks. e.g. oil separating/filtering equipment and oil content meter. Oil in water concentration must be less than 15 ppm prior to discharge overboard.
  - Oil residue holding tanks.
  - Oil discharge monitoring and control system.
- Sewage and grey water discharges from vessels are regulated by MARPOL 73/78 Annex IV, which specifies the following:
  - Vessels must have a valid International Sewage Pollution Prevention Certificate.
  - Vessels must have an onboard sewage treatment plant providing primary settling, chlorination and dechlorination before discharge of treated effluent.
  - The discharge depth is variable, depending upon the draught of the seismic vessel / support vessel at the time, but will be in accordance with MARPOL 73/78 Annex IV.
  - Discharge of sewage beyond 12 nm requires no treatment. However, sewage effluent must not produce visible floating solids in, nor cause the discolouration of, the surrounding water.
  - Sewage must be comminuted and disinfected for discharges between 3 nm (± 6 km) and 12 nm (± 22 km) from the coast. This will require an onboard sewage treatment plant or a sewage comminuting and disinfecting system.
  - Disposal of sewage originating from holding tanks must be discharged at a moderate rate while the ship is proceeding on route at a speed not less than 4 knots.
- Sewage will be treated using a marine sanitation device to produce an effluent with:
  - A biological oxygen demand (BOD) of <25 mg/l (if the treatment plant was installed after 1/1/2010) or <50 mg/l (if installed before this date).
  - Minimal residual chlorine concentration of 0.5 mg/l.
  - No visible floating solids or oil and grease.

The project will also comply with industry best practices with regard to waste management, including:

- Waste management will follow key principles: Avoidance of Waste Generation, adopting the Waste Management Hierarchy (reduce, reuse, recycle, recover, residue disposal), and use of Best Available Technology.
- An inventory will be established of all the potential waste generated, clarifying its classification (hazardous, non-hazardous or inert) and quantity, as well as identifying the adequate treatment and disposal methods.
- Waste collection and temporary storage shall be designed to minimise the risk of escape to the environment (for example by particulates, infiltration, runoff or odours).
- On-site waste storage should be limited in time and volume.
- Dedicated, clearly labelled, containers (bins, skips, etc.) will be provided in quantities adapted to anticipated waste streams and removal frequency.

Sensitivity of Receptors

The operational waste discharges from the activities described above would primarily take place in the survey area and along the route taken by the support vessels between the survey area and the logistics base in Saldanha Bay/Cape Town. The 3D survey area is located in the offshore marine environment, far removed from coastal MPAs and any sensitive coastal receptors (e.g. key faunal

breeding/feeding areas, bird or seal colonies and nursery areas for commercial fish stocks); however, discharges could still directly affect migratory pelagic species transiting through the survey area. Vessel discharges *en route* to the onshore supply base could result in discharges closer to shore, thereby potentially having an environmental effect on the sensitive coastal environment.

The taxa most vulnerable to waste discharges are pelagic seabirds, turtles, and large migratory pelagic fish and marine mammals. Some of of the species potentially occurring in the survey area, are considered regionally or globally 'Critically Endangered' (e.g. southern bluefin tuna, leatherback turtles and blue whales), 'Endangered' (e.g. Black-Browed and Yellow-Nosed Albatross, whale shark, shortfin mako shark, fin and sei whales), 'Vulnerable' (e.g. bigeye tuna, blue marlin, loggerhead turtles, oceanic whitetip shark, dusky shark, great white shark, longfin mako and sperm, Bryde's and humpback whales) or 'Near Threatened' (e.g. striped marlin, blue shark, longfin tuna/albacore and yellowfin tuna). Although species listed as 'Critically Endangered' or 'Endangered' may potentially occur in the survey area, due to their extensive distributions their numbers are expected to be low. Based on the low numbers of listed species, the sensitivity is considered to be **MEDIUM.**

Consequence of Impact

The contracted survey / support vessels will have the necessary sewage treatment systems in place, and the vessel will have oil/water separators and food waste macerators to ensure compliance with MARPOL 73/78 standards. MARPOL compliant discharges would therefore introduce relatively small amounts of nutrients and organic material to oxygenated surface waters, which will result in a minor contribution to local marine productivity and possibly of attracting opportunistic feeders. The intermittent discharge of sewage is likely to contain a low level of residual chlorine following treatment, but given the relatively low total discharge and rapid dilution in surface waters this is expected to have a minimal effect on seawater quality.

Furthermore the survey area is suitably far removed from sensitive coastal receptors and the dominant wind and current direction will ensure that any discharges are rapidly dispersed north-westwards and away from the coast. There is no potential for accumulation of wastes leading to any detectable long-term impact.

Due to the distance offshore, it is only pelagic fish, birds, turtles and cetaceans that may be affected by the discharges, and these are unlikely to respond to the minor changes in water quality resulting from vessel discharges. The most likely animal to be attracted to the survey vessels will be large pelagic fish species, such as the highly migratory tuna and billfish, as well as sharks and odontocetes (toothed whales). Pelagic seabirds that feed primarily by scavenging would also be attracted.

Other types of wastes generated during the exploration activities will be segregated, duly identified transported to shore for ultimate valorisation and/or disposal at a licensed waste management facility. The disposal of all waste onshore will be fully traceable.

Based on the relatively small discharge volumes and compliance with MARPOL 73/78 standards, offshore location and high energy sea conditions, the potential impact of normal discharges from the survey / support vessels will be of VERY LOW intensity, IMMEDIATE duration and REGIONAL in extent (although localised at any one time around the project vessels). The impact consequence is therefore considered VERY LOW.

Impact Significance

The impacts associated with normal waste discharges from the survey vessel is deemed to be of VERY LOW significance, due to the medium sensitivity of the offshore receptors, the medium probability of the impact occurring and the very low consequence.

Identification of Mitigation Measures

In addition to compliance with MARPOL 73/78 regulations regarding waste discharges mentioned above, the following measures will be implemented to reduce wastes at the source:

No.	Mitigation measure	Classification
1	Implement leak detection and repair programmes for valves, flanges, fittings, seals, etc.	Avoid/Reduce at Source
2	Use a low-toxicity biodegradable detergent for the cleaning of all deck spillages.	Reduce at Source

Residual Impact Assessment

This potential impact cannot be eliminated because the seismic / support vessels are needed to undertake the survey and will generate routine discharges during operations. With the implementation of the project controls and mitigation measures, the residual impact will remain of VERY LOW significance.

12	*Impacts of normal vessel discharges on marine fauna*	
Project Phase:	Mobilisation, Operation and Decommissioning	
Type of Impact	Indirect	
Nature of Impact	Negative	
Sensitivity of Receptor	Medium	
	Pre-Mitigation Impact	Residual Impact
Consequence	VERY LOW	VERY LOW
Intensity	Minor	Minor
Extent	Regional	Regional
Duration	Immediate	Immediate
Significance	VERY LOW	VERY LOW
	Pre-Mitigation Impact	Residual Impact
Probability	Likely	Likely
Confidence	High	High
Reversibility	Fully Reversible	Fully Reversible
Loss of Resources	Low	Low
Mitigation Potential	-	Very Low
Cumulative potential	Unlikely	Unlikely

4.5 Unplanned Events

4.5.1 Faunal Strikes with Project Vessels and Equipment

Source of Impact

The project activities that will result in potential collision impacts with marine fauna are listed below.

Project phase	Activity
Mobilisation	Ship strikes during transit of vessels to survey area
Operation	Ship strikes during Operation of survey vessels
	Strikes and entanglement of marine fauna during seismic and/or acquisition
Demobilisation	Ship strikes during transit to port or next destination

These activities and their associated aspects are described below:

- Passage of the seismic vessel and chase vessels - Ship strikes.
- Towing of seismic equipment - Collision with or entanglement in towed seismic apparatus.

Impact Description

The potential effects of vessel presence and towed equipment on turtles and cetaceans include physiological injury or mortality.

Project Controls

The operator will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques.

Sensitivity of Receptors

The leatherback and loggerhead turtles that occur in offshore waters around southern Africa, and likely to be encountered in the proposed survey area are considered regionally 'Critically Endangered' and 'Near Threatened', respectively. However, due to their extensive distributions and feeding ranges, the numbers of individuals encountered during the survey are likely to be low. Consequently, the sensitivity of turtles is considered to be **MEDIUM**.

Thirty three species or sub species/populations of cetaceans (whales and dolphins) are known or likely to occur off the West Coast. The majority of migratory cetaceans in South African waters are baleen whales (mysticetes), while toothed whales (odontocetes) may be resident or migratory. Of the 33 species, the blue whale is listed as 'Critically Endangered', the fin and sei whales are 'Endangered' and the sperm, Bryde's (offshore) and humpback whales are considered 'Vulnerable' (South African Red Data list Categories). Although the survey area is far removed from the coast, overlap with Child's Bank and the proximity to Tripp Seamount, where a greater number of individuals can be expected, the sensitivity of cetaceans to strikes is considered to be **HIGH**.

Consequence of Impact

Ship strikes are globally the biggest threat to large whales, having direct, long-term and population-level consequences (Schoeman *et al.* 2020). Although most scientific publications to date have

focussed on collisions between vessel and whales and manatees, there is growing evidence that at least 75 marine species, including smaller whales, dolphins, porpoises, dugongs, manatees, whale sharks, sharks, seals, sea otters, turtles, penguins, and fish are at risk of collision, especially within coastal areas frequented by smaller vessels (reviewed by Schoeman *et al.* 2020). As the proposed 3D survey area is located in a region of very high vessel traffic (see Figure 46), potential collisions between marine fauna and vessels would not be limited to project-specific vessels. Given the slow speed (about 4 - 6 kts) of the vessel while towing the seismic array, ship strikes whilst surveying are unlikely, but may occur during the transit of the vessel to or from the survey area. Ship strikes by the chase vessel may also occur.

The physical presence of the survey vessel and increased vessel traffic west of the main transport routes could increase the likelihood of animal-vessel collisions. Ship strikes have been reported to result in medium-term effects such as evasive behaviour by animals experiencing stress, or longer-term effects such as decreased fitness or habitual avoidance of areas where disturbance is common and in the worst case death (see for example Constantine 2001; Hastie *et al.* 2003; Lusseau 2004, 2005; Bejder *et al.* 2006; Lusseau *et al.* 2009). Ship strikes have been documented from many regions and for numerous species of whales (Panigada *et al.* 2006; Douglas *et al.* 2008; Elvin & Taggart 2008) and dolphins (Bloom & Jager 1994; Elwen & Leeney 2010), with large baleen whales being particularly susceptible to collision (Pirotta *et al.* 2019). Any increase in vessel traffic through areas used as calving grounds or through which these species migrate will increase the risk of collision between a whale and a vessel.

The potential for ship strikes of cetaceans is dependent on the abundance and behaviour of cetaceans in the area and vessel speed. For example, Keen *et al.* (2019) modeled fin whale ship strike risk in the California Current System and found that night-time collision risk was twice as high as the daytime risk. Due to their extensive distributions and feeding ranges, the number of cetaceans encountered by project vessels in the offshore environment is expected to be low.

The large amount of equipment towed astern of survey vessels also increases the potential for collision with or entrapped in seismic equipment and towed surface floats. Entanglement of cetaceans in gear is possible in situations where tension is lost on the towed array.

Basking turtles are particularly slow to react to approaching objects and may not be able to move rapidly away from approaching airguns. In the past, almost all reported turtle entrapments were associated with the subsurface structures ("undercarriage") of the tail buoys attached to the end of each seismic cable. Towing points are located on the leading edge of each side of the undercarriage, and these are attached by chains to a swivel leading to the end of the seismic cable (Ketos Ecology 2009). Entrapment occurs either as a result of 'startle diving' in front of towed equipment or following foraging on barnacles and other organisms growing along seismic cables and surfacing to breathe immediately in front of the tail buoy (primarily loggerhead and Olive Ridley turtles). In the first case the turtle becomes stuck within the angled gap between the chains and the underside of the buoy, lying on their sides across the top of the chains and underneath the float with their ventral surface facing the oncoming water thereby causing the turtle to be held firmly in position (Figure 49, left). Depending on the size of the turtle, they can also become stuck within the gap below a tail buoy, which extends to 0.8 m below water level and is ~0.6 m wide. The animal would need to be small enough to enter the gap, but too big to pass all the way through the undercarriage. Furthermore, the presence of the propeller in the undercarriage of some buoy-designs prohibits turtles that have entered the undercarriage from travelling out of the trailing end of the buoy (Figure 49, right). Once

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stuck inside or in front of a tail buoy, the water pressure generated by the 4-6 knot towing speed, would hold the animal against/inside the buoy with little chance of escape due to the angle of its body in relation to the forward movement of the buoy. For a trapped turtle this situation will be fatal, as it will be unable to reach the surface to breathe (Ketos Ecology 2009). To prevent entrapment, the seismic industry has implemented the use of "turtle guards" on all tailbuoys.

The potential for collision between adult turtles and the seismic vessel, or entanglement of turtles in the towed seismic equipment and surface floats, is highly dependent on the abundance and behaviour of turtles in the survey area at the time of the survey. Due to their extensive distributions and feeding ranges, and the extended distance from their nesting sites, the number of turtles encountered during the proposed seismic surveys is expected to be low. Should collisions or entanglements occur, the impacts would be of high intensity for individuals but of LOW intensity for the population as a whole. Furthermore, as the duration of the impact would be limited to the IMMEDIATE-TERM (1.5 months) and be restricted to the survey area (REGIONAL), the potential for collision and entanglement in seismic equipment is therefore considered to be of VERY LOW consequence.

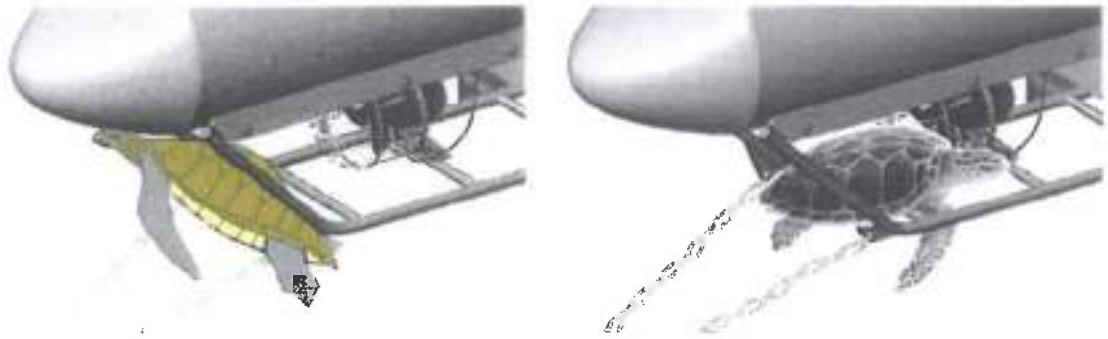

Figure 49: Turtles commonly become trapped in front of the undercarriage of the tail buoy in the area between the buoy and the towing chains (left), and inside the 'twin-fin' undercarriage structure (right) (Ketos Ecology 2009).

The potential for strikes and entanglement of cetaceans in the towed seismic equipment, is similarly highly dependent on the abundance and behaviour of cetaceans in the survey area at the time of the survey. Due to their extensive distributions and feeding ranges, the number of cetaceans encountered during the proposed seismic surveys is expected to be low. Should entanglements occur, the impacts would be of high intensity for individuals but of LOW intensity for the population as a whole. Furthermore, as the duration of the impact would be limited to the IMMEDIATE-TERM (1.5 months) and be restricted to the survey area (REGIONAL), the potential for entanglement in seismic equipment is therefore considered to be of VERY LOW consequence.

Impact Significance

The potential for collision with or entanglement by turtles and cetaceans during the seismic survey or the transit of the vessel to or from the survey area is deemed to be of LOW significance, due to the high sensitivity of the receptors, but very low likelihood of the impact occurring and the low consequence.

Recommendations for mitigation include:

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No	Mitigation measure	Implementation
1	The vessel operators should keep a constant watch for marine mammals and turtles in the path of the vessel.	Avoid
2	Keep watch for marine mammals behind the vessel when tension is lost on the towed equipment and either retrieve or regain tension on towed gear as rapidly as possible.	Avoid
3	Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector turtle guards'.	Abate on site
4	Ensure vessel transit speed between the survey area and port is a maximum of 12 knots (22 km/hr), except in MPAs where it is reduced further to 10 knots (18 km/hr) as well as when they are present in the vicinity.	Avoid/reduce at source

Monitoring

Should a collision with a large whale occur, the event must be reported to the IWC database, which has been shown to be a valuable tool for identifying the species most affected, vessels involved in collisions, and correlations between vessel speed and collision risk (Jensen & Silber 2003).

Residual Impact Assessment

With the implementation of the mitigation measures above, the residual impact would remain LOW.

13	*Impacts on turtles and cetaceans due to ship strikes, collision and entanglement with towed equipment*	
Project Phase:	**Mobilisation, Operation & Decommissioning**	
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Sensitivity of Receptor	**High**	
	Pre-Mitigation Impact	**Residual Impact**
Magnitude/Consequence	**VERY LOW**	**VERY LOW**
Intensity	Low	Minor
Extent	Regional	Regional
Duration	Immediate	Immediate
Significance	**LOW**	**LOW**

	Pre-Mitigation Impact	Residual Impact
Probability	Unlikely	Unlikely
Confidence	High	High
Reversibility	Fully Reversible	Fully Reversible
Loss of Resources	Low	Low
Mitigation Potential	-	Low
Cumulative potential	Unlikely	Unlikely

4.5.2 Accidental Loss of Equipment

Source of Impact

The project activities that will result in the accidental loss of equipment are listed below.

Project phase	Activity
Mobilisation	n/a
Operation	Accidental loss of equipment to the water column or seabed during operation
Demobilisation	n/a

These activities and their associated aspects are described further below:

- Irretrievable loss of equipment to the seabed during vessel transfer with crane.
- Accidental loss of paravanes, streamers, arrays and tail buoys during seismic acquisition.

During seismic acquisition, the survey vessel tows a substantial amount of equipment; the deflectors or paravanes, which keep the streamers equally spread are towed by heavy-duty rope, and the streamers themselves are towed by lead-in cables. Each streamer is fitted with a dilt float at the head of the streamer, numerous streamer mounts (birds and fins) to control streamer depth and lateral positioning, and a tail buoy to mark the end of the streamer. Streamers are neutrally buoyant at the required depth (5-10 m) but have buoyancy bags embedded within them that inflate at a depth of 40 m. If streamers are accidentally lost they would therefore float in the water column for some time before sinking. Dilt floats and tail buoys would ultimately be dragged down under the weight of the streamer.

Airguns are suspended under floats by a network of ropes, cables and chains, with each float configuration towed by an umbilical. Should both the float and umbilical fail, the airguns would sink to the seabed.

In the unlikely event of complete failure of buoyancy and tow systems, the seismic equipment and the attached ropes, cables and chains could pose an entanglement hazard to turtles and marine mammals.

If equipment falls to the seabed, it would crush benthic fauna in its footprint, but ultimately provide a hard surface for colonisation.

Impact Description

The potential impacts associated with lost equipment include:

- Potential disturbance and damage to seabed habitats and crushing of epifauna and infauna within the equipment footprint;
- Potential physiological injury or mortality to pelagic and neritic marine fauna due to entanglement in streamers, arrays and tail buoys drifting on the surface or in the water column.

Project Controls

The seismic contractor will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques.

Sensitivity of Receptors

Loss of equipment would likely take place during seismic acquisition within the survey area, which is located in the offshore marine environment, more than 40 km offshore at its closest point, far removed from any sensitive coastal receptors (e.g. key faunal breeding/feeding areas, bird or seal colonies and nursery areas for commercial fish stocks). The survey area lies well offshore where the pelagic and benthic ecosystem threat status is mainly considered as 'Least threatened', and where the deepwater habitat types are comparatively uniform and cover large areas. The benthic fauna beyond ~450 m depth are very poorly known and there are no species of commercial value occurring that far offshore. Sensitive deep-water coral communities would be expected with topographic features such as Tripp Seamount and Child's Bank. The sensitivity of benthic fauna is considered to be LOW.

Lost equipment could also pose an entanglement risk to migratory turtles and cetaceans transiting through the survey area. The taxa most vulnerable to entanglement in lost equipment are turtles and marine mammals. Some of the species potentially occurring in the survey area, are considered regionally or globally 'Critically Endangered' (e.g. leatherback turtles and blue whales), 'Endangered' (e.g. whale shark, fin and sei whales), or 'Vulnerable' (e.g. loggerhead turtles and sperm, Bryde's and humpback whales). Although species listed as 'Critically Endangered' or 'Endangered' may potentially occur in the survey area, entanglement is highly unlikely. In addition, due to their extensive distributions their numbers are expected to be low. Based on the low numbers of listed species, the sensitivity is considered to be MEDIUM.

Overall, considering the precautionary principle, the sensitivity of marine fauna for collision or entanglement is considered to be MEDIUM.

Consequence of Impact

The accidental loss of equipment onto the seafloor would provide a localised area of hard substrate in an area of otherwise unconsolidated sediments. The availability of hard substrata on the seabed provides opportunity for colonisation by sessile benthic organisms and could provide shelter for demersal fish and mobile invertebrates thereby potentially increasing the benthic biodiversity and biomass in the continental slope and abyssal regions. The benthic fauna inhabiting islands of hard substrata in otherwise unconsolidated sediments of the outer shelf and continental slope are, however, very poorly known but would likely be different from those of the surrounding

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unconsolidated sediments. In the unlikely event of equipment loss, associated impacts would be of LOW intensity and be highly localised and limited to the SITE over the IMMEDIATE-term (any lost object, depending on its size, will likely sink into the sediments and be buried over time). The impact consequence for equipment lost to the seabed is therefore considered VERY LOW.

The loss of streamers and floats would result in entanglement hazards in the water column before the streamers sink under their own weight. In the unlikely event of streamer loss, associated impacts would similarly be of LOW intensity and be highly localised and limited to the SITE (although would potentially float around regionally) over the IMMEDIATE-term. The impact consequence for equipment lost to the water column is therefore considered VERY LOW.

Impact Significance

The impacts associated with the accidental loss of equipment are deemed to be of VERY LOW significance, due to the medium sensitivity of the offshore receptors, the very low likelihood of the impact occurring and the very low consequence.

Identification of Mitigation Measures

The following measures will be implemented to manage accidental loss of equipment:

No.	Mitigation measure	Classification
1	Ensuring that loads are lifted using the correct lifting procedure and within the maximum lifting capacity of crane system.	Avoid
2	Minimise the lifting path between vessels.	Avoid
3	Undertake frequent checks to ensure items and equipment are stored and secured safely on board each vessel.	Avoid
4	In the event that equipment is lost during the operational stage, assess safety and metocean conditions before performing any retrieval operations. Establishing a hazards database listing the type of gear left on the seabed and/or in the Reconnaissance Permit Area with the dates of abandonment/loss and locations, and where applicable, the dates of retrieval	Repair/restore

Residual Impact Assessment

With the implementation of the project controls and mitigation measures, the residual impact will remain of VERY LOW significance

14	*Impacts on benthic and pelagic fauna due to accidental loss of equipment to the seabed or the water column*	
Project Phase:	**Operation**	
Type of Impact	**Direct**	
Nature of Impact	**Negative**	
Sensitivity of Receptor	**Medium**	
	Pre-Mitigation Impact	**Residual Impact**
Consequence	**VERY LOW**	**VERY LOW**
Intensity	**Low**	**Minor**
Extent	**Site**	**Site**
Duration	**Immediate**	**Immediate**
Significance	**VERY LOW**	**VERY LOW**
Probability	**Unlikely**	**Unlikely**
Confidence	**High**	**High**
Reversibility	**Fully Reversible to Partially Reversible**	**Fully Reversible to Partially Reversible**
Loss of Resources	**Low**	**Low**
Mitigation Potential	**-**	**Low**
Cumulative potential	**Unlikely**	**Unlikely**

4.5.3 Release of diesel to sea during bunkering or due to vessel accident

Source of Impact

The project activities that will result in the accidental release of diesel / oil are listed below.

[illegible]	[illegible]
Mobilisation	Loss of fuel from vessel accident
Operation	Loss of fuel from vessel accident
	Bunkering of fuel
Demobilisation	Loss of fuel from vessel accident

These activities and their associated aspects are described further below:

- Instantaneous spills of marine diesel at the surface of the sea can potentially occur during operation, and Such spills are usually of a low volume.
- Larger volume spills of marine diesel would occur in the event of a vessel collision or vessel accident.

Impact Description

Marine diesel spilled in the marine environment would have an immediate detrimental effect on water quality, with the toxic effects potentially resulting in mortality (e.g. suffocation and poisoning) of

marine fauna or affecting faunal health (e.g. respiratory damage). If the spill reaches the coast, it can result in the smothering of sensitive coastal habitats.

Project Controls

The operator will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques. The purpose of the Operator's performance standards is to reduce the risk of pollution and oil spills for projects to As Low As Reasonably Practicable (ALARP). The objectives of the Operator's policies and procedures are to:

- Apply the hazard management process;
- Careful HSSE management by all parties;
- Design and install equipment and/or implement Procedures to reduce the impact of discharges to the environment;
- Assess the Maritime Safety Risks and put controls in place to manage these risks to ALARP;
- Establish and maintain procedures for managing the risk of maritime operations that comply with the Operator's Maritime Safety Requirements for Design, Engineering and Operation..

Escort vessels with appropriate radar and communications will be used during the survey operation to warn vessels that are in danger of breaching the safety/exclusion zone.

Regulation 37 of MARPOL Annex I will be applied, which requires that all ships of 400 gross tonnage and above carry an approved Shipboard Oil Pollution Emergency Plan (SOPEP). The purpose of a SOPEP is to assist personnel in dealing with unexpected discharge of oil, to set in motion the necessary actions to stop or minimise the discharge, and to mitigate its effects on the marine environment.

As standard practice, an Emergency Response Plan (ERP) / Evacuation Plan will be prepared and put in place. A Medical Evacuation Plan (Medevac Plan) will form part of the ERP.

Project vessels will be equipped with appropriate spill containment and clean-up equipment, e.g. booms, dispersants and absorbent materials. All relevant vessel crews will be trained in spill clean-up equipment use and routine spill clean-up exercises.

Sensitivity of Receptors

Accidental spills and loss of marine diesel during bunkering or in the event of a vessel collision could take place in the survey area and along the route taken by the survey and support vessels between the survey area and the logistics base at Saldanha Bay or Cape Town. The survey area is located in the offshore marine environment, more than 100 km offshore at its closest point, far removed from coastal MPAs and any sensitive coastal receptors (e.g. key faunal breeding/feeding areas, bird or seal colonies and nursery areas for commercial fish stocks); however, discharges could still directly affect migratory pelagic species transiting through the survey area. Diesel spills or accidents en route to the onshore supply base could result in fuel loss closer to shore, thereby potentially having Oil or diesel spilled in the marine environment will have an immediate detrimental effect on water quality. Being highly toxic, marine diesel released during an operational spill would negatively affect any marine fauna it comes into contact with. The taxa most vulnerable to hydrocarbon spills are coastal and pelagic seabirds. Some of the species potentially occurring in the survey area, are considered regionally or globally 'Critically Endangered' (e.g. Tristan Albatross, Cape Gannet) or 'Endangered' (e.g. Black-Browed and Yellow-Nosed Albatross, African Penguin, Bank and Cape Cormorant) or 'Vulnerable' (e.g. Hartlaub's Gull, Swift Tern). As Tripp Seamount is located ~25 km to the north of

the proposed 3D the survey area, the sensitivity of marine fauna to diesel spill is considered to be HIGH.

Consequence of Impact

Various factors determine the impacts of oil released into the marine environment. The physical properties and chemical composition of the oil, local weather and sea state conditions and currents greatly influence the transport and fate of the released product. The physical properties that affect the behaviour and persistence of an oil spilled at sea are specific gravity, distillation characteristics, viscosity and pour point, all of which are dependent on the oils chemical composition (e.g. the amount of asphaltenes, resins and waxes). Spilled oil undergoes physical and chemical changes (collectively termed 'weathering'), which in combination with its physical transport, determine the spatial extent of oil contamination and the degree to which the environment will be exposed to the toxic constituents of the released product.

As soon as oil is spilled, various weathering processes come into play. Although the individual processes may act simultaneously, their relative importance varies with time. Whereas spreading, evaporation, dispersion, emulsification and dissolution are most important during the early stages of a spill, the ultimate fate of oil is determined by the longer term processes of oxidation, sedimentation and biodegradation.

As a general rule, oils with a volatile nature, low specific gravity and low viscosity (e.g. marine diesel) are less persistent and tend to disappear rapidly from the sea surface. In contrast, high viscosity oils containing bituminous, waxy or asphaltenic residues, dissipate more slowly and are more persistent, usually requiring a clean-up response.

Oil spilled in the marine environment will have an immediate detrimental effect on water quality. Any release of liquid hydrocarbons thus has the potential for direct, indirect and cumulative effects on the marine environment. These effects include physical oiling and toxicity impacts to marine fauna and flora, localised mortality of plankton (particularly copepods), pelagic eggs and fish larvae, and habitat loss or contamination (CSIR 1998; Perry 2005).

The consequences and effects of small (2 000 - 20 000 litres) diesel fuel spills into the marine environment are summarised below (NOAA 1998). Diesel is a light oil that, when spilled on water, spreads very quickly to a thin film and evaporates or naturally disperses within a few days or less, even in cold water. Diesel oil can be physically mixed into the water column by wave action, where it adheres to fine-grained suspended sediments, which can subsequently settle out on the seafloor. As it is not very sticky or viscous, diesel tends to penetrate porous sediments quickly, but also to be washed off quickly by waves and tidal flushing. In the case of a coastal spill, shoreline cleanup is thus usually not needed. Diesel oil is degraded by naturally occurring microbes within one to two months. Nonetheless, in terms of toxicity to marine organisms, diesel is considered to be one of the most acutely toxic oil types. Many of the compounds in petroleum products are known to smother organisms, lower fertility and cause disease. Intertidal invertebrates and seaweed that come in direct contact with a diesel spill may be killed. Fish kills, however, have never been reported for small spills in open water as the diesel dilutes so rapidly. Due to differential uptake and elimination rates, filter-feeders (particularly mussels) can bio-accumulate hydrocarbon contaminants. Crabs and shellfish can be tainted from small diesel spills in shallow, nearshore areas.

Chronic and acute oil pollution is a significant threat to both pelagic and inshore seabirds. Diving sea birds that spend most of their time on the surface of the water are particularly likely to encounter

floating oil and will die as a result of even moderate oiling which damages plumage and eyes. The majority of associated deaths are as a result of the properties of the oil and damage to the water repellent properties of the birds' plumage. This allows water to penetrate the plumage, decreasing buoyancy and leading to sinking and drowning. In addition, thermal insulation capacity is reduced requiring greater use of energy to combat cold.

Impacts of oil spills on turtles are thought to primarily affect hatchling survival (CSIR & CIME 2011). Turtles encountered in the project area would mainly be migrating adults and vagrants. Similarly, little work has been done on the effect of an oil spill on fur seals.

The effects of oil pollution on marine mammals is poorly understood (White *et al.* 2001), with the most likely immediate impact of an oil spill on cetaceans being the risk of inhalation of volatile, toxic benzene fractions when the oil slick is fresh and unweathered (Geraci & St Aubin 1990, cited in Scholz *et al.* 1992). Common effects attributable to the inhalation of such compounds include absorption into the circulatory system and mild irritation to permanent damage to sensitive tissues such as membranes of eyes, mouth and respiratory tract. Direct oiling of cetaceans is not considered a serious risk to the thermoregulatory capabilities, as cetacean skin is thought to contain a resistant dermal shield that acts as a barrier to the toxic substances in oil. Baleen whales may experience fouling of the baleen plates, resulting in temporary obstruction of the flow of water between the plates and, consequently, reduce feeding efficiency. Field observations record few, if any, adverse effects among cetaceans from direct contact with oil, and some species have been recorded swimming, feeding and surfacing amongst heavy concentrations of oil (Scholz *et al.* 1992) with no apparent effects.

In the unlikely event of an operational spill or vessel collision, the magnitude of the impact would depend on whether the spill occurred in offshore waters where encounters with pelagic seabirds, turtles and marine mammals would be low due to their extensive distribution ranges, or whether the spill occurred closer to the shore where encounters with sensitive receptors will be higher. Based on the results of the oil spill modelling undertaken in the Orange Basin (PRDW 2013) a diesel slick in the survey area would be blown in a north-westerly direction due to the dominant winds and currents in the survey area. The diesel would most likely remain at the surface for <36 hours with no probability of reaching sensitive coastal habitats. In offshore environments, impacts associated with a spill or vessel collision would thus be of LOW intensity, REGIONAL (depending on the nature of the spill) over the IMMEDIATE-term (<5 days). The impact consequence for a marine diesel spill is therefore considered VERY LOW.

However, in the case of a spill or vessel collision en route to the survey area, the spill may extend into coastal MPAs and reach the shore affecting intertidal and shallow subtidal benthos and sensitive coastal bird species, in which case the intensity would be considered HIGH, but still remaining REGIONAL over the IMMEDIATE-TERM. The magnitude would however remain MEDIUM.

Impact Significance

The impact methodology used to assess the impact significance calculates an overall LOW pre-mitigation significance. However, considering the high sensitivity of receptors and the very low (offshore) and medium consequence (nearshore), the potential impact on the marine fauna is in reality considered to range from LOW significance (offshore) to MEDIUM significance (nearshore) without mitigation. The likelihood of the impact occurring is, however, low.

Identification of Mitigation Measures

In addition to compliance with MARPOL 73/78 regulations regarding waste discharges mentioned above, the following measures will be implemented:

No.	Mitigation measure	Objective
1	Use low toxicity dispersants cautiously and only with the permission of DFFE.	Abate on and off site
2	As far as possible, and whenever the sea state permits, attempt to control and contain the spill at sea with suitable recovery techniques to reduce the spatial and temporal impact of the spill	Abate on site
3	Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station.	Restore
4	Ensure offshore bunkering is not undertake in the following circumstances: – Wind force and sea state conditions of ≥6 on the Beaufort Wind Scale; – During any workboat or mobilisation boat operations; – During helicopter operations; – During the transfer of in-sea equipment; and – At night or times of low visibility.	Avoid / Reduce at source

Residual Impact Assessment

With the implementation of the project controls and mitigation measures, the residual impact will reduce to LOW significance for nearshore spills, and remain LOW for offshore spills.

15	*Impacts of an operational spill or vessel collision on marine fauna*	
Project Phase:	Seismic Exploration	
Type of Impact	Direct	
Nature of Impact	Negative	
Sensitivity of Receptor	High	
	Pre-Mitigation Impact	Residual Impact
Consequence	MEDIUM	VERY LOW
Intensity	Low to High*	Low
Extent	Regional	Local
Duration	Immediate	Immediate
Significance	MEDIUM	LOW
Probability	Possible	Possible
Confidence	High	High
Reversibility	Reversible	Reversible
Loss of Resources	Low to Medium*	Low
Mitigation Potential	Medium	Medium
Cumulative potential	Unlikely	Unlikely

* If the spill occurs near the coast and/or in proximity to sensitive coastal or offshore receptors.

4.6 Confounding Effects and Cumulative Impacts

Cumulative effects are the combined potential impacts from different actions that result in a significant change larger than the sum of all the impacts. Consideration of 'cumulative impact' should

include "past, present and reasonably foreseeable future developments or impacts". This requires a holistic view, interpretation and analysis of the biophysical, social and economic systems (DEAT 2004).

Cumulative impact assessment is limited and constrained by the method used for identifying and analysing cumulative effects. As it is not practical to analyse the cumulative effects of an action on every environmental receptor, the list of environmental effects being considered to inform decision makers and stakeholders should focus on those that can be meaningfully interpretted (DEAT 2004).

While it is foreseeable that further exploration and future production activities could arise if the current Environmental Authorisation is granted, there is not currently sufficient information available to make reasonable assertions as to nature of such future activities. This is primarily due to the current lack of relevant geological information, which the proposed exploration process aims to address. There are many other rights holders in the South African and adjacent Namibian offshore environment, but most of these are not undertaking any exploration activities at present or would be concurrently with the proposed 3D survey, particularly not in the far offshore environment. Thus, the possible range of the future prospecting, mining, exploration and production activities that could arise will vary significantly in scope, location, extent, and duration depending on whether a resource(s) is discovered, its size, properties and location, etc. As these cannot at this stage be reasonably defined, it is not possible to undertake a reliable assessment of the potential cumulative environmental impacts. It is also possible that the proposed, or future, exploration fails to identify an economic petroleum resource, in which case the potential impacts associated with the production phase would not be realised.

Table 15 summarise the applications for hydrocarbon exploration off the South African West Coast submitted to the Petroleum Agency of South Africa (PASA), and off southern Namibia submitted to the Namibian Ministry of Mines and Energy since 2007, indicating which of these have been successfully taken through to completion. Applications for mineral prospecting rights in the South African Sea Areas (SASA) submitted to the Department of Minerals and Energy are also shown. The purpose of this table, which may not be complete, is to emphasise two things. Firstly, that a large number of applications are submitted annually and secondly, that only a small percentage of those applications submitted (and potentially approved) are taken through to completion. The number of applications submitted and/or approved can therefore not be used as an indication of cumulative impacts.

For example, there have recently been numerous applications by seismic operators for Reconnaissance Permits off the West Coast, particularly in the Deep Water Orange Basin area. Other than this project, there are currently three other applications for 3D surveying being prepared over much the same area of the Deep Water Orange Basin. Should these all be approved, it is, however, highly unlikely that the operators will undertake these surveys either concurrently or sequentially. This again emphasises that the number of applications submitted to PASA cannot be assumed to relate to a realistic assessment of cumulative impacts.

Table 15: Applications for hydrocarbon exploration on the South African West Coast and southern Namibia (grey shading) since 2007, indicating which of these have been undertaken. Applications for mineral prospecting rights are also shown (blue shading).

Year	Right Holder/Operator	Block	Activity	Approval	Conducted
South African West Coast - Hydrocarbon Exploration					
2007	PASA	Orange Basin	2D seismics	Yes	2D: Nov-Dec 2007
2008	PASA	West Coast	2D seismics	Yes	2D Sep 2008
2008	PetroSA	Block 1	3D seismic	Yes	3D: Jan-Apr 2009
2011	Forest Oil (Ibhubesi)	Block 2A	3D seismic survey	Yes	3D: May - Jul 2011
2011	PetroSA	Block 5/6 (ER224) Block 7 (ER228)	3D seismics and CSEM	Yes	2D: Dec 2012 - Feb 2013 3D: Jan 2020 - Apr 2020
2011	PetroSA	Block 1	Exploration drilling	Yes (June 2011)	??
2012	BHP Billiton (now Ricocure, Azinam & Africa Oil)	Block 3B/4B	2D and 3D seismics		
2013	Spectrum	West Coast Multiclient	2D seismics	Yes	2D: April 2015
2013	PetroSA	Block 1	2D and 3D seismics	Yes	3D: Feb - May 2013 (conducted by Cairn)
2013	Anadarko	Block 2C	2D and 3D seismics, MBES, heatflow, seabed sampling	Yes (2013)	??
2013	Anadarko	Block 5/6/7	MBES, heatflow, coring	Yes	MBES: Jan - Mar 2013

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Year	Right Holder/Operator	Block	Activity	Approval	Conducted
2014	OK/Shell	Northern Cape Ultra Deep ER274	2D and 3D seismics, MBES, gradiometry and magnetics, seabed sampling	Yes	Shell audit in 2020 2D : Feb-Mar 2021
2014	Shell	Deep Water Orange Basin	Exploration drilling	Yes	Shell relinquished block to TEEPSA
2014	Cairn	ER 92/3/083	2D seismics	Yes (obtained by PetroSA)	2D: Feb-Mar 2014
2014	Cairn	Block 1	Seabed sampling	Yes	
2014-15	Thombo	Block 2B (ER105)	Exploration drilling	Yes	Africa Energy preparing to drill in late 2022/23
2014	New Age Energy	Southwest Orange Basin	2D seismics		
2015	Cairn	Block 1	Exploration drilling		
2015	Sunbird	West Coast	Ibhubesi pipeline	Yes	No activities undertaken. The EA was renewed for an additional 5 years on 30 June 2022
2015	Rhino	SW Coast Inshore	2D seismics and MBES		
2015	Rhino	Block 3617, 3717	2D and 3D seismics, MBES	Yes (Feb 2017)	??
2017	Impact Africa/TEEPSA (ER335)	SW Orange Deep (portion of New Age Energy Block)	2D and 3D seismics		
2018	PGS	West Coast Multiclient	2D and 3D seismics	Unknown	

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Year	Right Holder/Operator	Block	Activity	Approval	Conducted
2019	Anadarko	Block 5/6/7	2D seismics	Yes (issued to PetroSA in 2013)	
2021	Searcher	West Coast multiclient	2D and 3D seismics	Yes (Dec 2021) Appealed	2D: Jan 2022
2021	TGS	West Coast multiclient	2D seismics	Yes	Decided not to survey
2021	Tosaco	Block 1 ER362	3D seismics	EIA not completed	
2022	Ion	Deep Water Orange Basin	3D seismics	Application in prep.	
2022	Searcher	Deep Water Orange Basin	3D seismics	Application in prep.	
2022	Shearwater	Deep Water Orange Basin	3D seismics	Application in prep.	
2022	TGS	Deep Water Orange Basin	3D seismics	Application in prep.	
2022	TEEPSA	Block 567	Exploration drilling	EIA in prep.	
2022	TEEPSA	Deep Water Orange Basin	2D and 3D seismics, drilling	EIA in prep.	

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Year	Right Holder/Operator	Block	Activity	Approval	Conducted
Southern Namibia - Hydrocarbon Exploration					
2011	Signet	Block 2914B Now part of PEL 39	2D and 3D seismics Development of production facility		
2011	PGS	Block 2815	3D seismics	Yes	3D: 2011 (MRT)
2013	Spectrum Namibia	Orange Basin Multiclient	2D seismics	Yes	2D: April 2014
2014	Shell Namibia	2913A 2914B	3D seismics	Yes	2015: 3D in 2813A, 2913A
2016	Spectrum	Southern Namibia multiclient	2D seismics	Yes 2017	2D: Apr 2019
2017	Shell Namibia	PEL39	Exploration drilling	Yes 2018	Dec 2021
2019	Galp Namibia	PEL83	Exploration drilling	Yes	Applying for ECC extension
2019	TEEPNA	2913B (PEL56)	Exploration drilling	Yes 2019	Drilling: Nov 2021 - Mar 2022 ECC Renewal application submitted
2020	TEEPNA	2912, 2913B (PEL 91, PEL56)	3D seismics	Yes 2021	Planned for Jan 2023
2020	TGS Namibia	2711, 2712A, 2712B, 2713, 2811, 2812A, 2812B, 2813B in the Orange Basin	3D seismics	Pending	
2020	Tullow Namibia (Hanmattan Energy Ltd)	2813B (PEL90)	3D seismics		ESIA ongoing

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Year	Right Holder/Operator	Block	Activity	Approval	Conducted
South African Sea Areas - Minerals Prospecting and Mining					
2011	Aurumar	SASA 1C-9C SASA 12C,14C-18C, 20C	Heavy Minerals coring	Yes	Jan-Mar 2011 2C-5C: Geophysical & coring 7C-10C: Geophysical & coring 12c, 14c-18c &20c : Only desktop
2013-2014	Belton Park Trading	SASA 2C-5C	Geophysical surveys, coring, bulk sampling	Yes	Survey: ongoing in 2C and 3C Sampling: ongoing in 2C and 3C Various prospecting operations undertaken over duration of prospecting right
2017	Belton Park Trading	SASA 2C (3C was incorporated into mining right area in 2019).	Mining	Yes	Ongoing prospecting and mining has taken place over various campaigns to date: • SASA 2C: 9 Aug - 7 Nov 2018; • SASA 2C: 13 Mar - 5 May 2019; • SASA 2C: 9 Jul - 25 Oct 2019; and • SASA 2C & 3C: 27 Feb -to 31 Aug 2020. Mining is currently ongoing.
2018	De Beers Marine	SASA 6C	Geophysical surveys, coring, bulk sampling	Yes	Survey: May-Jul 2021 Sampling: Dec 2021 - Jan 2022

Year	Right Holder/Operator	Block	Activity	Approval	Conducted
2020	Belton Park Trading	SASA 14b, 15b, 17b	Geophysical surveys, coring, bulk sampling	Yes but appeal still under review	
2020	Belton Park Trading	SASA 13C, 15C, 16C, 17C, 18C	Geophysical surveys, coring, bulk sampling	Yes but appeal still under review	
2021	De Beers Marine	SASA 4C & 5C	Geophysical surveys, coring, bulk sampling	Application in prep.	
2021	Samara Mining	SASA 4C & 5C	Geophysical surveys, coring, bulk sampling	Application contested and withdrawn	
2021-2022	Moonstone Diamond Marketing	SASA 11b, 13b	Geophysical surveys, coring, bulk sampling	Applications delayed Second round EIAs in prep.	
2022	Trans-Atlantic Diamonds	SASA 14A	Geophysical surveys, coring, sampling	Yes	
2022	Trans-Atlantic Diamonds	SASA 11C	Geophysical surveys, coring, sampling	FBAR submitted to DMRE on 2 March 2022	

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Furthermore, the assessment methodology used in the EIA by its nature already considers past and current activities and impacts. In particular, when rating the sensitivity of the receptors, the status of the receiving environment (benthic ecosystem threat status, protection level, protected areas, etc.) or threat status of individual species is taken into consideration, which is based to some degree on past and current actions and impacts (e.g. the IUCN conservation rating is determined based on criteria such as population size and rate of decline, area of geographic range / distribution, and degree of population and distribution fragmentation).

The most reliable gauge of cumulative pressures is provided by Sink *et al.* (2019) and Harris *et al.* (2022). The map was generated as part of the NBA 2018 by doing a cumulative pressure assessment in which the impact of both current and historical ocean-based activities on marine biodiversity was determined by spatially evaluating the intensity of each activity and the functional impact to, and recovery time of, the underlying ecosystem types (Figure 50, left). Based on the severity of modification across the marine realm, a map of ecological condition was generated (Figure 50, right). From this it can be determined that the Reconnaissance Permit Area is located in an area experiencing very low cumulative impacts and that the ecological condition is therefore still natural or near-natural.

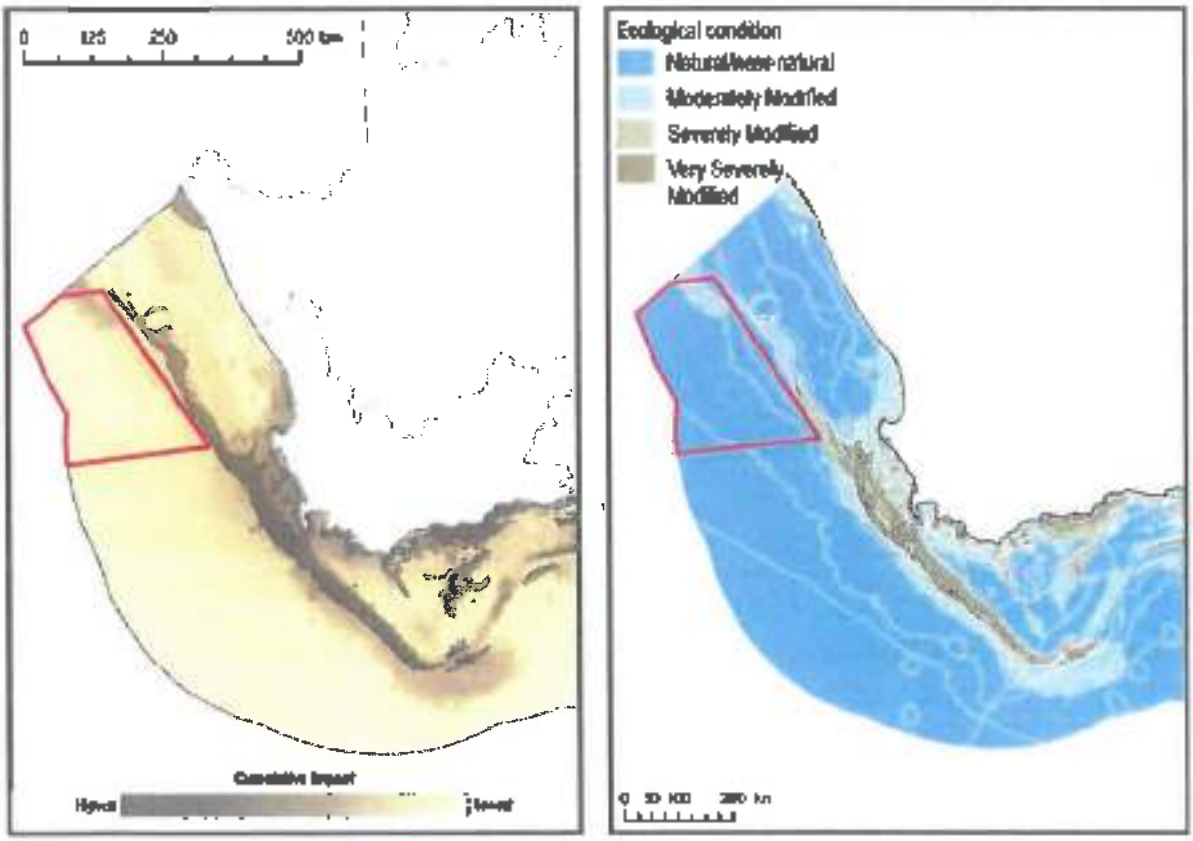

Figure 50: The Reconnaissance Permit Area (red polygon) in relation to cumulative impact on marine biodiversity, based the intensity of all cumulative pressures and the sensitivity of the underlying ecosystem types to each of those pressures (left) and the ecological condition of the marine realm based on the severity of modification as a result of the cumulative impacts (adapted from Sink *et al.* 2019 and Harris *et al.* 2022).

The assessments of impacts of seismic sounds provided in the scientific literature usually consider short-term responses at the level of individual animals only, as our understanding of how such short-term effects relate to adverse residual effects at the population level are limited. Data on behavioural reactions to seismic noise acquired over the short-term could, however, easily be misinterpreted as being less significant than the cumulative effects over the long-term and with multiple exposures, i.e. what is initially interpreted as an impact not having a detrimental effect and thus being of low significance, may turn out to result in a long-term decline in the population, particularly when combined with other acoustic and non-acoustic stressors stressors (e.g. temperature, competition for food, climate change, shipping noise) (Przeslawski *et al.* 2015; Erbe *et al.* 2018, 2019; Booth *et al.* 2020; Derous *et al.* 2020). Physiological stress, for example, may not be easily detectable in marine fauna, but can affect reproduction, immune systems, growth, health, and other important life functions (Rolland *et al.* 2012; Lemos *et al.* 2026). Confounding effects are, however, difficult to separate from those due to seismic surveys.

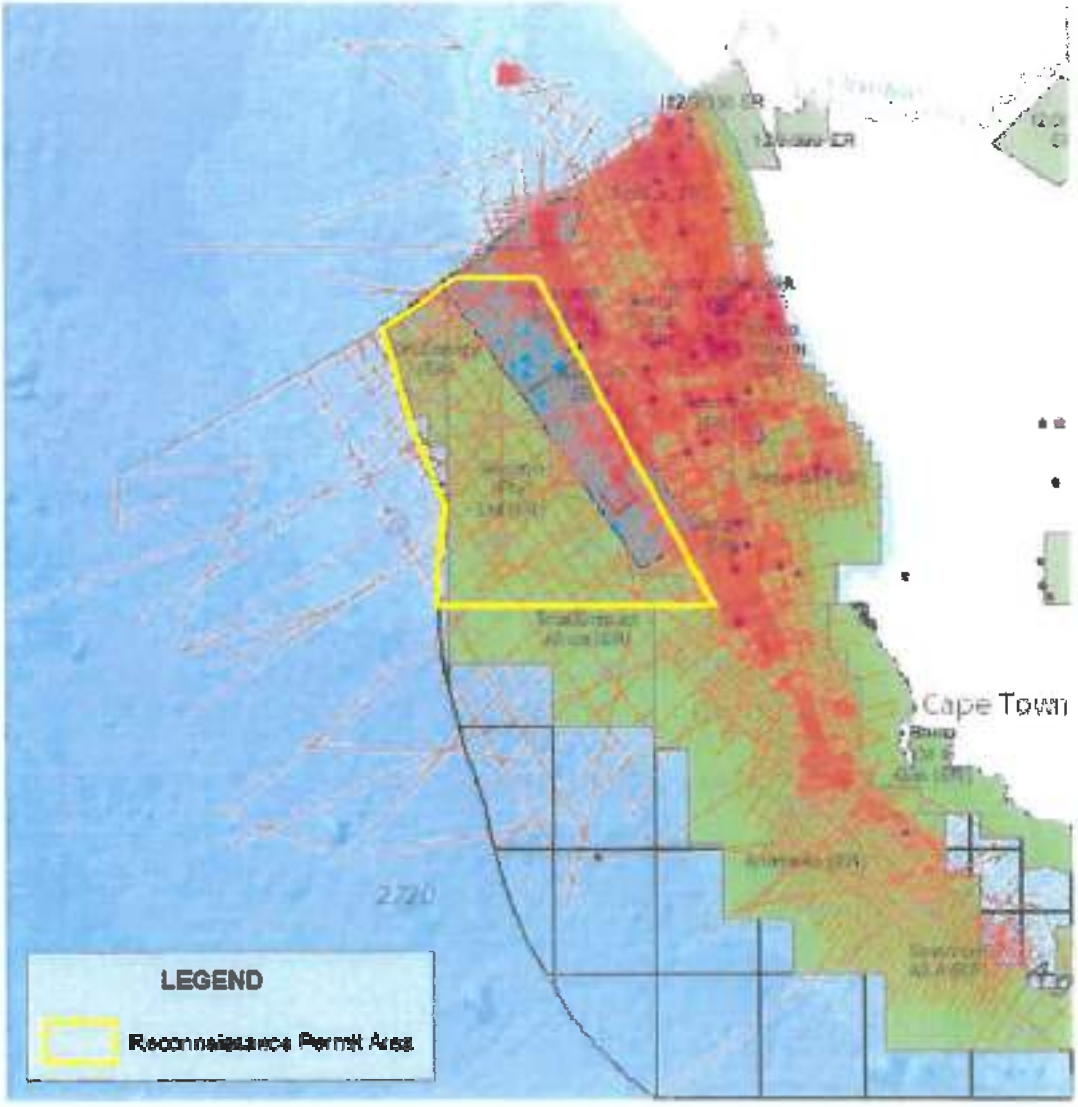

Figure 51: The Reconnaissance Permit Area (yellow polygon) and proposed 3D survey area (white polygon) in relation to historical 2D (red lines) and 3D (blue and purple polygons) surveys conducted on the West Coast between 2001 and 2018 (Source: PASA).

Similarly, potential cumulative impacts on individuals and populations as a result of other seismic surveys undertaken previously, concurrently or subsequently are difficult to assess. A significant adverse residual environmental effect is considered one that affects marine biota by causing a decline in abundance or change in distribution of a population(s) over more than one generation within an area. Natural recruitment may not re-establish the population(s) to its original level within several generations or avoidance of the area becomes permanent. Historic survey data for the West Coast is illustrated in Figure 51, which shows the 2D survey lines shot between 2001 and 2018, and indicates 3D survey areas on the West Coast. Despite the density of seismic survey coverage over the past 17 years, the southern right whale population is reported to be increasing by 6.5% per year (Brandão *et al.* 2017), and the humpback whale by at least 5% per annum (IWC 2012) over a time when seismic surveying frequency has increased, suggesting that, for these population at least, there is no evidence of long-term negative change to population size as a direct result of seismic survey activities. Similar 2D and 3D data for southern Namibia (up to August 2017) are presented in Figure 51.

Reactions to sound by marine fauna depend on a multitude of factors including species, state of maturity, experience, current activity, reproductive state, time of day (Wartzok *et al.* 2004; Southall *et al.* 2007). If a marine animal does react briefly to an underwater sound by changing its behaviour or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the population as a whole (NRC 2005). However, if a sound source displaces a species from an important feeding or breeding area for a prolonged period, impacts at the population level could be significant. The increasing numbers of southern right and humpback whales around the Southern African coast, and their lingering on West Coast feeding grounds long into the summer, suggest that those surveys conducted over the past 17 years have not negatively influenced the distribution patterns of these two migratory species at least. Information on the population trends of resident species of baleen and toothed whales is unfortunately lacking, and the potential effects of seismic surveys on such populations remains unknown.

Consequently, suitable mitigation measures must be implemented during seismic data acquisition to ensure the least possible disturbance of marine fauna in an environment where the cumulative impact of increased background anthropogenic noise levels has been recognised as an ongoing and widespread issue of concern (Koper & Plön 2012; Simmonds *et al.* 2014; Williams *et al.* 2015; Chahouri *et al.* 2021). Should other concurrent seismic exploration activities be undertaken in the Orange Basin, cumulative impacts can be expected.

Despite the difficultly in undertaking a reliable assessment of the potential cumulative environmental impacts of future seismic acquisition in the Deep Water Orange Basin due to likely variation in the scope, extent and duration of proposed surveys, the cumulative impacts of three potential surveys occurring concurrently (see Figure 53) needs to be considered.

The cumulative assessment table below assumes the worst case scenario of three surveys (Searcher, TGS and GX[7]) occurring simultaneously during the summer survey window in 2022/23. The assement methodology adopted by SLR Consulting is used to determine the significance of the cumulative impact.

In the unlikely event that multiple surveys would be undertaken concurrently within the Deep Water Orange Basin Area, associated impacts to marine fauna would be of HIGH intensity and extend

[7] It is understood that IOnI GXT has been declared bankrupt and have ceased operations - as such, the BDM GXT Reconnaissance Permit is considered to be defunct.

REGIONALLY, over the SHORT-term (assuming they take place over the same summer survey window. The impact consequence for cumulative surveys is therefore considered MEDIUM.

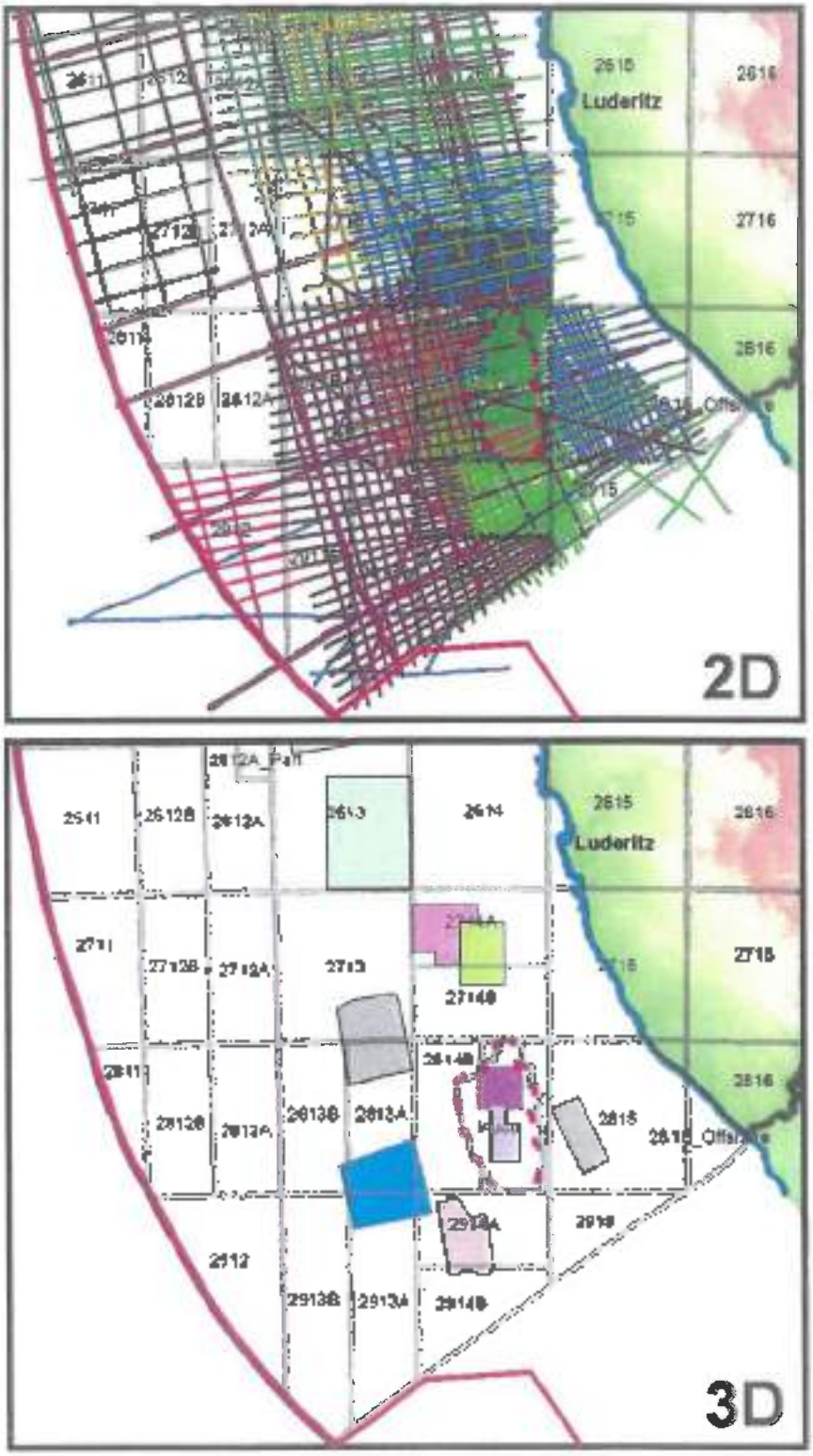

Figure 52: The Reconnaissance Permit Area (red polygon) in relation to historical 2D (top) and 3D (bottom) surveys conducted in southern Namibia up to August 2017 (Source: Namibian MME).

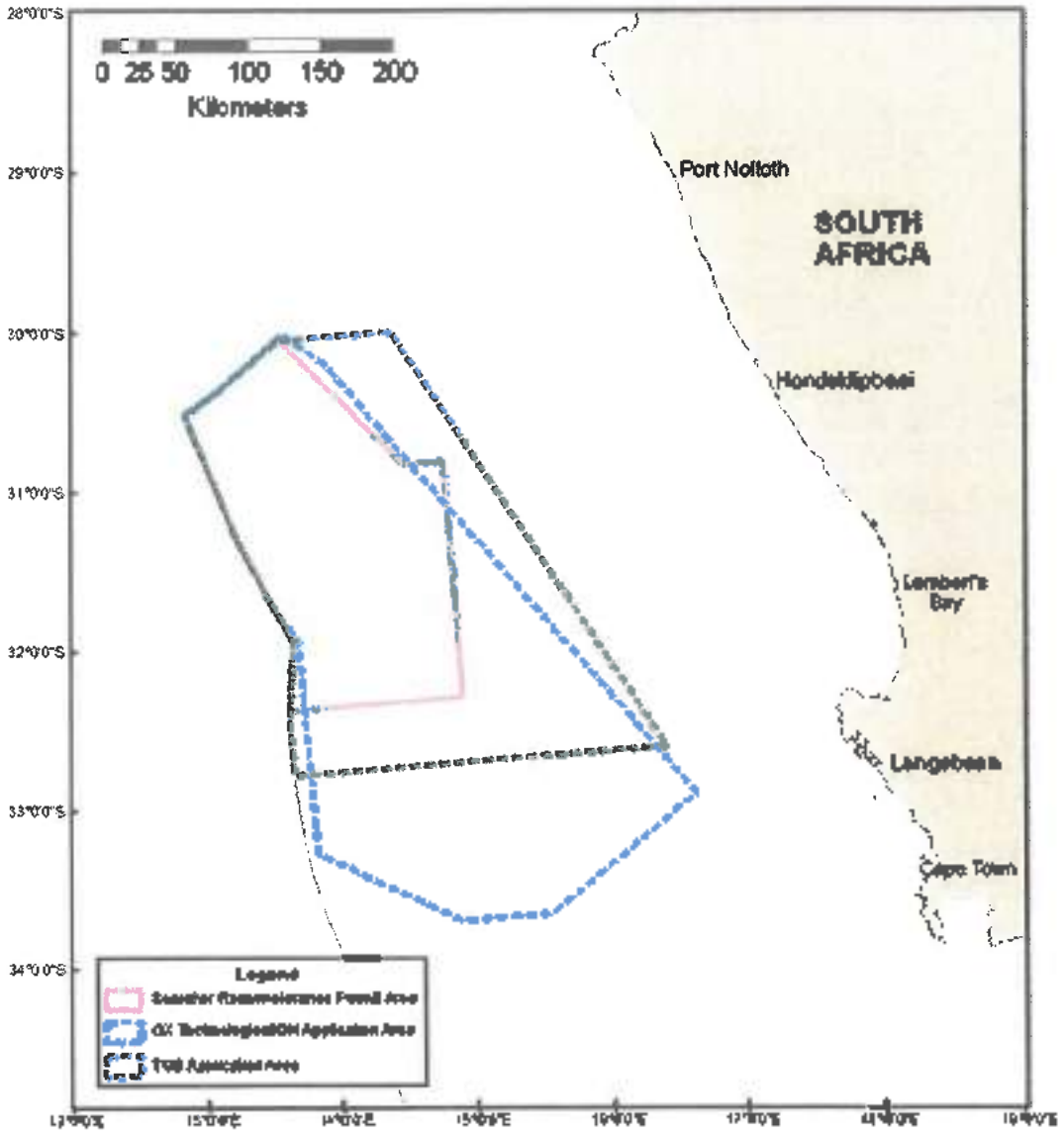

Figure 53: The Reconnaissance Permit Area (shaded) in relation to other pending applications in the Orange Basin Area.

Impact Significance

The impacts to marine fauna associated with concurrent surveys are deemed to be of MEDIUM significance, due to the high sensitivity of the offshore receptors, the very high likelihood of cumulative effects of acoustic impacts on marine fauna.

In applying the EIMS assessment methodology, the numerical approach similarly results in the cumulative impact having a MEDIUM significance.

16	*Impacts to marine fauna of concurrent seismic acquisition by multiple operators*
Project Phase:	**Mobilisation, Operation & Decommissioning**
Type of Impact	**Direct - Cumulative**
Nature of Impact	**Negative**
Sensitivity of Receptor	**High**
Magnitude/Consequence	**MEDIUM**
Intensity	**High**
Extent	**Regional**
Duration	**Short**
Significance	**MEDIUM**
Probability	**Definite**
Confidence	**High**
Reversibility	**Partially Reversible**
Loss of Resources	**Medium**

Identification of Mitigation Measures

The following measures should be considered:

No.	Mitigation measure	Responsibility
1	Should surveys be run simultaneously, ensure that a distance of at least 40 km is maintained between survey vessels[8] until sufficient objective evidence is obtained that a reduced buffer distance is acceptable.	Above on site

Residual Impact Assessment

With the implementation of the above-mentioned controls and mitigation measures, the intensity of the impact would reduce to MEDIUM and the probability of the impact would reduce to LIKELY, but the overall significance would remain MEDIUM.

[8] This 40 km buffer maintained by any other survey vessels aligns to advice by the US Department of Interior (2014) and is considered sufficient on the basis that it provides a corridor between vessels where airgun noise approaches ambient levels such that animals may pass between, and/or the potential cumulative effect beyond this distance is considered to be negligible.

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5. FINDINGS AND RECOMMENDATIONS

5.1 Key Findings

The proposed survey activities to be undertaken by TGS are expected to result in impacts on marine invertebrate fauna in the Orange Basin, ranging from negligible to very low significance. Only in the case of potential impacts to turtles and marine mammals are impacts of low significance expected.

A summary of impacts and mitigation measures of seismic noise on marine fauna is provided in Table 16. Other impacts that may occur during seismic surveys are summarised in Table 17.

Table 16: Summary of the impacts and mitigation of seismic noise.

Impact	Significance (before mitigation)	Significance (after mitigation)
Plankton and ichthyoplankton	Medium	Very Low
Marine invertebrates	Negligible	Negligible
Pelagic fish	Medium	Low
Diving Seabirds	Low	Very Low
Turtles	Medium	Low
Seals	Low	Very Low
Whales and dolphins		
Baleen whale	Medium	Low
Toothed whales and dolphins	Medium	Low

Table 17: Summary of other impacts and mitigation of seismic surveys.

Impact	Significance (before mitigation)	Significance (after mitigation)
Non-seismic noise - vessel	Very Low	Very Low
Vessel lighting	Very Low	Very Low
Hull fouling and ballast water discharge	Very Low	Negligible
Waste Discharges to sea	Very Low	Very Low
Ship strikes and entanglement in gear	Low	Low
Accidental loss of equipment	Very Low	Very Low
Operational spills and vessel collision	Medium	Low

5.2 Environmental Acceptability

If all environmental guidelines, and appropriate mitigation measures recommended in this report are implemented, there is no reason why the proposed seismic survey programme should not proceed. It should also be kept in mind that some of the migratory species are now present year round off the West Coast, and that certain baleen and toothed whales are resident and/or show seasonality opposite to the majority of the baleen whales. Data collected by independent onboard observers should form part of a survey close-out report to be forwarded to the necessary authorities, and any incidence data

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and seismic source output data arising from surveys should be made available for analyses of survey impacts in Southern African waters.

5.3 Recommendations

Detailed mitigation measures for seismic surveys in other parts of the world are provided by Weir *et al.* (2006), Weir & Dolman (2007), Compton *et al.* (2007), US Department of Interior (2007), Reyes Reyes *et al.* (2016), Vilardo & Barbosa (2018), Bröker *et al.* (2015) and Bröker (2019). Many of the international guidelines presented in these documents are extremely conservative as they are designed for areas experiencing repeated, high intensity surveys and harbouring particularly sensitive species, or species with high conservation status. A number of countries have more recently updated their guidelines, most of which are based on the JNCC (2010, 2017) recommendations but adapted for specific areas of operation. A review and comparison of these is provided in MaMa CoCo SEA (2015). The guidelines currently applied to seismic surveying in South African waters are those proposed in the Generic EMPR (CCA & CMS 2001) and by Purdon (2018). Purdon (2018) highlights the importance of developing mitigation guidelines both locally and regionally and points out that if South Africa is to maintain environmental integrity, mitigation guidelines for seismic surveys specific to the country, and based on the most recent scientific data, need to be implemented.

These have been updated as necessary to include salient points from recognised international guidelines, particularly the JNCC (2010, 2017) Guidelines and the 2013 New Zealand Code of Conduct for seismic operations (New Zealand Dept. of Conservation 2013). The proposed mitigation is thus comprehensive and in-line with, and in certain instances more comprehensive than, international good-practice industry standards.

Elliott *et al.* (2019) point out that in most cases the mitigation standards adopted are designed to mitigate impacts on marine mammals (e.g. Nowacek *et al.* 2013), with no set of standards or guidelines for sea turtles and fish. Even less in known about the efficacy of mitigation in protecting marine vertebrates from acoustic impacts (Parsons *et al.* 2009). The authors argue that without baseline information on species before surveys (see for example Fossati *et al.* 2018), it is difficult to assess the efficacy of existing guidelines and standards during or after surveys.

Adopting as far as possible the principles outlined in Nowacek & Southall (2016) and Nowacek *et al.* (2013, 2015), the mitigation measures proposed for seismic surveys are as provided below for each phase of a seismic survey operation:

No.	Mitigation measure	Classification
1. Survey Planning		
1.1	Plan seismic surveys to avoid sensitive areas and periods for some marine fauna: • Movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (June/July and late October/November) , and their aggregation on the summer feeding grounds between St Helena Bay and Dassen Island from late October to late December and ensure that migration paths are not blocked by seismic operations. If possible the survey should be undertaken from North to South to avoid these feeding aggregations.	Avoid
1.2	Plan survey, as far as possible, so that the first commencement of airgun firing in a new area (including gun tests) is undertaken during daylight hours.	Abate on site

No.	Mitigation measure	Classification
1.3	Prohibit airgun use (including airgun tests) outside of the Reconnaissance Permit Area.	Avoid
1.4	Although a seismic vessel and its gear may pass through a declared Marine Protected Area, acoustic sources (airguns) must not be operational during this transit.	Avoid
1.5	A 5 km buffer zone where no airgun operation is permitted is recommended around all MPAs	Avoid
2. Key Equipment		
2.1	**Passive Acoustic Monitoring (PAM)**	
2.1.1	Ensure the seismic vessel is fitted with Passive Acoustic Monitoring (PAM) technology, which detects some animals through their vocalisations.	Abate on site
2.1.2	As the survey area would largely be in waters deeper than 1 000 m where sperm whales and other deep-diving odontocetes are likely to be encountered, implement the use of PAM 24-hr a day when the airgun is in operation.	Abate on site
2.1.3	Ensure that the PAM hydrophone streamer is towed in such a way that the interference of vessel noise is minimised.	Abate on site
2.1.4	Ensure the PAM streamer is fitted with at least four hydrophones, of which two are HF and two LF, to allow directional detection of cetaceans.	Abate on site
2.1.5	Ensure spare PAM hydrophone streamers (e.g. 4 heavy tow cables and 6 hydrophone cables) are readily available in the event that PAM breaks down, in order to ensure timeous redeployment.	Abate on site
2.2	Acoustic Source	
2.2.1	Define and enforce the use of the lowest practicable airgun volume for production, and design arrays to maximise downward propagation, minimise horizontal propagation and minimise high frequencies in airgun pulses.	Abate on site
2.2.2	Ensure a display screen for the acoustic source operations is provided to the marine observers. All information relating to the activation of the acoustic source and the power output levels must be readily available to support the observers in real time via the display screen and to ensure that operational capacity is not exceeded.	Abate on site
2.2.3	Ensure the ramp-up noise volumes do not exceed the production volume.	Abate on site
2.2	Streamers	
2.2.1	Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'.	Abate on site
2.2.2	Ensure that solid streamers rather than fluid-filled streamers are used to avoid leaks.	Avoid
3. Key Personnel		
3.1	• Make provision for the placing of a qualified MMOs on board the seismic vessel. As a minimum, one must be on watch during daylight hours for the pre-shoot observations and when the acoustic source is active. • The duties of the MMO would be to: – Provide effective regular briefings to crew members, and establish clear lines of communication and procedures for onboard operations; – Record airgun activities, including sound levels, "soft-start" procedures and pre-firing regimes; – Observe and record responses of marine fauna to seismic shooting from optimum vantage points, including seabird, large pelagic fish (e.g. shoaling tuna, sunfish, sharks), turtle, seal and cetacean incidence and behaviour	Abate on site

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No:	Mitigation measure:	Classification:
	and any mortality or injuries of marine fauna as a result of the seismic survey. Data captured should include species identification, position (latitude/longitude), distance/bearing from the vessel, swimming speed and direction (if applicable) and any obvious changes in behaviour (e.g. startle responses or changes in surfacing/diving frequencies, breathing patterns) as a result of the seismic activities. Both the identification and the behaviour of the animals must be recorded accurately along with current seismic sound levels. Any attraction of predatory seabirds, large pelagic fish or cetaceans (by mass disorientation or stunning of fish as a result of seismic survey activities) and incidents of feeding behaviour among the hydrophone streamers should also be recorded; – Record sightings of any injured or dead marine mammals, large pelagic fish (e.g. sharks), seabirds and sea turtles, regardless of whether the injury or death was caused by the seismic vessel itself. If the injury or death was caused by a collision with the seismic vessel, the date and location (latitude/longitude) of the strike, and the species identification or a description of the animal should be recorded and included as part of the daily report; – Record meteorological conditions at the beginning and end of the observation period, and whenever the weather conditions change significantly; – Request the delay of start-up or temporary termination of the seismic survey or adjusting of seismic shooting, as appropriate. It is important that MMO decisions on the termination of firing are made confidently and expediently, and following dialogue between the observers on duty at the time. A log of all termination decisions must be kept (for inclusion in both daily and "close-out" reports); – Use a recording spreadsheet (e.g. JNCC, 2017) in order to record all the above observations and decisions; and – Prepare daily reports of all observations, to be forwarded to the necessary authorities as required, in order to ensure compliance with the mitigation measures.	

B20

No.	Mitigation measure	Classification
3.2	• Make provision for placing of a qualified PAM operator on board the seismic vessel. As a minimum, one must be on 'watch' during the pre-shoot observations and when the acoustic source is active. • The duties of the PAM operator would be to: – Provide effective regular briefings to crew members, and establish clear lines of communication and procedures for onboard operations; – Ensure that the hydrophone cable is optimally placed, deployed and tested for acoustic detections of marine mammals; – Confirm that there is no marine mammal activity within 500 m of the airgun array prior to commencing with the "soft-start" procedures; – Record species identification, position (latitude/longitude), distance and bearing from the vessel and acoustic source, where possible; – Record general environmental conditions; – Record airgun activities, including sound levels, "soft-start" procedures and pre-firing regimes; and – Request the delay of start-up and temporary termination of the seismic survey, as appropriate.	Abate on site
3.3.	Ensure MMOs and PAM operators are briefed on the area-specific sensitivities and on the seismic survey planning (including roles and responsibilities, and lines of communication).	Abate on site
4. Airgun Testing		
4.1	Maintain a pre-shoot watch of 60-minutes before any instances of airgun testing. If only a single lowest power airgun is tested, the pre-shoot watch period can be reduced to 30 minutes.	Avoid / Abate on site
4.2	Implement a "soft-start" procedure if testing multiple airguns. • The "soft-start" should be carried out over a time period proportional to the number of guns being tested and not exceed 20 minutes; airguns should be tested in order of increasing volume; • If testing all airguns at the same time, a 20 minute "soft-start" is required; • If testing a single lowest power airgun a "soft-start" is not required.	Avoid / Abate on site
5. Pre-Start Protocols		
5.1	Implement a dedicated MMO and PAM pre-shoot watch of at least 60 minutes (to accommodate deep-diving species in water depths greater than 200 m).	Avoid / Abate on site
5.2	Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source if: • during daylight hours it is confirmed: – visually by the MMO during the pre-shoot watch (60 minutes) that there are no penguins or feeding aggregations of diving seabirds, shoaling large pelagic fish, turtles, seals or cetaceans within 500 m of the seismic source, and – by PAM technology that there are no vocalising cetaceans detected in the 500 m mitigation zone. • during times of poor visibility or darkness it is confirmed by PAM technology that no vocalising cetaceans are present in the 500 m mitigation zone during the pre-shoot watch (60 minutes).	Avoid / Abate on site

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Ref.	Mitigation measure	Classification
5.3	Delay "soft-starts" if penguins or feeding aggregations of diving seabirds, shoaling large pelagic fish, turtles, seals or cetaceans are observed within the mitigation zone. • A "soft-start" should not begin until 30 minutes after cetaceans depart the 500 m mitigation zone or 30 minutes after they are last seen or acoustically detected by PAM in the mitigation zone. • In the case of penguins, diving seabirds, shoaling large pelagic fish and turtles, delay the "soft-start" until animals are outside the 500 m mitigation zone. • In the case of fur seals, which may occur commonly around the vessel, delay "soft-starts" for at least 10 minutes until it has been confirmed that the mitigation zone is clear of all seal activity. However, if after a period of 10 mins seals are still observed within 500 m of the airgun, the normal "soft-start" procedure should be allowed to commence for at least a 20-minute duration. Seal activity should be carefully monitored during "soft-starts" to determine if they display any obvious negative responses to the airgun and gear or if there are any signs of injury or mortality as a direct result of the seismic activities.	Avoid / Abate on site
5.4	As noted above for planning, when arriving at the survey area for the first time, survey activities should, as far as possible, only commence during daylight hours with good visibility. However, if this is not possible due to prolonged periods of poor visibility (e.g. thick fog) or unforeseen technical issue which results in a night-time start, the initial acoustic source activation (including gun tests) may only be undertaken if the normal 60-minute PAM pre-watch and "soft-start" procedures have been followed.	Avoid / Abate on site
5.5	Schedule "soft-starts" so as to minimise, as far as possible, the interval between reaching full power operation and commencing a survey line. The period between the end of the soft start and commencing with a survey line must not exceed 20 minutes. If it does exceed 20 minutes, refer to breaks in firing below.	Abate on site
6. Line Turns		
6.1	If line changes are expected to take longer than 40 minutes: • Terminate airgun firing at the end of the survey line and implement a pre-shoot search (60 minutes) and "soft-start" procedure (20 minutes) when approaching the next survey line. • If line turn is shorter than 80 minutes (i.e. shorter than a 60-minute pre-shoot watch and 20-minute "soft-start" combined), the pre-shoot watch can commence before the end of the previous survey line.	Abate on site
6.2	If line changes are expected to take less than 40 minutes, airgun firing can continue during the line change if: • The power is reduced to 180 cubic inches (or as close as is practically feasible) at standard pressure. Airgun volumes of less than 180 cubic inches can continue to fire at their operational volume and pressure. • The Shot Point Interval (SPI) is increased to provide a longer duration between shots, with the SPI not to exceed 5 minutes; and • The power is increased and the SPI is decreased in uniform stages during the final 10 minutes of the line change (or geophone repositioning), prior to data collection re-commencing (i.e. a form of mini soft start). • Normal MMO and PAM observations continue during this period when reduced power airgun is firing.	Abate on site

No.	Mitigation measure	Classification
7. Shut-Downs		
7.1	Terminate seismic shooting on: • observation and/or detection of penguins or feeding aggregations of diving seabirds, turtles, slow swimming large pelagic fish (including whale sharks, basking sharks, manta rays) or cetaceans within the 500 m mitigation zone. • observation of any obvious mortality or injuries to cetaceans, turtles, seals or mass mortalities of squid and fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO to be as a direct result of the survey.	Abate on site
7.2	Depending the species, specific mitigation will be implemented to continue the survey operations, as specified below: • For specific species such as turtles, penguins, diving seabirds and slow swimming large pelagic fish (including whale sharks, basking sharks, manta rays), terminate shooting until such time as the animals are outside of the 500 m mitigation zone (seismic 'pause', no soft-start required). • For cetaceans, terminate shooting until such time as there has been a 30 minute delay from the time the animal was last sighted within the mitigation zone before the commencement of the normal soft start procedure.	Abate on site
8. Breaks in Airgun Firing		
8.1	If after breaks in firing, the airgun can be restarted within 5 minutes, no soft-start is required and firing can recommence at the same power level provided no marine mammals have been observed or detected in the mitigation zone during the break-down period.	Abate on site
8.2	For all breaks in firing of longer than 5 minutes, but less than 20 minutes, implement a "soft-start" of similar duration, assuming there is continuous observation by the MMO and PAM operator during the break.	Abate on site
8.3	For all breaks in firing of 20 minutes or longer, implement a 60-minute pre-shoot watch and 20-minute "soft-start" procedure prior to the survey operation continuing.	Abate on site
8.4	For planned breaks, ensure that there is good communication between the seismic contractor and MMOs and PAM operators in order for all parties to be aware of these breaks and that early commencement of pre-watch periods can be implemented to limit delays.	Abate on site
9. PAM Malfunctions		
9.1	If the PAM system malfunctions or becomes damaged during night-time operations or periods of low visibility, continue operations for 30 minutes without PAM if no marine mammals were detected by PAM in the mitigation zones in the previous 2 hours, while the PAM operator diagnoses the issue. If after 30 minutes the diagnosis indicates that the PAM gear must be repaired to solve the problem, reduce power to 160 cubic inches. Firing of the reduced power gun may continue for 30 minutes while PAM is being repaired, the last 10-minute of which is a 10-minute ramp up to full power (mini "soft-start"). If the PAM repair will take longer than 60 minutes, stop surveying until such time as a functional PAM system can be redeployed and tested.	Abate on site

No.	Mitigation measure	Classification
9.2	If the PAM system breaks down during daylight hours, continue operations for 20 minutes without PAM, while the PAM operator diagnoses the issue. If the diagnosis indicates that the PAM gear must be repaired to solve the problem, operations may continue for an additional 2 hours without PAM monitoring as long as: • No marine mammals were detected by PAM in the mitigation zones in the previous 2 hours; • Two MMOs maintain watch at all times during operations when PAM is not operational; • The time and location in which operations began and stop without an active PAM system is recorded.	Abate on site

Vessel and Aircraft Operations

No.	Mitigation measure	Classification
1	Pre-plan flight paths to ensure that no flying occurs over seabird and seal colonies and offshore islands by at least 1 852 m (i.e. 1 nm)	Avoid / abate on site
2	Avoid extensive low-altitude coastal flights by ensuring that the flight path is perpendicular to the coast, as far as possible	Avoid/ abate on site
3	Brief all pilots on the ecological risks associated with flying at a low level along the coast or above marine mammals	Avoid
4	The lighting on the survey and support vessels should be reduced to a minimum compatible with safe operations whenever and wherever possible. Light sources should, if possible and consistent with safe working practices, be positioned in places where emissions to the surrounding environment can be minimised	Reduce at Source
5	Keep disorientated, but otherwise unharmed, seabirds in dark containers for subsequent release during daylight hours. Ringed/banded birds should be reported to the appropriate ringing/banding scheme (details are provided on the ring)	Repair or Restore
6	Avoid the unnecessary discharge of ballast water.	Reduce at source
7	Use filtration procedures during loading in order to avoid the uptake of potentially harmful aquatic organisms, pathogens and sediment that may contain such organisms	Avoid/reduce at source
8	Ensure that routine cleaning of ballast tanks to remove sediments is carried out, where practicable, in mid-ocean or under controlled arrangements in port or dry dock, in accordance with the provisions of the ship's Ballast Water Management Plan	Avoid/reduce at source
9	Ensure all equipment (e.g. arrays, streamers, tail buoys etc) that has been used in other regions is thoroughly cleaned prior to deployment	Avoid/Reduce at Source
10	Implement a waste management system that addresses all wastes generated at the various sites, shore-based and marine. This should include: – Separation of wastes at source; – Recycling and re-use of wastes where possible; – Treatment of wastes at source (maceration of food wastes, compaction, incineration, treatment of sewage and oily water separation).	Avoid/Reduce at Source
11	Implement leak detection and repair programmes for valves, flanges, fittings, seals, etc.	Avoid/Reduce at Source

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No.	Mitigation measure	Classification
12	Use a low-toxicity biodegradable detergent for the cleaning of all deck spillages.	Reduce at Source
13	The vessel operators should keep a constant watch for marine mammals and turtles in the path of the vessel.	Avoid
14	Keep watch for marine mammals behind the vessel when tension is lost on the towed equipment and either retrieve or regain tension on towed gear as rapidly as possible.	Avoid
15	Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'.	Avoid
16	Ensure vessel transit speed between the survey area and port is a maximum of 12 knots (22 km/hr), except in the MPAs where it is reduced further to 10 knots (18 km/hr) as well as when they are present in the vicinity.	Avoid/reduce at source
17	Ensuring that loads are lifted using the correct lifting procedure and within the maximum lifting capacity of crane system.	Avoid
18	Minimise the lifting path between vessels	Avoid
19	Undertake frequent checks to ensure items and equipment are stored and secured safely on board each vessel.	Avoid
20	In the event that equipment is lost during the operational stage, assess safety and metocean conditions before performing any retrieval operations. Establishing a hazards database listing the type of gear left on the seabed and/or in the Reconnaissance Permit Area with the dates of abandonment/loss and locations, and where applicable, the dates of retrieval	Repair/restore
21	Use low toxicity dispersants cautiously and only with the permission of DFFE.	Abate on and off site
22	As far as possible, and whenever the sea state permits, attempt to control and contain the spill at sea with suitable recovery techniques to reduce the spatial and temporal impact of the spill	Abate on site
23	Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station.	Restore
24	Ensure offshore bunkering is not undertake in the following circumstances: – Wind force and sea state conditions of ≥6 on the Beaufort Wind Scale; – During any workboat or mobilisation boat operations; – During helicopter operations; – During the transfer of in-sea equipment; and – At night or times of low visibility.	Avoid / Reduce at source

It is further recommended that seismic operators and holders of hydrocarbon exploration licences give consideration to contributing to a centrally managed research fund. Collaboration across the industry to collectively fund pro-active research would provide opportunity for the development and implementation of a structured and experimentally sound acoustic study to quantitatively inform the authorities and stakeholders of acoustic impacts to the various faunal groups in southern African waters.

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APPENDIX 1: METHOD FOR ASSESSING IMPACT SIGNIFICANCE

The following convention was used to determine significance ratings in the assessment. For further details the reader is referred to Chapter 3 and Appendix 8 of the EA Amendment Report.

The impact significance rating methodology, as provided by EIMS, is guided by the requirements of the NEMA EIA Regulations, 2014. The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E + D + M + R) * N}{4}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table.

Table1: Criteria for determination of impact consequence

Aspect	Score	Definition
Nature	-1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).

Aspect	Score	Definition
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table.

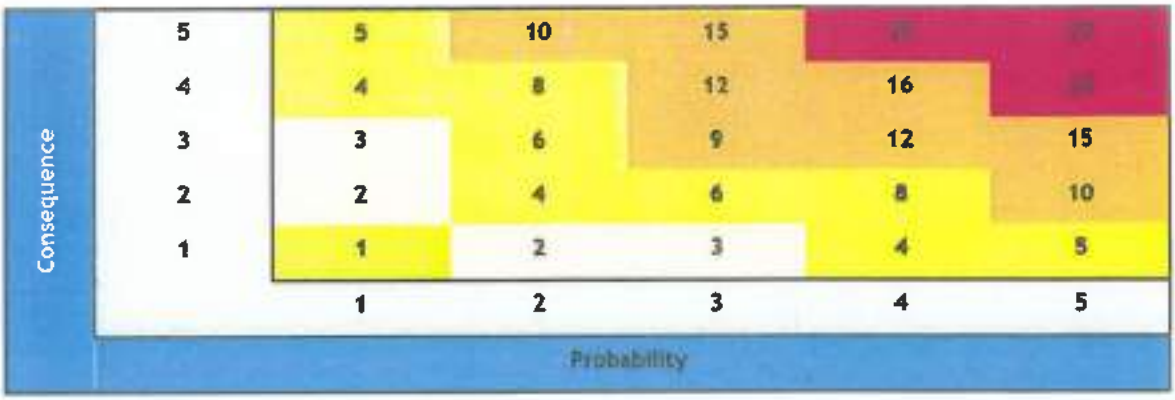
Table 2: Probability scoring

Probability	1	Unlikely/Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Possible/Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Likely/Medium probability (the impact may occur; >50% and <75%),
	4	Highly Likely/High probability (it is most likely that the impact will occur - > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \times P$$

Table 3: Determination of environmental risk



The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table .

Table 4: Significance classes

Risk Score	Description
1	Negligible (i.e. where impact has an insignificant environmental risk)
>1; 3	Very Low (i.e. where the impact has a very low environmental risk)
>3; < 9	Low (i.e. where the impact is unlikely to be a significant environmental risk).
≥ 9; < 17	Medium (i.e. where the impact could have a significant environmental risk).
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/ mitigated.

Further to the assessment criteria presented above it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority / significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/ mitigation impacts are implemented.

Table 5: Criteria for the determination of prioritisation

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table. The impact priority is therefore determined as follows:

$$\text{Priority} = CI + LR$$

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 1.5 (refer to Table).

Table 6: Determination of prioritisation factor

Priority	Ranking	Prioritisation Factor
2	Low	1
3	Medium	1.125
4	Medium	1.25
5	Medium	1.375
6	High	1.5

In order to determine the final impact significance the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is to be able to increase the post mitigation environmental risk rating by a factor of 0.5, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

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Table 7: Environmental Significance Rating

Value	Description
0	No impact
-1	Impact occurs but is negligible
> -1 ≤ 3	Very Low negative
< -10	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ -10 < -20	Medium negative (i.e. where the impact could influence the decision to develop in the area).
< -20	High negative (i.e. where the impact would influence on the decision to develop in the area).

APPENDIX A
Curriculum Vitae Dr Andrea Pulfrich

Personal Details

Born:	Pretoria, South Africa on 11 August 1961
Nationality and Citizenship:	South African and German
Languages:	English, German, Afrikaans
ID No:	610811 0179 087
Address:	20 Plein Street, McGregor, 6708, South Africa
	PO Box 302, McGregor, 6708, South Africa
Tel:	+27 21 782 9553
Cell:	082 781 8152
E-mail:	apulfrich@pisces.co.za

Academic Qualifications

- BSc (Zoology and Botany), University of Natal, Pietermaritzburg, 1982
- BSc (Hons) (Zoology), University of Cape Town, 1983
- MSc (Zoology), University of Cape Town, 1987
- PhD, Department of Fisheries Biology of the Institute for Marine Science at the Christian-Albrechts University, Kiel, Germany, 1995

Membership in Professional Societies

- South African Council for Natural Scientific Professions (Pr.Sci.Nat. No: 400327/06)
- South African Institute of Ecologists and Environmental Scientists
- International Association of Impact Assessment (South Africa)

Employment History and Professional Experience

1998-present: Director: Pisces Environmental Services (Pty) Ltd. Specifically responsible for environmental impact assessments, baseline and monitoring studies, marine specialist studies, and environmental management plan reports.

1998: Senior researcher on contract to Namdeb Diamond Corporation and De Beers Marine South Africa, at the University of Cape Town; investigating and monitoring the impact of diamond mining on the marine environment and fisheries resources; experimental design and implementation of dive surveys; collaboration with fishermen and diamond divers; deep water benthic sampling, sample analysis and macrobenthos identification.

1996-1998: Senior researcher at the University of Cape Town, on contract to the Chief Director: Marine and Coastal Management (South African Department of Environment Affairs and Tourism); investigating and monitoring the experimental fishery for perlemoen on the Cape south coast; experimental design and implementation of dive surveys for stock assessments; collaboration with fishermen, supervision of Honours and Masters students.

1989-1994: Institute for Marine Science at the Christian-Albrechts University of Kiel, Germany; research assistant in a 5 year project to investigate the population dynamics of mussels and cockles in the Schleswig-Holstein Wadden Sea National Park (employment for Doctoral degree); extensive and intensive dredge sampling for stock assessments, collaboration with and mediation between, commercial fishermen and National Park authorities, co-operative interaction with colleagues working in the Dutch and Danish Wadden Sea.

supervision of Honours and Masters projects and student assistants, diving and underwater scientific photography. Scope of doctoral study: experimental design and implementation of a regular sampling program including: (i) plankton sampling and identification of lamellibranch larvae, (ii) reproductive biology and condition indices of mussel populations, (iii) collection of mussel spat on artificial collectors and natural substrates, (iv) sampling of recruits to the established populations, (v) determination of small-scale recruitment patterns, and (vi) data analysis and modelling. Courses and practicals attended as partial fulfilment of the degree: Aquaculture, Stock Assessment and Fisheries Biology, Marine Chemistry, and Physical and Regional Oceanography.

1988-1989: Australian Institute of Marine Science; volunteer research assistant and diver; implementation and maintenance of field experiments, underwater scientific photography, digitizing and analysis of stereo-photoquadrats, larval culture, analysis of gut contents of fishes and invertebrates, carbon analysis

1985-1987: Sea Fisheries Research Institute of the South African Department of Environment Affairs and Tourism: scientific diver on deep diving surveys off Cape Agulhas: censusing fish populations, collection of benthic species for reef characterization.

South African National Research Institute of Oceanography and Port Elizabeth Museum: technical assistant and research diver; quantitative sampling of benthos in Mossel Bay, and census of fish populations in the Tsitsikamma National Park.

University of Cape Town, Department of Zoology and Percy Fitzpatrick Institute of African Ornithology: research assistant; supervisor of diving survey and collection of marine invertebrates, Prince Edward Islands.

1984-1984: University of Cape Town, Department of Zoology: research assistant (employment for M\Sc Degree) and demonstrator of first year Biological Science courses. Scope of MSc study: the biology, ecology and fishery of the western Cape linefish species *Pachymetopon blochii*, including (i) socio-economic survey of the fishery and relevant fishing communities, (ii) collection and analysis of data on stomach contents, reproductive biology, age and growth, (iii) analysis of size-frequency and catch statistics, (iv) underwater census, (v) determination of hook size selectivity, (vi) review of historical literature and (vii) recommendations to the Sea Fisheries Research Institute of the South African Department of Environment Affairs and Tourism for the modification of existing management policies for the hottentot fishery.

DECLARATION OF THE ENVIRONMENTAL SPECIALIST

I, ...Dr Andrea Pulrich... (Full Name and Surname) declare that –

General declaration:

- I act as an independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting undertaking the specialist work as required, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I have not, and will not engage in, conflicting interest in the undertaking of the activity.
- I understand to disclose to the applicant and competent authority all material information in my possession that reasonably has or may have the potential of influencing- any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- I have taken into account, to the extent possible, the matters referred to in Regulation 18 when preparing the report, plan or document.
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me this form are true and correct.
- I will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations.
- I am aware of what constitutes an offence in terms of Regulation 48 and that a person convicted of an offence in terms of Regulation 48(1) is liable to the penalties as contemplated in Section 49B of the Act.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remunerative for work performed in terms of the Regulations.

Signature of the Specialist: Andrea Pulrich

Name of Company: Pisces Environmental Services (Pty) Ltd

Date: 2 December 2022

UNDERTAKING UNDER OATH/AFFIRMATION

I, ...Andrea Pulfrich...swear under oath/affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

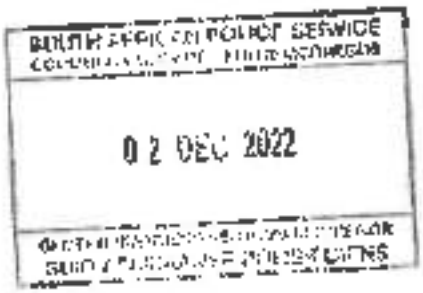
Name of Company: Pisces Environmental Services (Pty) Ltd

Date: 2 December 2022

Signature of the Commissioner of Oaths:

Date: 2022.12.02

Official Stamp below



PROPOSED 3D MULTI-CLIENT SEISMIC SURVEY IN THE ORANGE BASIN, OFFSHORE SOUTH AFRICA

SPECIALIST FISHERIES ASSESSMENT

SEPTEMBER 2022

Prepared on behalf of the applicant:

TGS

CapMarine
Capricorn Marine Environmental

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CAPRICORN MARINE ENVIRONMENTAL PTY LTD

PROPOSED 3D SEISMIC SURVEY WITHIN THE ORANGE BASIN

WEST COAST, SOUTH AFRICA

Fisheries Specialist Study

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20 September 2022

EXPERTISE AND DECLARATION OF INDEPENDENCE

This report was prepared by David Japp and Sarah Wilkinson of Capricorn Marine Environmental (Pty) Ltd. Dave Japp has a BSc degree in Zoology from the University of Cape Town (UCT) and a MSc degree in Fisheries Science from Rhodes University. Sarah Wilkinson has a BSc (Hons) degree in Botany from UCT. Both have considerable experience in undertaking specialist environmental impact assessments relating to South African commercial fisheries and fish stocks. David Japp has worked in the field of fisheries science and resource assessment since 1987. His work has included environmental economic assessments and the evaluation of environmental impacts on commercial fisheries. Sarah Wilkinson has worked on marine resource assessments, specialising in spatial and temporal analysis (GIS) of fisheries.

This specialist report was compiled for EIMS on behalf of TGS Geophysical Company (UK) Ltd, for their use during an Environmental Management Plan (EMP) Process associated with a Reconnaissance Permit Application for an area situated within the Orange Basin off the West Coast of South Africa. This specialist study will form an integral component of the EMP and will help to ensure that the approach meets the current environmental management best practice in terms of sustainable development. We do hereby declare that Capricorn Marine Environmental (Pty) Ltd is financially and otherwise independent of EIMS and the Applicant.

Dave Japp

Sarah Wilkinson

EXECUTIVE SUMMARY

TGS Geophysical Company (UK) Limited ("TGS") is applying for a Reconnaissance Permit to undertake prospective three-dimensional (3D) seismic survey acquisition off the West Coast of South Africa in order to investigate for oil and gas reserves. The reconnaissance application area of 57 400 km^2 is situated 120 km from the coastline at its closest approach and covers a water depth range of approximately 500 m to 4000 m. TGS is applying for authorisation to survey the full block area, although the acquisition area would likely be planned across a smaller area within the Reconnaissance Permit area. The survey would be undertaken by a dedicated vessel towing a short array of airguns (sound source) and a long array of up to 10 streamer cables (passive receivers). The streamer array would be towed at a depth of approximately 8 m below the sea surface and would extend up to 12 km or 8 km astern of vessel, respectively. It is anticipated that the total survey duration would be approximately 70 days.

Environmental Impact Management Services Pty Ltd (EIMS) has been appointed as the Independent Environmental Practitioner (EAP) to undertake an Environmental Management Plan (EMP) process for the proposed exploration activities. Capricorn Marine Environmental (Pty) Ltd has been contracted to provide a specialist assessment of the impact of the proposed activities on the fishing industry. Several aspects of the proposed activities were identified as posing a potential risk to the fishing industry and these risks were assessed with respect to each commercial fishing sector operational off the West Coast of South Africa. The aspects of the planned operations that were identified as posing a risk to fisheries include 1) noise emitted by the seismic survey operation; 2) safety zone around the survey vessel; and 3) accidental events such as hydrocarbon spill and loss of survey equipment to sea. The potential impacts arising from these aspects were assessed under the following categories: 1) the effects of increased ambient sound on fish behaviour and associated effects on recruitment and catch rates; 2) temporary exclusion of vessels from accessing fishing grounds; 3) water contamination due to accidental release of marine diesel and 4) obstruction to fishing operations as a result of lost equipment.

The impact of temporary exclusion from fishing ground was assessed on each fishing sector based on the type of gear used and the proximity of fishing areas in relation to the proposed survey area (inclusive of vessel manoeuvring areas beyond the boundary of the seismic acquisition area). The impact on catch rates due to sound elevation levels was assessed using the results of a Sound Transmissions Modelling Loss (STML) report and sensitivity / vulnerability differences amongst the targeted fish species identified for each sector. The impact significance was assessed based on a combination of the magnitude, duration and extent as well as the probability of it occurring. Significance was assigned to the pre-mitigation impact (i.e. before additional mitigation measures are applied, but taking into account embedded controls specified as part of the project description) and residual impacts after additional mitigation is applied. The table below provides a summary of the impacts on fisheries of each of the identified project activities, where the impact significance range across fishing sectors is presented before and after the implementation of recommended mitigation measures.

Sound generated during the seismic surveys is expected to be in the order of 255-256 dB re 1 µPa at 1 m (Peak sound pressure level) at an operating frequency range of 5 – 300 Hz. The zone of potential injury for fish eggs and larvae, as well as fish species with a swim bladder, is predicted to be within 160 m from the array source. Fish species without swim bladders have higher injury impact thresholds, and therefore a smaller zone of potential injury within 80 m from the array source. Impact of mortal injury to fish eggs and larvae and fish with a swim bladder as a result of cumulative exposure to multiple airgun array pulses was assessed to be 50 m from the adjacent survey lines for a 24-hour survey operation. The zones of potential recoverable injury (TTS effect) for fish species with and without swim bladders are predicted to be up to 3.5 km from the survey lines for the 24-hour operation scenarios considered. Existing experimental data regarding recoverable injury and TTS impacts for fish eggs and larvae is sparse and no guideline recommendations have been provided.

However, based on a subjective approach, noise impacts related to recoverable injury and TTS on fish eggs and larvae are expected to be moderate in the near field (tens of meters). Impact is expected to be low at intermediate field (hundreds of meters) and far field (thousands of meters) from the source location. Generation of noise during the seismic survey has the potential to affect catch due to behavioural responses of fish to increased noise levels. For the current project, the potential impact of elevated sound levels (produced by seismic airguns) on behavioural disturbance to fish (and associated effects on commercial catch rates) may extend to a distance of ~4 km from the sound source. With the implementation of the project controls and mitigation measures, the residual impact due to seismic noise is considered to be of LOW NEGATIVE significance for the large pelagic longline and tuna pole-line sectors. Due to the remote location of the Reconnaissance Permit area, noise would be expected to attenuate to below threshold levels before reaching fishing grounds of all other sectors viz. the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, traditional linefish, west coast rock lobster and small-scale fisheries sectors. The Reconnaissance Permit area does not coincide with spawning areas of key commercial species and noise generated by the seismic source would be expected to attenuate to below threshold levels for behavioural disturbance before reaching inshore recruitment and/or nursery areas. The Reconnaissance Permit area is situated well offshore of distributional area of snoek during its spawning and migration periods (an important species for the linefish and small-scale fisheries sectors).

During the seismic survey, fishing vessels would be required to maintain a safe operational distance from the vessel which may extend up to 6 nautical miles. The impact of potential exclusion was assessed for each commercial sector based on the affected area of fishing ground and the amount of catch reported within the Reconnaissance Permit area. The impact of potential exclusion resulting from the proposed seismic survey is the same as for the noise described above. With the implementation of the project controls and mitigation measures, the residual impact due to fisheries exclusion is considered to be of LOW NEGATIVE significance for large pelagic longline and tuna pole-line sectors. There is no impact expected on the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, traditional linefish, west coast rock lobster and small-scale fisheries sectors.

It is recommended that the survey avoid taking place during June and July during the peak period of fishing activity for the large pelagic longline sector within the area. Prior to the commencement of survey activities, affected parties should be informed of the navigational co-ordinates of the proposed survey acquisition area, timing and duration of proposed activities and any implications relating to the exclusion zone that would be requested, as well as the movements of support vessels related to the project. The relevant fishing associations include FishSA, incorporating the main commercial fishery sectors, as well as the SA Tuna Association, SA Tuna Longline Association, Fresh Tuna Exporters Association and small-scale fishery groups including the South African United Fishers Front (SAUFF). Other key stakeholders should be notified prior to commencement and on completion of the project. These include; the South African Navy Hydrographic Office (SANHO), South African Maritime Safety Association (SAMSA), Ports Authority and DFFE Vessel Monitoring, Control and Surveillance Unit in Cape Town (Vessel Monitoring System Unit).

For the duration of the survey, a navigational warning should be broadcast to all vessels via Navigational Telex (Navtex) and Cape Town radio. In addition, it is recommended that updates of the scheduled weekly survey plan should be circulated to the operators of affected fishing vessels on a daily basis. A Fisheries Liaison Officer (FLO) should be present on board the survey vessel or escort vessel for the duration of the survey in order to facilitate communications between the survey and fishing vessels in the Reconnaissance Permit area.

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ACRONYMS, ABBREVIATIONS AND UNITS

CapMarine	Capricorn Marine Environmental (Pty) Ltd
CPUE	Catch Per Unit Effort
dB	Decibel
DFFE	Department of Forestry, Fisheries and Environment
EAP	Environmental Assessment Practitioner
EMPr	Environmental Management Programme
EIA	Environmental Impact Assessment
ER	Exploration Right
FLO	Fisheries Liaison Officer
GRT	Gross Registered Tonnage
Hz	Hertz
ICCAT	International Convention for the Conservation of Atlantic Tunas
IOTC	Indian Ocean Tuna Commission
kg	Kilogram
kHz	Kilohertz
m	Metres
NEMA	National Environmental Management Act 107 of 1998, as amended
Pa	Pascal
SADSTIA	South African Deep-Sea Trawling Industry Association
SAHLLA	South African Hake Longline Association
SANHO	South African Navy Hydrographic Office
SAMLMA	South African Marine Linefish Management Association
SAPFIA	South African Pelagic Fishing Industry Association
SASMIA	South African Squid Management Industrial Association
SATLA	South African Tuna Longline Association
SECIFA	South Coast Inshore Trawl Fishing Association
SEL	Sound Exposure Level
SPL	Sound Pressure Level
t	Tonnes
TAC	Total Allowable Catch
TAE	Total Allowable Effort
ToR	Terms of Reference
VMS	Vessel Monitoring System

1 INTRODUCTION

1.1 BACKGROUND

TGS Geophysical Company (UK) Limited ("TGS") is applying for a Reconnaissance Permit to undertake a speculative three-dimensional (3D) seismic survey to investigate for offshore oil and gas reserves within the Orange Basin, off the West Coast of South Africa. Although the Reconnaissance Permit application area extends over a number of licence blocks between the South African – Namibian border and Cape Columbine, the proposed 3D acquisition area is confined to the Deep Water Orange Basin Block. The Reconnaissance Permit application area is approximately 57 400 km² in extent and is situated at least 120 km from the coastline at its shoreward extent, off St Helena Bay, extending northwards along the western coastline to approximately 230 km offshore Hondeklip Bay (see Figure 1.1). The corner co-ordinates of the area are provided in Table 1.1. The Reconnaissance Permit application area extends across a seafloor depth range of 500 m to 4 000 m. The proposed 3D seismic acquisition would cover a smaller area within the application area although the location has not yet been decided.

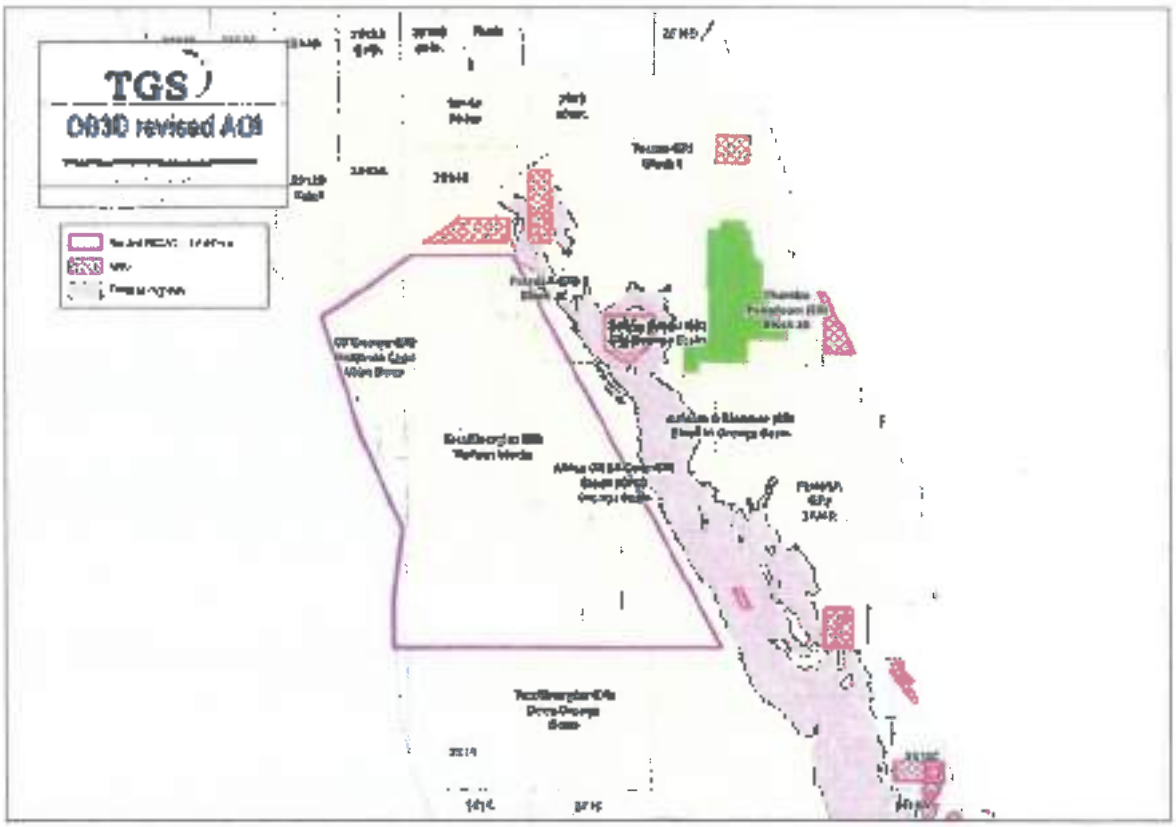

Figure 1.1: Location of the Reconnaissance Permit application area for 3D seismic acquisition.

The survey would be undertaken by a dedicated vessel towing a short array of airguns as well as an array of up to 10 receiving cables up to 8 km in length. It is proposed that the seismic survey would be undertaken during the 2023 / 2024 Austral Summer, subject to granting of the Reconnaissance Permit and vessel availability, over a period of approximately 70 days (excluding weather downtime).

As part of the Environmental Management Plan (EMP) process, Capricorn Marine Environmental (Pty) Ltd (CapMarine) has been appointed by EIMS to undertake an assessment of the impact of the proposed activity on commercial and small-scale fishing operations.

1.2 TERMS OF REFERENCE

The information from this study is intended to inform the EMP process through providing fisheries baseline data for the licence area and surrounds, an expert opinion on the relevant fisheries sectors including proposed mitigation measures to be implemented to manage/mitigate potential impacts of the proposed exploration activities. The specific Terms of Reference (ToR) for the Fisheries Specialist Study are as follows:

- A description of the existing baseline fisheries characteristics within the Reconnaissance Permit area (distribution of fish stocks and commercial, subsistence and recreational fishing activities).
- An introduction presenting a brief background to the study and an appreciation of the requirements stated in the specific terms of reference for the study.
- Details of the approach to the study where activities performed and methods used are presented.
- The specific identified sensitivity of fishing sectors related to the proposed activity.
- Map/s superimposing the proposed survey areas on the spatial distribution of effort expended by each fishing sector.
- Calculation of proportion of fishing ground that coincides with the proposed affected area.
- Assessment of potential impacts on fisheries using prescribed impact rating methodology.
- A description of any assumptions made and any uncertainties or gaps in knowledge.
- Recommendation of mitigation measures, where appropriate.

1.3 PROJECT DESCRIPTION

Seismic surveys are carried out during oil and gas exploration activities in order to investigate subsea geological formations. Seismic surveys are undertaken to collect either 2D or 3D data. 2D surveys are typically applied to obtain regional data from widely spaced survey grids (tens of kilometres) and infill surveys on closer grids (down to a 1 km spacing) are applied to provide more detail over specific areas of interest. 3D surveys are typically applied to promising petroleum prospects to assist in fault interpretation, distribution of sand bodies, estimates of oil and gas in place and the location of exploration wells.

During seismic surveys high-intensity, low frequency sound pulses are generated by an acoustic instrument towed behind a survey vessel, just below the sea surface. The sounds are directed towards the seabed and the seismic signal is reflected by the geological interfaces below the seafloor. The reflected signals are received by an array of receivers or sets of hydrophones towed behind the vessel.

During 3D seismic acquisition, the hydrophones are embedded in multiple streamers. Analyses of the returned signals allow for interpretation of subsea geological formations. The hydrophone streamers must be towed at constant depth, with flotation usually achieved by filling the cables with gel or flexible polymer foam, so that they are neutrally buoyant. To compensate for minor adjustments, Automatic Cable Levellers, or "birds" are used. For the 3D survey, an array of up to 10 hydrophone cables, spaced 150 m apart, will be towed astern of the vessel at a depth of 15 m below the sea surface. The extent of

the towed array would therefore be approximately 1 km wide and 8 km long. The end of each hydrophone streamer will be marked with a tail buoy, to warn shipping about the presence of the cable in the water. The tail buoy also acts as a platform for surface positioning systems so that the cable location can be accurately monitored. Refer to Figure 4.1 for a schematic overview of the seismic vessel towed gear configuration.

During seismic acquisition, the survey vessel would travel along a series of predefined transects of a prescribed survey grid which has been chosen to cross any known or suspected geological structure in the area. The headings of transects would be fixed and reciprocal. During surveying the seismic vessel would travel at a speed of between four and six knots (i.e. 2 to 3 metres per second). As the survey vessel would be restricted in manoeuvrability (a turn radius of 4.5 km is expected), other vessels should remain clear of it. A supply/chase vessel usually assists in the operation of keeping other vessels at a safe distance.

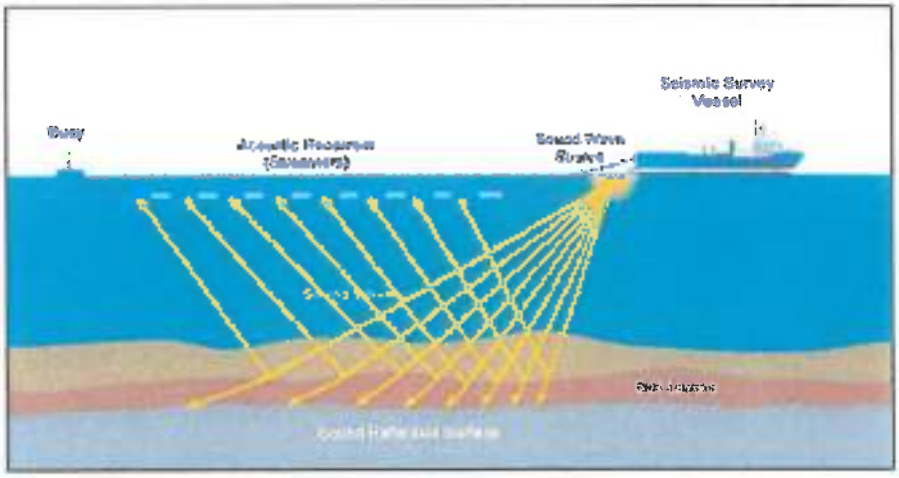

Figure 1.2: Principles of offshore seismic acquisition surveys (from fishsafe.eu).

The anticipated airgun array for the proposed survey would be Sercel G-GUN II 2 820 CUI consisting of 30 active airguns with operating pressures of 2 000 pound-force per square inch. The airgun array would be situated some 50 m behind the vessel at a depth of 8 m below the surface.

During surveying the seismic vessel "fires" the airgun array at regular intervals. Each triggering of a sound pulse is termed a seismic shot, and these are fired at intervals of 6 – 20 seconds (depending on water depth and other environmental characteristics) (Barger & Hamblen 1980). Each seismic shot is usually only between 5 and 30 milliseconds in duration, and despite peak levels within each shot being high, the total energy delivered into the water is low.

Airguns have most of their energy in the 5-300 Hz frequency range, with the optimal frequency required for deep penetration seismic work being 50-60 Hz. The maximum sound pressure levels at the source of airgun arrays in use today in the seismic industry are in the range 230-255 dB re 1 µPa at 1 m, with the majority of their produced energy being low frequency of 10-100 Hz (McCauley 1994; NRC 2003). The location where this level of sound is attained is directly beneath the airgun array, generally near its centre, but the exact location and depth beneath the array are dependent on the detailed makeup of the array, the water depth, and the physical properties of the seafloor (Dragoset 2000).

2 APPROACH AND METHODOLOGY

2.1 DATA SOURCES

The description of the baseline environment in the study area is based on a review and collation of existing information. Catch and effort data were sourced from the Department of Forestry, Fisheries and Environment (Branch: Fisheries) (DFFE) record for the years 2000 to 2019. All data were referenced to a latitude and longitude position and were redisplayed on a 60x60, 10x10 or 5x5 minute grid. Additional information was obtained from the Marine Administration System from DFFE and from the *South Africa, Namibia and Mozambique Fishing Industry Handbook 2019 (47th Edition)*

2.2 ASSESSMENT METHODOLOGY

The proposed Project's potential significant impacts on commercial and small-scale fishing are evaluated in this study. The assessment was focused on the effects caused by 1) exclusion of fishing in the area during the survey operations and 2) effects on catch rates due to noise disturbance in the wider vicinity of the survey area.

The spatial distribution of fishing effort and catch was mapped at an appropriate resolution for each fishing sector (based on the fishing method and resulting area covered by fishing gear). Fishing catch and effort within the vessel survey area (includes proposed seismic acquisition area and extended vessel manoeuvring area) was expressed as a percentage of the total effort and catch figures for each sector. This provided an indication of the proportion of fishing ground that could be affected by the presence of the survey vessel in relation to each fishing sector.

The potential reduction in catch was estimated as:

$$Ct = CT \times \left(\frac{Df}{Dt}\right)$$

where

Ct = catch potentially lost as a result of exclusion from fishing grounds (tons)

CT = total catch recorded as taken in the impact area (in this case the entire survey area) during fishing period (tons)

Df = duration of impact (days)

Dt = total days fished in the survey area during fishing period (dependant on the seasonality of each fishery)

The convention used to evaluate the significance of the impacts is presented in Appendix 1. The sensitivity of the receptor was derived from the baseline information. The impact magnitude, duration and extent was assigned to the pre-mitigation impact (i.e. before additional mitigation measures are applied, but taking into account embedded controls specified as part of the project description) and residual impacts after additional mitigation is applied. Thereafter the impact significance rating was determined as a function of the intensity and the sensitivity of the impact. Significance was assigned to the predicted impact pre-mitigation and post-mitigation (residual) after considering all possible feasible mitigation measures in accordance with the mitigation hierarchy.

2.3 ASSUMPTIONS, LIMITATIONS AND INFORMATION GAPS

The study is based on a number of assumptions and is subject to certain limitations, which should be noted when considering information presented in this report. The validity of the findings of the study is not expected to be affected by these assumptions and limitations:

- The official governmental record of fisheries data was used to display fishing catch and effort relative to the proposed project area. These data are derived from logbooks that are completed by skippers, and it is assumed that there will be a proportion of erroneous data due to mistakes in the capturing of these data into electronic format. The proportion of erroneous data is estimated to be up to 10% of the total dataset and would be primarily related to the accurate recording or transcription of the fishing position (latitude and longitude). Where obvious errors in the reporting of fishing positions were identified these were excluded from the analysis.
- In assessing the impact of the proposed exclusion zone on fishing operations, catch and effort figures are quoted across the entire extent of the proposed survey areas. In practice, the exclusion area would be a moving exclusion zone of approximately 165 km^2 extending around the vessel (based on the required safety clearances shown in Figure 2.1). The approach adopted for this report is likely to be an overestimate of the potential impact on fishing operations which in reality could continue within certain portions of the proposed survey area.
- The acoustic impact is transitory i.e. the sound source moves in space and time as the survey progresses within the target area.
- The effects of seismic sound on the CPUE of fish and invertebrates have been drawn from the findings of international studies. To date there have been no studies focused directly on the species found locally. Although the results from international studies are likely also to be representative for local species, current gaps in knowledge on the topic lead to uncertainty when attempting to accurately quantify the potential loss of catch for each type of fishery. Research into the effects of seismic sound on marine fauna is ongoing.

3 DESCRIPTION OF RECEIVING ENVIRONMENT: FISHERIES BASELINE

3.1 OVERVIEW OF FISHERIES SECTORS

South Africa has a coastline that spans two ecosystems over a distance of 3623 km, extending from the Orange River in the west on the border with Namibia, to Ponta do Ouro in the east on the Mozambique border. The western coastal shelf has highly productive commercial fisheries similar to other upwelling ecosystems around the world, while the East Coast is considerably less productive but has high species diversity, including both endemic and Indo-Pacific species. South Africa's fisheries are regulated and monitored by the DFFE. All fisheries in South Africa, as well as the processing, sale in and trade of almost all marine resources, are regulated under the Marine Living Resources Act, 1998 (No. 18 of 1998) (MLRA).

Approximately 22 different fisheries sectors currently operate within South African waters. Table 3.1 lists these along with ports and regions of operation, catch landings and the number of active vessels and rights holders (2017). The proportional volume of catch and economic value of each of these sectors for 2017 is indicated in Figure 3.1. The primary fisheries in terms of economic value and overall tonnage of landings are the demersal (bottom) trawl and long-line fisheries targeting the Cape hakes (*Merluccius paradoxus* and *M. capensis*) and the pelagic-directed purse-seine fishery targeting pilchard (*Sardinops sagax*), anchovy (*Engraulis encrasicolus*) and red-eye round herring (*Etrumeus whiteheadi*). Highly migratory tuna and tuna-like species are caught on the high seas and seasonally within the South

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African waters by the pelagic long-line and pole fisheries. Targeted species include albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*), yellowfin tuna (*T. albacares*) and swordfish (*Xiphias gladius*). The traditional line fishery targets a large assemblage of species close to shore including snoek (*Thyrsites atun*), Cape bream (*Pachymetopon blochii*), geelbek (*Atractoscion aequidens*), kob (*Argyrosomus japonicus*), yellowtail (*Seriola lalandi*) and other reef fish. Crustacean fisheries comprise a trap and hoop net fishery targeting West Coast rock lobster (*Jasus lalandii*), a line trap fishery targeting the South Coast rock lobster (*Palinurus gilchristi*) and a trawl fishery based solely on the East Coast targeting penaeid prawns, langoustines (*Metanephrops andamanicus* and *Nephropsis stewarti*), deep-water rock lobster (*Palinurus delagoae*) and red crab (*Chaceon macphersoni*). Other fisheries include a mid-water trawl fishery targeting horse mackerel (*Trachurus trachurus capensis*) predominantly on the Agulhas Bank (South Coast) and a hand-jig fishery targeting chokka squid (*Loligo vulgaris reynaudi*) exclusively on the South Coast. In addition to commercial sectors, recreational fishing occurs along the coastline comprising shore angling and small, open boats generally less than 10 m in length. The commercial and recreational fisheries are reported to catch over 250 marine species, although fewer than 5% of these are actively targeted by commercial fisheries, which comprise 90% of the landed catch.

Most commercial fish landings must take place at designated fishing harbours. For the larger industrial vessels targeting hake, only the major ports of Saldanha Bay, Cape Town, Mossel Bay and Port Elizabeth are used. On the West Coast, St. Helena Bay and Saldanha Bay are the main landing sites for the small pelagic fleets. These ports also have significant infrastructure for the processing of anchovy into fishmeal as well as the canning of sardine. Smaller fishing harbours on the West / South-West Coast include Port Nolloth, Hondeklip, Doringbaai, Lamberts Bay, Hout Bay and Gansbaai harbours. On the East Coast, Durban and Richards Bay are deployment ports for the crustacean trawl and large pelagic longline sectors. There are more than 230 small-scale fishing communities on the South African coastline (DAFF, 2016). Small-scale fisheries operate in the nearshore environment. Recreational fisheries comprise shore-based, estuarine and boat-based line fisheries as well as spearfishing and net fisheries, including cast, drag and hoop net techniques.

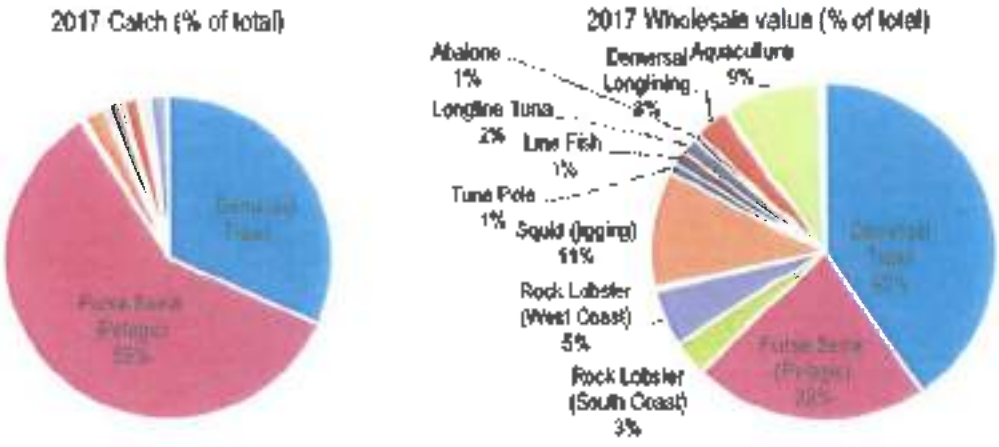

Figure 3.1: Pie chart showing percentage of landings by weight (left) and wholesale value (right) of each commercial fishery sector as a contribution to the total landings and value for all commercial fisheries sectors combined (2017). Source: DEFF, 2019.

Table 3.1: South African offshore commercial fishing sectors: wholesale value of production in 2017 (adapted from DEFF, 2019).

Sector	No. of Rights Holders (Vessels)	Catch (tons)	Landed Catch /Sales (tons)	Wholesale Value of Production (rm) 2017 (R 000)	% of Total Value
Small pelagic purse-seine	111 (101)	313476	313476	2164224	22.0
Demersal trawl (offshore)	50 (45)	169743	98200	3891978	39.5
Demersal trawl (inshore)	18 (31)	4452	2736	90104	0.9
Midwater trawl	34 (6)	19 555			
Demersal long-line	146 (64)	8113	8113	319228	3.2
Large pelagic long-line	30 (31)	2541	2541	154199	1.6
Tuna pole	170 (128)	2399	2399	97583	1.0
Linefish	422 (450)	4931	4931	122096	1.2
Longline shark demersal	4	72	72	1566	0.0
South coast rock lobster	13 (12)	699	451	387912	3.4
West coast rock lobster	240 (105)	1238	1238	531659	5.4
Crustacean trawl	6 (5)	310	310	32012	0.3
Squid jig	92 (138)	11578	11578	1099910	11.2
Miscellaneous nets	190 (N/a)	1502	1502	25589	0.3
Oysters	146 pickers	42	42	3300	0.0
Seaweeds	14 (N/a)	9877	6824	27095	0.3
Abalone	N/a (N/a)	86	86	61920	0.6
Aquaculture		3907	3907	881042	9.0
TOTAL		528966	458456	9841417	100

Table 3.2: South African offshore commercial fishing sectors, landings, number of rights holders, wholesale catch value and target species (DEFF, 2019).

Sector	Areas of Operation	Main Ports	Target Species
Small pelagic purse-seine	West Coast South Coast	St Helena Bay, Saldanha, Hout Bay, Gansbaai, Mossel Bay	Anchovy (*Engraulis encrasicolus*), sardine (*Sardinops sagax*), Redeye round herring (*Etrumeus whiteheadi*)
Demersal trawl (offshore)	West Coast South Coast	Cape Town, Saldanha, Mossel Bay, Port Elizabeth	Deepwater hake (*Merluccius paradoxus*), shallow-water hake (*Merluccius capensis*)
Demersal trawl (inshore)	South Coast	Cape Town, Saldanha, Mossel Bay	East coast sole (*Austroglossus pectoralis*), shallow-water hake (*Merluccius capensis*), juvenile horse mackerel (*Trachurus capensis*)
Mid-water trawl	West Coast South Coast	Cape Town, Port Elizabeth	Adult horse mackerel (*Trachurus capensis*)
Demersal longline	West Coast South Coast	Cape Town, Saldanha, Mossel Bay, Port Elizabeth, Gansbaai	Shallow-water hake (*Merluccius capensis*)
Large pelagic longline	West Coast South Coast East Coast	Cape Town, Durban, Richards Bay, Port Elizabeth	Yellowfin tuna (*T. albacares*), Big eye tuna (*T. obesus*), Swordfish (*Xiphias gladius*), southern bluefin tuna (*T. maccoyii*)
Tuna pole-line	West Coast South Coast	Cape Town, Saldanha	Albacore tuna (*T. alalunga*), yellowfin tuna
Linefish	West Coast South Coast East Coast	All ports, harbours and beaches around the coast	Snoek (*Thyrsites atun*), Cape bream (*Pachymetopon blochii*), galjoen (*Arrectoscion aequidens*), kob (*Argyrosomus japonicus*), yellowtail (*Seriola lalandi*), Spandae, Serranidae, Carangidae, Scombridae, Sciaenidae
South coast rock lobster	South Coast	Cape Town, Port Elizabeth	*Palinurus gilchristi*
West coast rock lobster	West Coast	Hout Bay, Kalk Bay, St Helena	*Jasus lalandii*
Crustacean trawl	East Coast	Durban, Richards Bay	Tiger prawn (*Penaeus monodon*), white prawn (*Fenneropenaeus indicus*), brown prawn (*Metapenaeus monoceros*), pink prawn (*Haliporoides triarthrus*)
Squid jig	South Coast	Port Elizabeth, Port St Francis	Squid/chokka (*Loligo vulgaris reynaudii*)
Gillnet	West Coast	False Bay to Port Nolloth	Mullet / harders (*Liza richardsonii*)
Beach seine	West Coast South Coast East Coast	Coastal/Nearshore	Mullet / harders (*Liza richardsonii*)
Oysters	South Coast East Coast	Coastal/Nearshore	Cape rock oyster (*Striostrea margaritacea*)
Seaweeds	West Coast South Coast East Coast	Coastal/Nearshore	Beach-cast seaweeds (kelp, *Gelidium* spp. and *Gracilaria* spp.
Abalone	West Coast	Coastal/Nearshore	*Haliotis midae*
Small-Scale fisheries	West Coast South Coast East Coast	Coastal/Nearshore	

3.2 SPAWNING AND RECRUITMENT OF FISH STOCKS

The South African coastline is dominated by seasonally variable and sometimes strong currents, and most species have evolved selective reproductive patterns to ensure that eggs and larvae can enter suitable nursery grounds situated along the coastline. Three nursery grounds can be identified in South African waters, viz the Natal Bight, the Agulhas Bank and the inshore Western Cape coasts. Each is linked to a spawning area, a transport and/or recirculation mechanism, a potential for deleterious offshore or alongshore transport and an enriched productive area of coastal or shelf-edge upwelling (Hutchings et al., 2002).

Hake, sardines, anchovy and horse mackerel are mostly serial, broadcast spawners, producing large numbers of eggs sporadically that are widely dispersed in ocean currents (Hutchings et al., 2002). The principal commercial fish species undergo a critical migration pattern in the Agulhas and Benguela ecosystems. Adults spawn on the Agulhas Bank between the shelf-edge upwelling and the cold-water ridge, where copepod availability is highest (Crawford 1980; Hutchings 1994; Roel & Armstrong 1991; Hutchings et al. 2002). The spawn products are thought to move southwards from the central Agulhas Bank and then may drift northwards in the Benguela current across the shelf and up the west coast, or inshore and eastwards towards the south coast. As the eggs drift, hatching takes place followed by larval development. Settlement of larvae occurs in the inshore areas, in particular the bays that are used as nurseries, from October to March. In the southern Benguela system, juveniles shoal and then begin a southward migration down the west coast – it is at this stage that anchovy and sardine are targeted by the small pelagic purse seine fishery. Juveniles of demersal species such as hake are thought to move from a pelagic phase and to systematically migrate to the seafloor (a vertical migration) and then as they mature and grow in size, move offshore into deeper water where they are targeted by commercial fisheries (in hake this occurs in their third year of growth and is referred to as "recruiting" to the fishery).

Spawning of key species exploited by commercial fishery sectors off the West Coast are presented below (Hutchings et al. 2002):

- Hake, snoek and round herring move to the western Agulhas Bank and southern west coast to spawn during key periods (late winter to early spring), when losses due to offshore drift are at a minimum and eggs and larvae drift northwards and inshore to the west coast nursery grounds.
- Hake are serial spawners and are reported to spawn throughout the year with peaks in October/November and March/April (Johann Augustyn, SADSTIA and Dave Japp, CapMarine pers com.). During these periods there is a greater concentration of drifting eggs and larvae compared to other months. Spawning of the shallow-water hake occurs primarily over the shelf (<200 m) whereas that by the deep-water hake occurs off the shelf.
- Horse mackerel spawn over the east/central Agulhas Bank during winter months but are also concentrated on the eastern part of the bank most months in feeding aggregations. Juveniles occur close inshore off the southern Cape coastline and west coast nursery habitats.
- Anchovies are known to spawn on the western, central and eastern Agulhas Bank, from October to March with spawning peaking during October to January (van der Lingen and Huggett, 2003) and some shifts to the west coast in years when Agulhas Bank water intrudes strongly north of Cape Point (van der Lingen *et al.*, 2001 in Hutchings *et al.*, 2002)
- Genomic and transcriptomic analyses have shown that there are two stocks of sardine off South Africa; the Cool Temperate Sardine (CTS) off the west coast and Warm Temperate Sardine (WTS) off the south coast, with some mixing (in both directions) between the two (Teske *et al.* 2021). Sardines spawn on the western, central and eastern Agulhas Bank, and also off the west coast

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north of Cape Point. Sardine eggs are found throughout the year, but spawning occurs from August to February (spring-summer) for the CTS off the west coast, and from June to November (winter-spring) for WTS off the south coast. There is an intense seasonal movement of sardine eastwards (the "sardine run") that occurs in mid-winter and which is associated with westerly frontal systems driving fish inshore in counter currents. And whilst sardine eggs are found off the east coast from June to December (see Connell 2010 AJMS 32(2)), the KwaZulu-Natal sardine run is not the spawning migration of a third stock but a navigation error by CTS.

- Squid (*Loligo* spp.) spawn in the nearshore zone on the eastern Agulhas Bank, principally in shallow waters (<50 m) between Knysna and Gqeberha. Their distribution and abundance are erratic and linked to temperature, turbidity, and currents (Augustyn et al. 1994; Schön et al. 2002). This niche area on the eastern Agulhas Bank optimises their spawning and early life stage as nowhere else on the shelf are both bottom temperature and bottom dissolved oxygen simultaneously at optimal levels for egg development (Roberts 2005; Oosthuizen & Roberts 2009). The greatest concentration of their food (copepods) tends to be found further west in the cold-water ridge on the central Agulhas Bank (Roberts & van den Berg 2002). Squid are not broadcast spawners but instead they lay benthic egg sacs. The paralarvae that hatch from the sacs are distributed close inshore and juveniles are dispersed over the entire shelf region of the Agulhas Bank. Larvae and juveniles are carried offshore and westwards (via the Benguela jet) to feed and mature, before returning to the spawning grounds to complete their lifecycle (Olyott et al. 2007).
- Snoek spawning occurs offshore during winter-spring (June to October), along the shelf break (150-400 m) of the western Agulhas Bank and the South African west coast. Prevailing currents transport eggs and larvae to a primary nursery ground north of Cape Columbine and to a secondary nursery area to the east of Danger Point; both shallower than 150 m. Juveniles remain on the nursery grounds until maturity, growing to between 33 and 44 cm in the first year (3.25 cm/month). Onshore-offshore distribution (between 5- and 150-m isobaths) of juveniles is determined largely by prey availability and includes a seasonal inshore migration in autumn in response to clupeoid recruitment. Adults are found throughout the distribution range of the species, and although they move offshore to spawn - there is some southward dispersion as the spawning season progresses - longshore movement is apparently random and without a seasonal basis (Griffiths, 2002; refer to Figure 3.3).
- The inshore area of the Agulhas Bank, especially between the cool water ridge and the shore, serves as an important nursery area for numerous linefish species (e.g. elf *Pomatomus saltatrix*, leervis *Lichia amia*, geelbek *Atractoscion aequidens*, carpenter *Argyrozona argyrozona*) (Wallace et al. 1984; Smale et al. 1994). A significant proportion of these eggs and larvae originate from spawning grounds along the east coast, as adults undertake spawning migrations along the South Coast into KwaZulu-Natal waters (van der Elst 1976, 1981; Griffiths 1997; Garratt 1988; Beckley & van Ballegooyen 1992). The eggs and larvae are subsequently dispersed southwards by the Agulhas Current, with juveniles occurring on the inshore Agulhas Bank, using the area between the cold-water ridge and the shore as nursery grounds (van der Elst 1976, 1981; Garratt 1988). In the case of the carpenter, a high proportion of the reproductive output comes from the central Agulhas Bank and the Tsitsikamma Marine Protected Area (MPA), and two separate nursery grounds appear to exist, one near Gqeberha and a second off the deep reefs off Cape Agulhas, with older fish spreading eastwards and westwards (van der Lingen et al. 2006).

Table 3.3 shows known spawning periods of key commercial species off the West Coast of South Africa.

Table 3.3: Table showing known spawning periods of key commercial species off the West Coast of South Africa.

Sector	Spawning intensity by Month (black = peak spawning)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Cape hakes												
Anchovy												
Sardine												
Snoek												

Refer to Figure 3.2 and Figure 3.3 for an overview of the main fish spawning grounds and nursery areas off the West and South Coasts of South Africa. Figure 3.4 shows the distribution of egg density of sardine and anchovy, and Figure 3.5 shows spawning ground and nursery areas of snoek and anchovy.

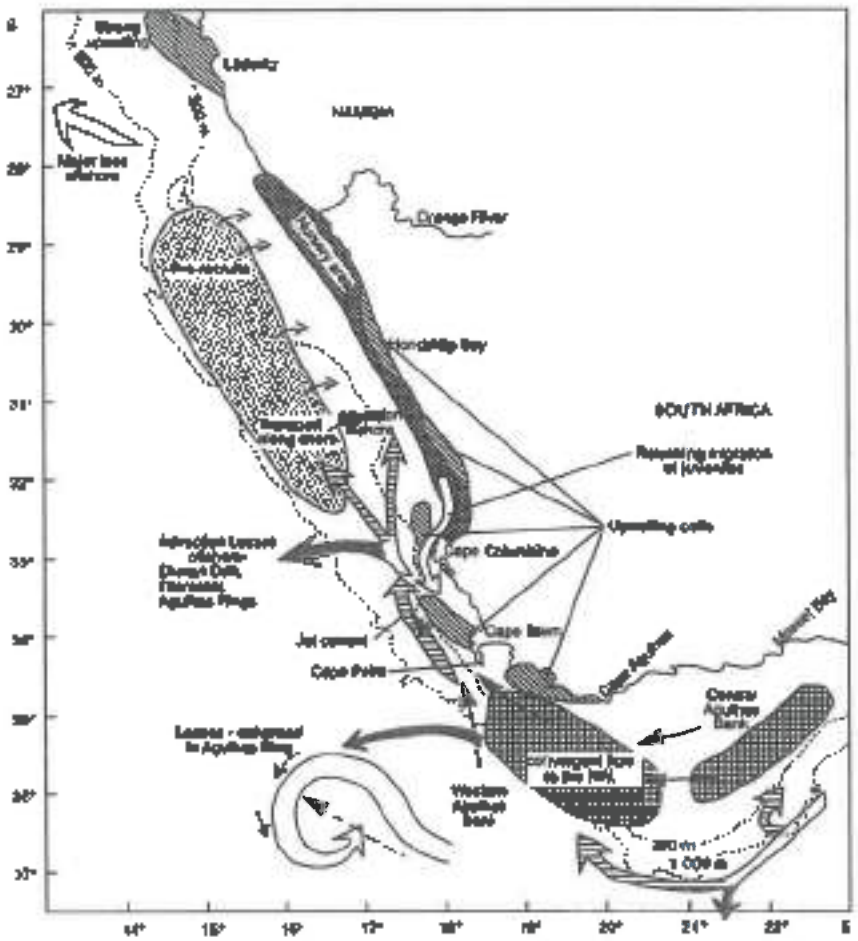

Figure 3.2: Generalised figure of the main fish recruiting process for species caught on the West Coast of South Africa (after Hutchings et al., 2002). Figure shows the West Coast nursery area and the western/central Agulhas Bank spawning grounds. Light stippled area on the West Coast marks the main recruiting area for the small pelagic fishery and dark stippled area on the Agulhas Bank marks the main spawning grounds for small pelagic fish.

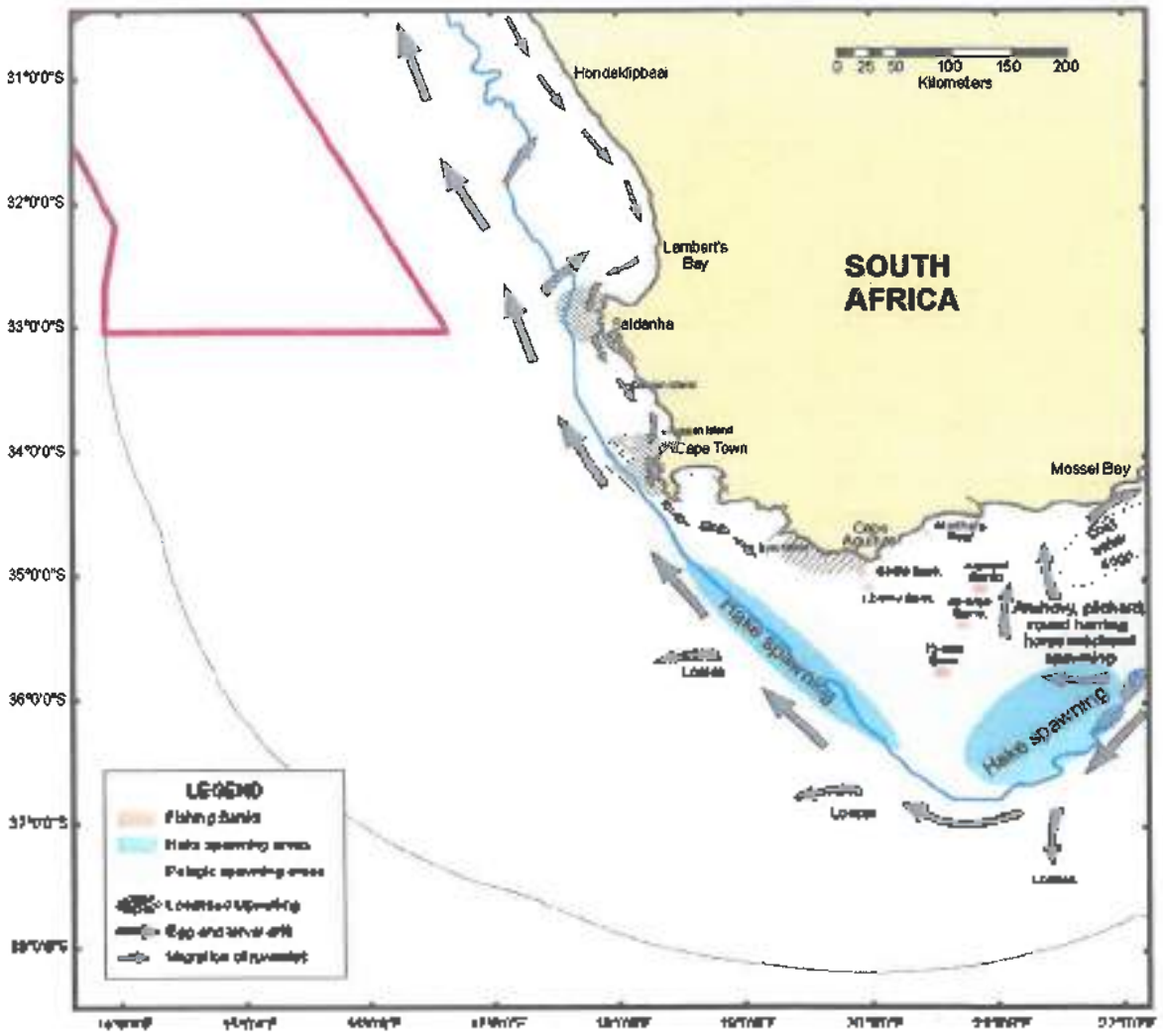

Figure 3.3: The Reconnaissance Permit area in relation to major spawning, recruitment and nursery areas in the southern Benguela region (adapted from Crawford et al. 1987, Hutchings 1994, and Hutchings et al., 2002, in Pisces 2022).

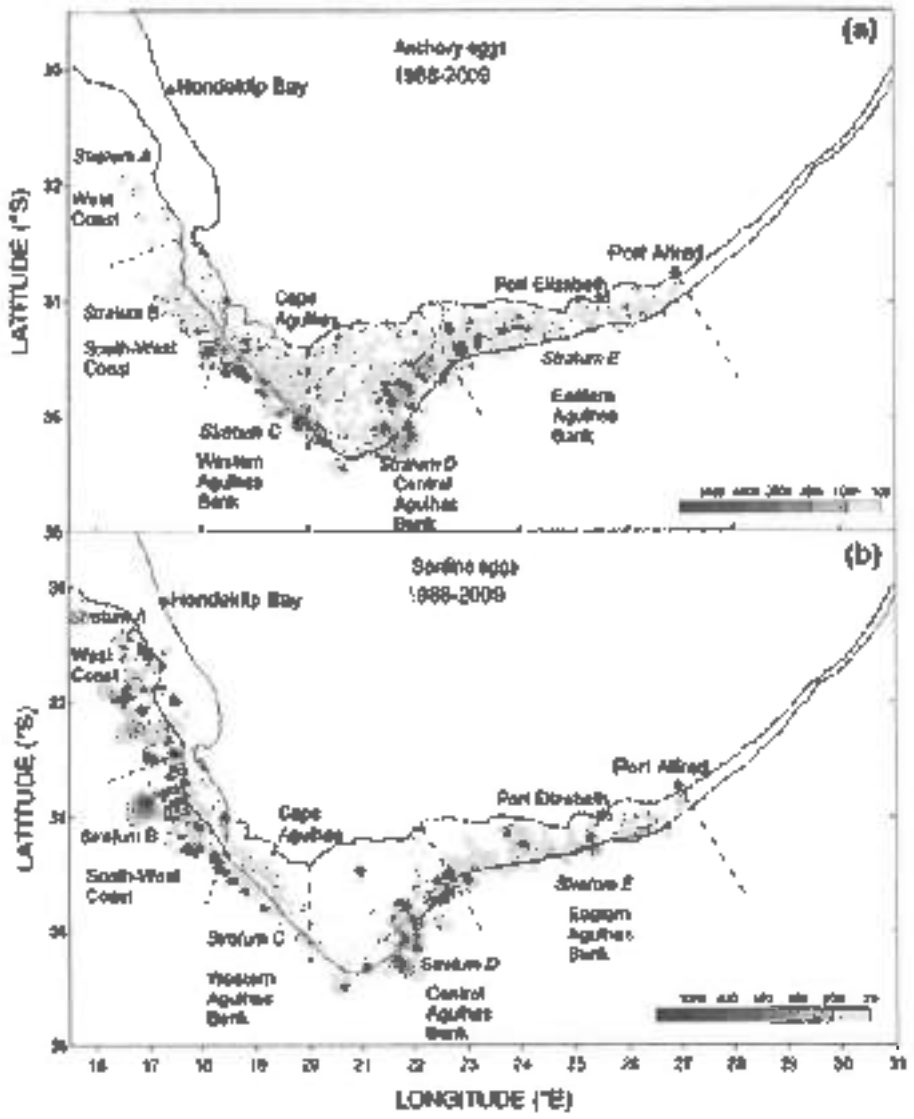

Figure 3.4: Composite distribution maps for eggs (eggs.m^{-2}) of (a) anchovy and (b) sardine collected during spawner biomass surveys by DFFE over the period 1988-2009 (Mhlongo et al., 2015).

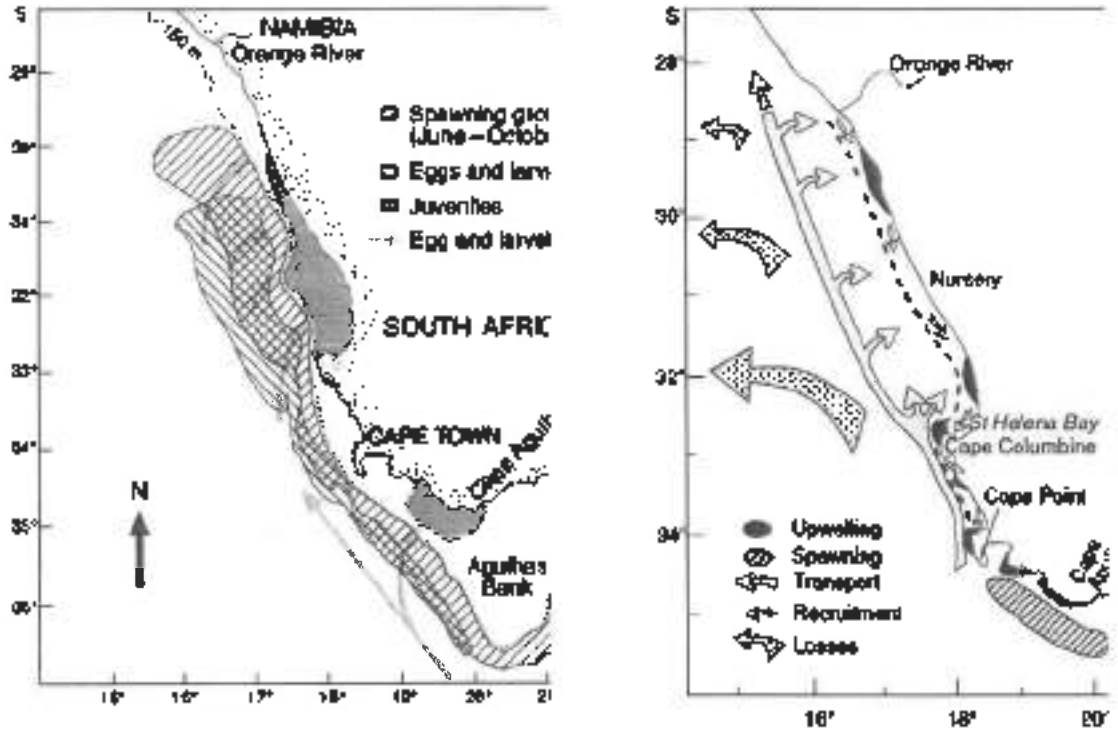

Figure 3.5: Conceptual model depicting the life history of snoek (left; Source: Griffiths, 2002) and anchovy (right; Hutchings et al., 1992) in the southern Benguela ecosystem, including spawning grounds, distribution and transport of eggs and larvae, and the nursery areas.

3.3 COMMERCIAL FISHING SECTORS

3.3.1 DEMERSAL TRAWL

The primary fisheries in terms of highest economic value are the demersal (bottom) trawl and longline fisheries targeting the Cape hakes (*Merluccius paradoxus* and *M. capensis*). Secondary species include a large assemblage of demersal fish of which monkfish (*Lophius vomerinus*), kingklip (*Genypterus capensis*) and snoek (*Thyrsites atun*) are the most commercially important. The demersal trawl fishery comprises an offshore (deep-sea) and inshore fleet, which differ primarily in terms of vessel capacity and the areas in which they operate. The wholesale value of catch landed by the inshore and offshore demersal trawl sectors, combined, during 2017 was R3.982 Billion, or 40.5% of the total value of all fisheries combined. The 2022 TAC for hake is set at 132 154 tons, of which 84% and 6% is allocated to the offshore and inshore trawl sectors, respectively. (The remaining 10% is allocated to the hake demersal longline sector – refer to section 3.3.3).

The annual TAC limits and landings of hake (both species) by the trawl and longline sectors is listed in Table 3.3. A time-series of total hake catch as well as hake catch by sector is shown in Figure 3.6.

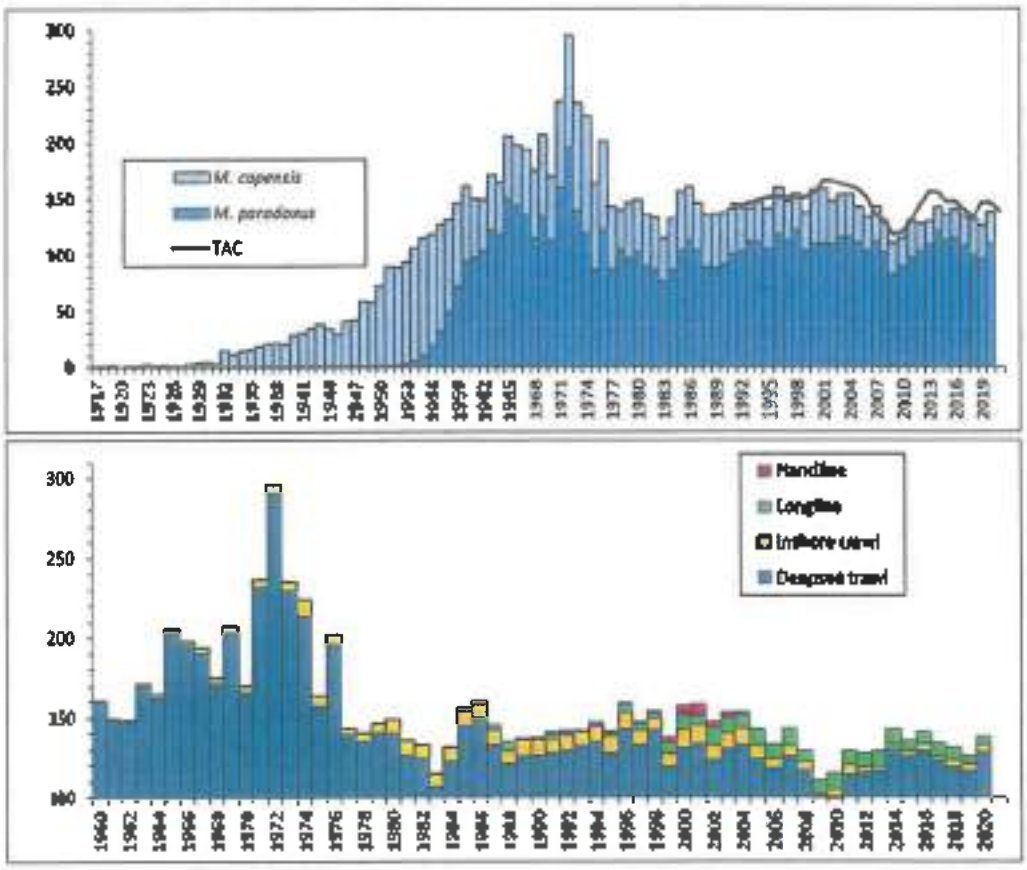

Figure 3.6: (top) Total catches ('000 tonnes) of Cape hakes split by species over the period 1917–2020 and the TAC set each year since the 1991. (bottom) Catches of Cape hakes per fishing sector for the period 1960–2020. Prior to 1960, all catches are attributed to the deep-sea trawl sector. Note that the vertical axis commences at 100 000 tonnes to better clarify the contributions by each sector. (Source DEFF, 2022)

Table 3.4: Annual total allowable catch (TAC) limits and catches (tons) of the two species of hake by the hake-directed fisheries on the West (WC) and South (SC) coasts (Adapted from DEFF, 2020[1]).

Year	TAC	*M. paradoxus*					*M. capensis*						TOTAL (both species)
		Offshore		Longline		TOTAL	Offshore		Inshore	Longline		TOTAL	
		WC	SC	WC	SC		WC	SC	SC	WC	SC		
2010	149831	63709	15457	2394	1527	89087	10186	4066	5472	3986	3024	26736	115823
2011	131780	76676	17804	2522	140	97142	15673	4069	6013	3521	3047	35525	129667
2012	144879	81411	16542	4958	306	103216	12928	4564	3228	2579	1737	25036	127666
2013	156676	74341	20889	6056	80	109316	6781	4475	2920	2606	1306	20071	129387
2014	155280	79252	41158	6670	6	121286	9674	6286	2965	2123	315	21361	142636
2015	147800	77521	31745	4001	16	113288	12727	4866	3807	2326	63	22217	135503
2016	147600	93173	18868	2806	1	114848	14744	2810	3973	4380	2	25889	140837
2017	140125	72326	30961	5288	25	108600	15273	4466	2612	2907	126	25484	134084
2018	133119	64252	29216	5156	89	98715	12589	12883	3983	2615	491	32566	131370
2019	148431	70606	22291	3177	29		14193	9454	4149	2980	179		
2020	146409	87093	10061	3220	1		18118	3500	4536	1289	177		

[1] FISHERIES/2021/OCT/SWG-DEM/21rev

2021	139109
2022	132184

The offshore fishery is comprised of 45 vessels operating from most major harbours on both the West and South Coasts. On the West and South-West Coasts, these grounds extend in a continuous band along the shelf edge approximately between the 200 m and 1 000 m bathymetric contours although most effort is in the >300 m to 600 m depth range. Monkfish-directed trawlers tend to fish shallower waters than hake-directed vessels on mostly muddy substrates. Trawl nets are generally towed parallel to the depth contours (thereby maintaining a relatively constant depth) in a north-westerly or south-easterly direction. Trawlers also target fish aggregations around bathymetric features, in particular seamounts and canyons, where there is an increase in seafloor slope and in these cases the direction of trawls follow the depth contours. The deep-sea sector is prohibited from operating in waters shallower than 110 m or within five nautical miles of the coastline. Fishing activity occurs year-round.

The inshore fishery consists of 31 vessels, which operate on the South Coast mainly from the harbours of Mossel Bay and Port Elizabeth. Inshore grounds are located on the Agulhas Bank and extend towards the Great Kei River in the east. Vessels also target sole close inshore between Struisbaai and Mossel Bay, between the 50 m and 80 m isobaths. Hake is targeted further offshore in traditional grounds between 100 m and 200 m depth in fishing grounds known as *the Blues* located on the Agulhas Bank.

Otter trawling is the main trawling method used in the South African hake fishery. This method of trawling makes use of trawl doors (also known as otter boards) that are dragged along the seafloor ahead of the net maintaining the horizontal net opening. Bottom contact is made by the footrope and by long cables and bridles between the doors and the footrope. Behind the trawl doors are bridles connecting the doors to the wings of the net (to the ends of the footrope and headrope). A headline, bearing floats and the weighted footrope (that may include rope, steel wire, chains, rubber discs, spacers, bobbins or weights) maintain the vertical net opening. The "belly", "wings" and the "cod-end" (the part of the net that retains the catch) may contact the seabed (see Figure 3.8). The configuration of trawling gear is similar for both offshore and inshore vessels however inshore vessels are smaller and less powerful than those operating within the offshore sector. The offshore fleet is segregated into wetfish and freezer vessels which differ in terms of the capacity for the processing of fish at sea and in terms of vessel size and capacity. While freezer vessels may work in an area for up to a month at a time, wetfish vessels may only remain in an area for about a week before returning to port. Wetfish vessels range between 24 m and 56 m in length while freezer vessels are usually larger, ranging up to 90 m in length. Inshore vessels range in length from 15 m to 40 m. Trips average three to five days in length and all catch is stored on ice.

Figure 3.7: Photograph of MFV *Harvest Mzansi*, a wetfish vessel operating in the South African offshore demersal trawl sector (source: www.sadatsa.co.za).

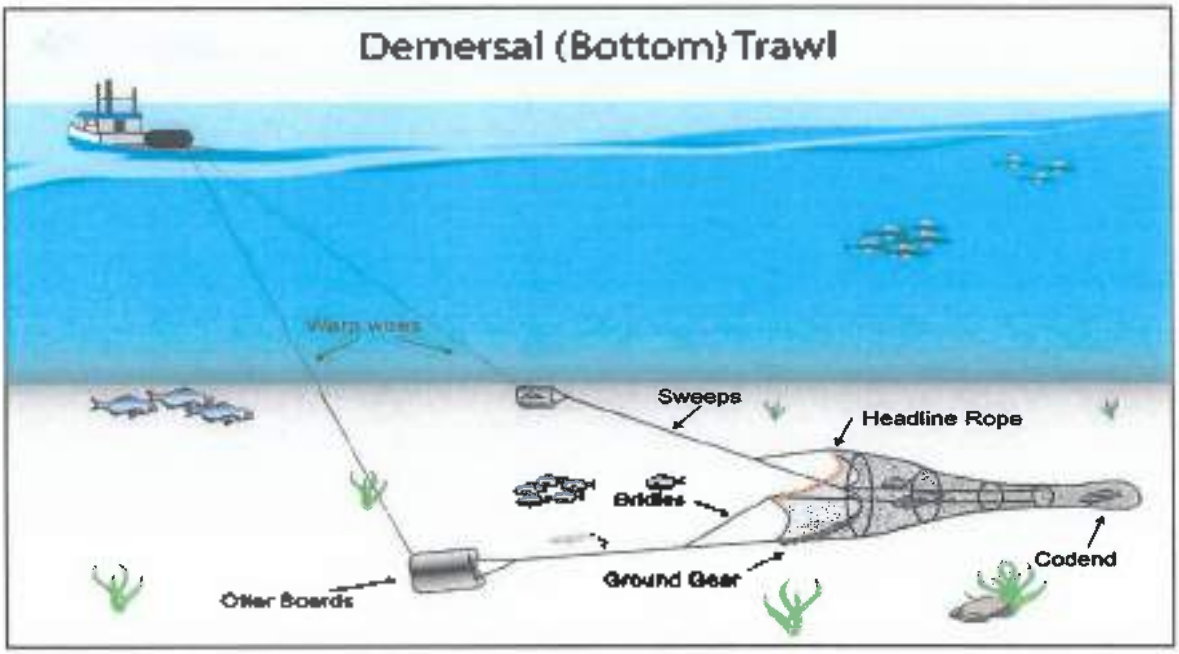

Figure 3.8: Typical gear configuration used by offshore demersal trawlers targeting hake (Source: www.afma.gov.au/fisheries-management/methods-and-gear/trawling).

The activity of the fishery is restricted by permit condition to operating within the confines of a historical "footprint" – an area of approximately 57 300 km^2 and 17 000 km^2 for the offshore and inshore fleets, respectively. Offshore trawlers operate along the west coast along the shelf break between approximately Hondeklipbaai and the southern tip of the Agulhas Bank between the 200 m and 750 m bathymetric contours, with sporadic trawls to a maximum depth of 900 m. The Reconnaissance Permit extends offshore of fishing grounds referred to as the "North Grounds" (Sink et. al, 2012). These grounds are characterised by sandy and muddy sand, with isolated patches of hard ground. The area has been trawled since the 1960's commencing on shallower grounds and with effort extending into deeper waters with the advancement of fishing technologies over time.

At it's closest point the demersal trawl footprint is situated approximately 5 km offshore of the area fished around the slopes of the submarine feature Childs Bank (referred to by the fishing industry as the "karbonkel") off Hondeklipbaai. The demersal trawl footprint is situated at least 10 km inshore of the eastern extent of the Reconnaissance Permit area towards the productive fishing grounds between Lamberts Bay and Saldanha Bay. Figure 3.9 shows the demersal trawling footprint and recent effort off the west coast of South Africa and in relation to the Reconnaissance Permit application area.

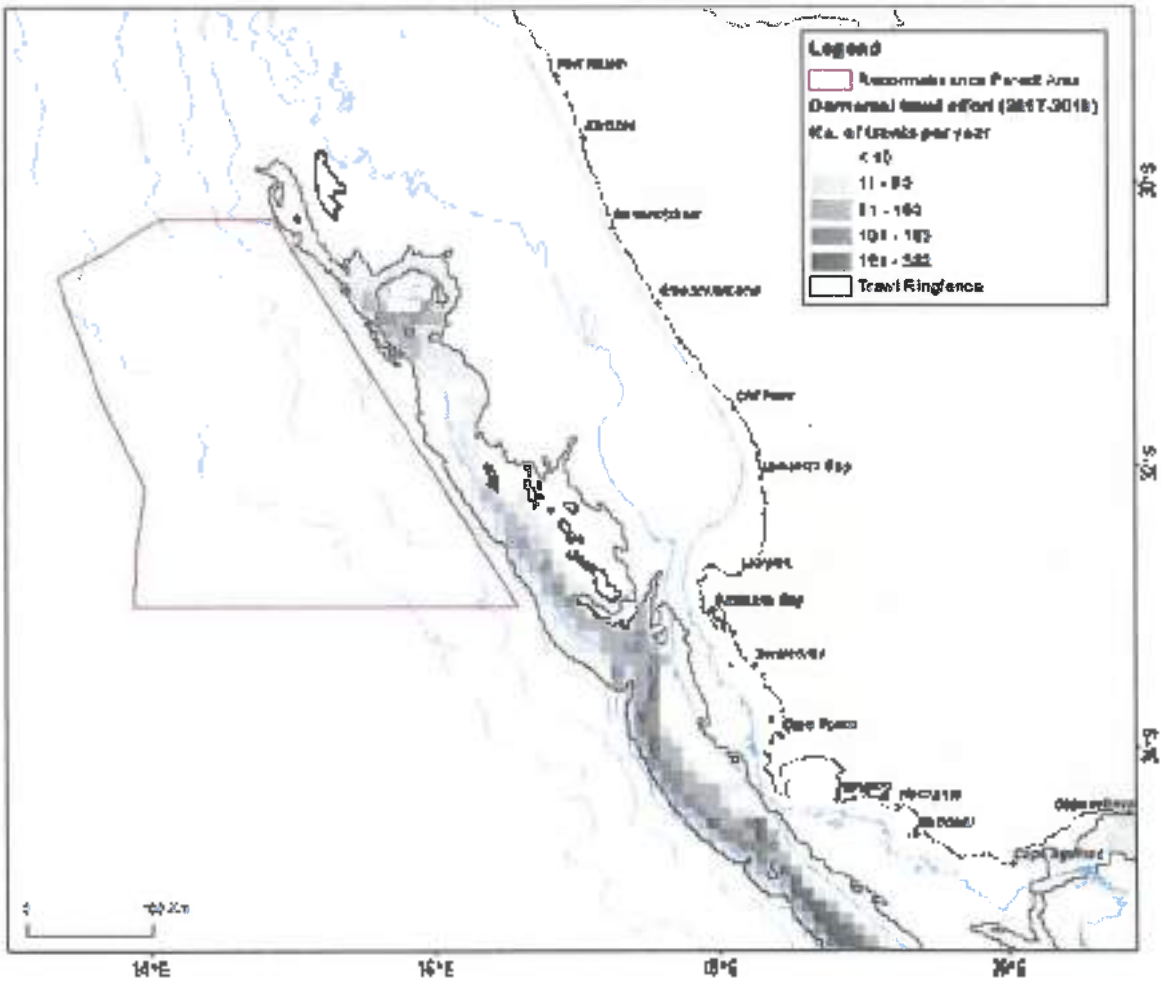

Figure 3.9: Overview of the trawl ringfence and the spatial distribution of fishing effort expended by the demersal trawl sector in relation the Reconnaissance Permit application area.

3.3.2 MIDWATER TRAWL

The midwater trawl fishery targets adult Cape horse mackerel (*Trachurus capensis*), which aggregate in highest concentration on the Agulhas Bank. Cape horse mackerel are semi-pelagic shoaling fish that occur on the continental shelf off southern Africa from southern Angola to the Wild Coast. Off South Africa, adult horse mackerel are currently more abundant off the South Coast than the West Coast. Horse mackerel yield a low-value product and are a source of cheap protein (DEFF, 2020).

This sector comprises six vessels and 34 rights holders which landed a total catch of 19 555 in 2019. Refer to Figure 3.10 for the catches and TACs for the midwater trawl fishery between 1996 and 2018. The fleet is split between dual rights holders who fish horse mackerel on hake-directed trawlers and

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others that combine their allocation on a single large midwater trawl vessel (the MFV *Desert Diamond* – refer to Figure 3.11). Dual rights holders fishing only occurs if horse mackerel availability is high when fishing for hake at which point that may switch from bottom trawl to midwater trawl. The amounts of horse mackerel caught by these vessels is a relatively small component of the horse mackerel TAC. Those horse mackerel rights holders that do not have hake rights or who do not have a suitable vessel to catch horse mackerel allow their share of the horse mackerel to be caught on a single large midwater trawler. This facilitates the economic use of a single large vessel that can more efficiently catch their horse mackerel allowing the vessels to fish year round. The area fished by this vessel is restricted largely (but not exclusively) to water deeper than 110 m or more than 20 nm from the coast and in an area east of Cape Point. The dual vessels may fish in a broader area, mostly on or near the hake fishing grounds.

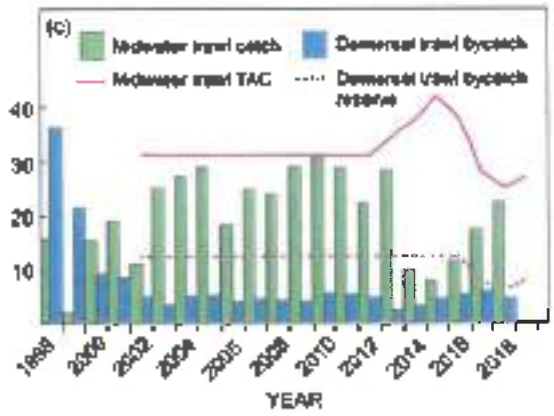

Figure 3.10: Trawl catches (tons, 1998 – 2018) split into the demersal and midwater trawl components. The midwater trawl TAC (solid line) and demersal trawl bycatch reserve (dashed line) are also shown (Source: DEFF, 2020).

Figure 3.11: Photograph of MFV Desert *Diamond* (midwater trawler).

Midwater trawl is defined in the Marine Living Resources Act (No. 18 of 1998) (MLRA) as any net which can be dragged by a fishing vessel along any depth between the seabed and the surface of the sea without continuously touching the bottom. In practice, midwater trawl gear does occasionally come into contact with the seafloor. Midwater trawling gear configuration is similar to that of demersal trawlers, except that the net is manoeuvred vertically through the water column (refer to Figure 3.12 for a schematic diagram of gear configuration). The towed gear may extend up to 1 km astern of the vessel and comprises trawl warps, net and cod end. Trawl warps are between 32 mm and 38 mm in diameter. The trawl doors (3.5 t each) maintain the net opening which ranges from 120 to 130 m in width and from 40 m to 80 m in height. Weights in front of, and along the ground-rope provide for vertical opening of the trawl. The cable transmitting acoustic signal from the net sounder might also provide a lifting force that maximizes the vertical trawl opening. To reduce the resistance of the gear and achieve a large opening, the front part of the trawls are usually made from very large rhombic or hexagonal meshes. The use of nearly parallel ropes instead of meshes in the front part is also a common design. Once the gear is deployed, the net is towed for several hours at a speed of 4.6 to 6.8 knots predominantly parallel with the shelf break.

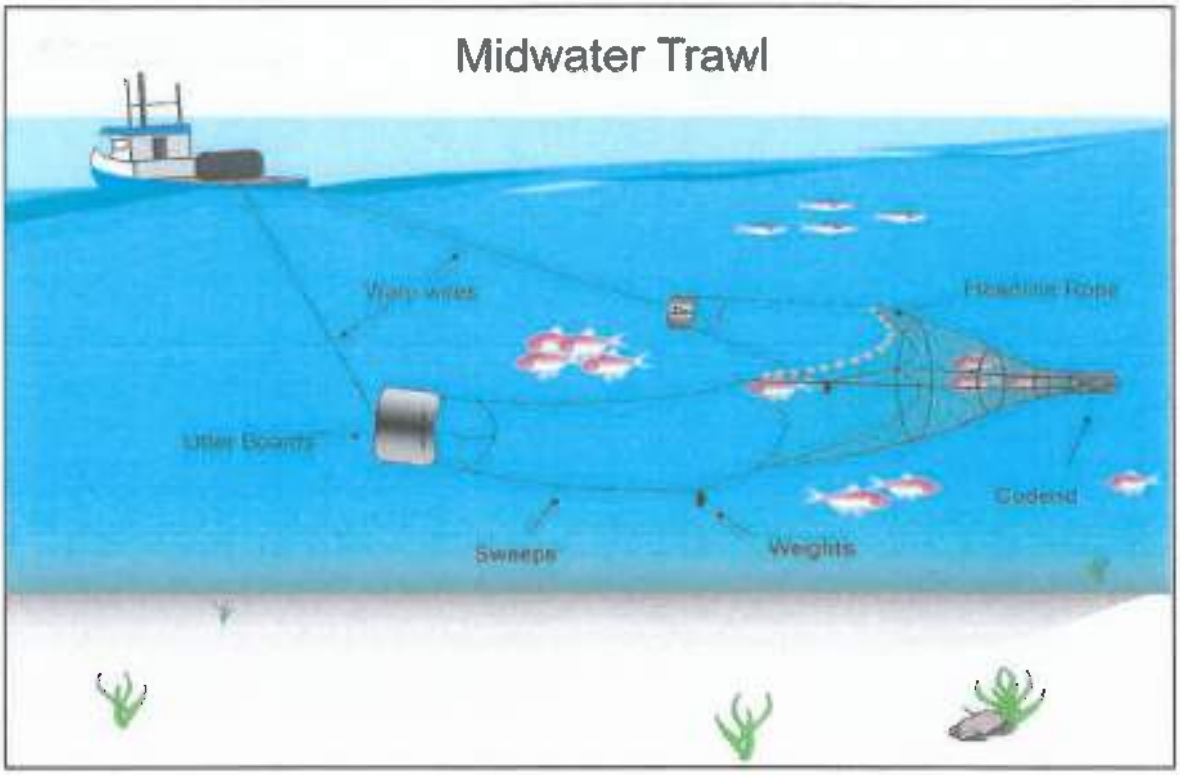

Figure 3.12: Schematic diagram showing the typical gear configuration of a midwater trawler
Source: www.afma.gov.au/fisheries-management/methods-and-gear/trawling

The fishery operates predominantly on the edge of the Agulhas Bank, where shoals are found in commercial abundance. Fishing grounds off the South Coast are situated along the shelf break and three dominant areas can be defined. The first lies between 22 °E and 23 °E at a distance of approximately 70 nm offshore from Mossel Bay and the second extends from 24 °E to 27 °E at a distance of approximately 30 nm offshore. The third area lies to the south of the Agulhas Bank 21 °E and 22 °E. These grounds range in depth from 100 m to 400 m and isolated trawls are occasionally recorded up to 650 m. Since 2017, DFFE has permitted experimental fishing to take place westward of 20°E.

Figure 3.13 shows the spatial extent of midwater trawls undertaken between 2017 and 2019 in relation to the Reconnaissance Permit application area. Sector activity off the West Coast takes place predominantly south of Cape Town at a depth range of between 120 m and 560 m. There is no overlap between midwater trawl grounds and the Reconnaissance Permit application area which is situated at least 30 km from the closest fishing location and 150 km from the main fishing areas.

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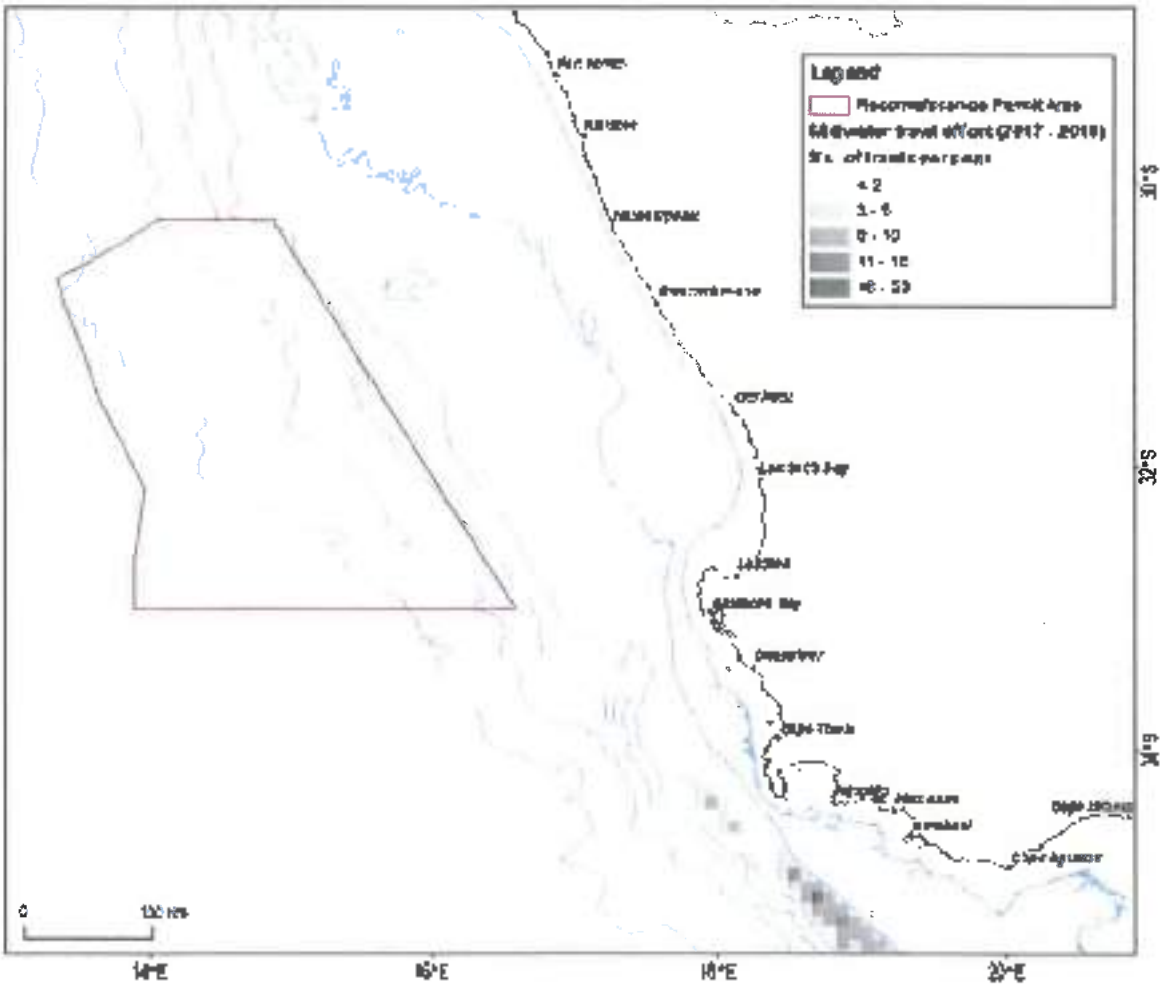


Figure 3.13: DFFE's catch reporting grid system and the spatial distribution of fishing effort expended by the midwater trawl sector in relation to the Reconnaissance Permit application area.

3.3.3 DEMERSAL HAKE LONGLINE

Like the demersal trawl fishery, the target species of the longline fishery is the Cape hakes, with a small non-targeted commercial by-catch that includes kingklip. In 2017, 8113 tons of catch was landed with a wholesale value of R319.2 Million, or 3.2% of the total value of all fisheries combined. Landings of 8 230 tons were reported in 2016. Refer to Table 3.3 for the landings of hake by the demersal longline fishery over the period 2010 to 2020.

A demersal longline vessel may deploy either a double or single line which is weighted along its length to keep it close to the seafloor. Steel anchors, of 40 kg to 60 kg, are placed at the ends of each line to anchor it, and are marked with an array of floats. If a double line system is used, top and bottom lines are connected by means of dropper lines. Since the top-line (polyethylene, 10 – 16 mm diameter) is more buoyant than the bottom line, it is raised off the seafloor and minimizes the risk of snagging or fouling. The purpose of the top-line is to aid in gear retrieval if the bottom line breaks at any point along the length of the line. Lines are typically between 10 km and 20 km in length, carrying between 6 900 and 15 600 hooks each. Baited hooks are attached to the bottom line at regular intervals (1 to 1.5 m) by means of a snood. Gear is usually set at night at a speed of between five and nine knots. Once

deployed the line is left to soak for up to eight hours before it is retrieved. A line hauler is used to retrieve gear (at a speed of approximately one knot) and can take six to ten hours to complete. A schematic representation of the gear configuration used by the demersal longline fleet is shown in Figure 3.14.

Currently 64 hake-directed vessels are active within the fishery, most of which operate from the harbours of Cape Town and Hout Bay. Fishing grounds are similar to those targeted by the hake-directed trawl fleet. The hake longline footprint extends down the west coast from approximately 150 km offshore of Port Nolloth (15°E, 29°S). It lies inshore to the south of St Helena Bay moving offshore once again as it skirts the Agulhas Bank to the south of the country (21°E, 37°S). Along the South Coast the footprint moves inshore again towards Mossel Bay. The eastern extent of the footprint lies at approximately (26°E, 34.5°S). Lines are set parallel to bathymetric contours, along the shelf edge up to the 1 000 m depth contour in places. The more patchy nature of effort in the north western extents of the footprint and the eastern edge of the Agulhas Bank may be attributed to proximity to fishing harbours. Fishing activity within the area occurs year-round with slightly lower levels during winter.

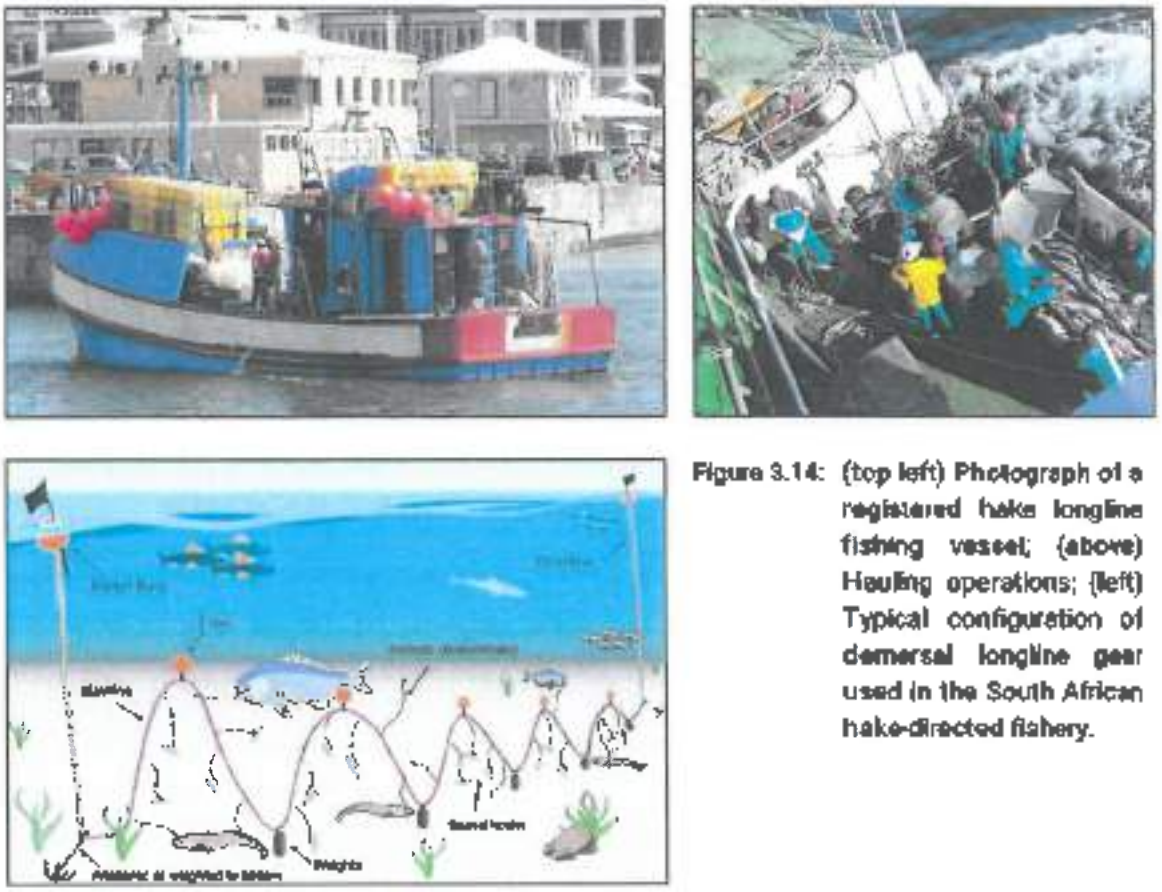


Figure 3.14: (top left) Photograph of a registered hake longline fishing vessel; (above) Hauling operations; (left) Typical configuration of demersal longline gear used in the South African hake-directed fishery.

Figure 3.15 shows the spatial distribution of demersal longline fishing areas in relation to the Reconnaissance Permit application area. Fishing effort takes place between the 100 m and 750 m bathymetric contours but the majority of effort takes place within the depth range 200 m to 650 m. There is no overlap between demersal hake-directed longline grounds and the Reconnaissance Permit application area, which is situated approximately 12 km offshore of the closest fishing locations.

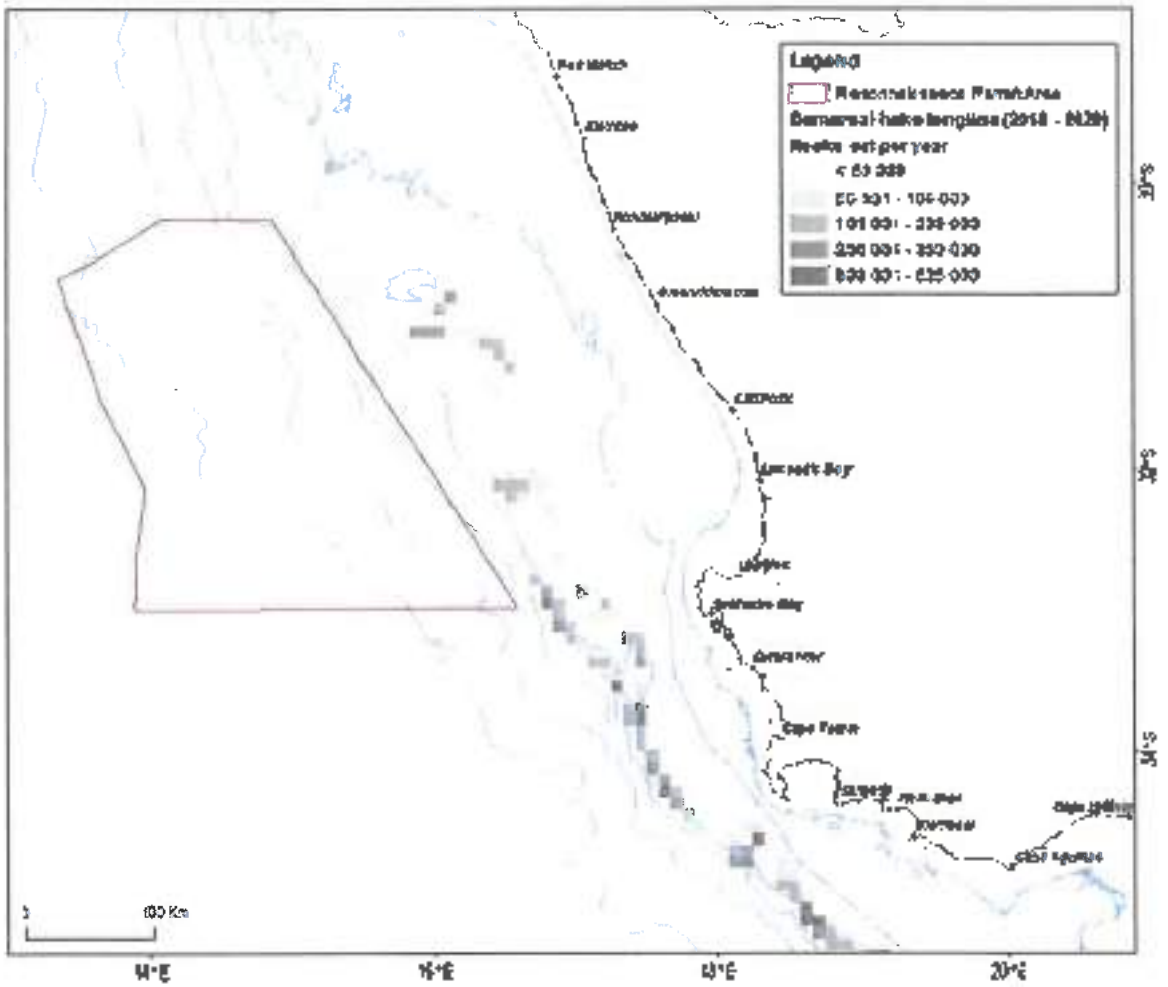


Figure 3.16: Spatial distribution of fishing effort expended by the hake-directed demersal longline sector in relation to the Reconnaissance Permit application area.

3.3.4 DEMERSAL SHARK LONGLINE

The shark longline sector formally commenced in 1991 when 30 permits were issued initially to target both demersal and pelagic sharks (pelagic sharks are those living in the water column, often occurring further offshore). In 2005 the dual targeting of demersal and pelagic sharks under the same permit was discontinued and the sector became an exclusive demersal shark longline fishery reduced to eleven Right Holders in 2004 and just six in 2006. The demersal shark longline fishery is permitted to operate in coastal waters from the Orange River on the West Coast to the Kei River on the East Coast, but fishing rarely takes place north of Table Bay. Vessels are typically <30 m in length and use nylon monofilament Lindgren Pitman spool systems to set weighted longlines baited with up to 2 000 hooks (average = 917 hooks). The fishery operates in waters generally shallower than 100 m, and uses bottom-set gear to target predominantly soupfin sharks and smoothhound sharks. Following an initial period of adjustment to catching and marketing demersal sharks, catches of soupfin and smoothhound sharks started increasing in 2006, and reporting became more reliable. As the majority of Right Holders own additional Rights in other fisheries, the number of active vessels fluctuates over the year but rarely exceeds four vessels operating at the same time. Annual landings have fluctuated widely due to variation in demand and price. Rights are due to be re-allocated during the fishing Rights allocation process in 2021/2022.

The commercial-scale exploitation of sharks began in the 1930s around traditional fishing villages in the Western Cape. This fishery used handlines and targeted inshore demersal sharks for their livers to be used in the production of Vitamin A oil. By the 1940s, catches of soupfin sharks had declined (Davies 1964) as targeting shifted. To date, this Western Cape soupfin fishery has not recovered to historical catch levels. To compensate for declining catch rates of high-value line fish species, a rapid increase was seen in shark catches between 1990 and 1993. After 2000, species-specific reporting came into effect and sharks continued to constitute a large proportion of the livelihood of these fishers around South Africa, with the establishment of a number of dedicated shark processing facilities. Shark catches by the line fishery since the 1990s have typically fluctuated in response to the availability of higher priced line fish species and market influences. Species targeted include soupfin sharks, smoothhound sharks, dusky sharks *Carcharhinus obscurus*, bronze whaler sharks *C. brachyurus*, and various skate species. Table 3.4 lists 2018 landings of the main demersal shark and skate species caught by line.

Table 3.5: Total catches per FAO area of demersal shark (2018).

Species	Catch by FAO Area (kg)			Total
	1.6	2.1	2.2	
Soupfin shark	7	2017	365	2389
Smoothhound shark	6	4244	5340	9591
Bronze shark	6	384	0	390
St. Joseph shark	0	112	33	144
Skate	0	145	444	589
Total	19	6902	6183	13103

Figure 3.16 shows the spatial distribution of shark-directed demersal longline catch between 2017 and 2019 in relation to the Reconnaissance Permit application area. Recent fishing activity shows effort occurs East of Cape Point, inshore of the 100 m depth contour and at least 230 km SE of the Reconnaissance Permit area at closest point. There is no overlap of the demersal longline sector with the Reconnaissance Permit area.

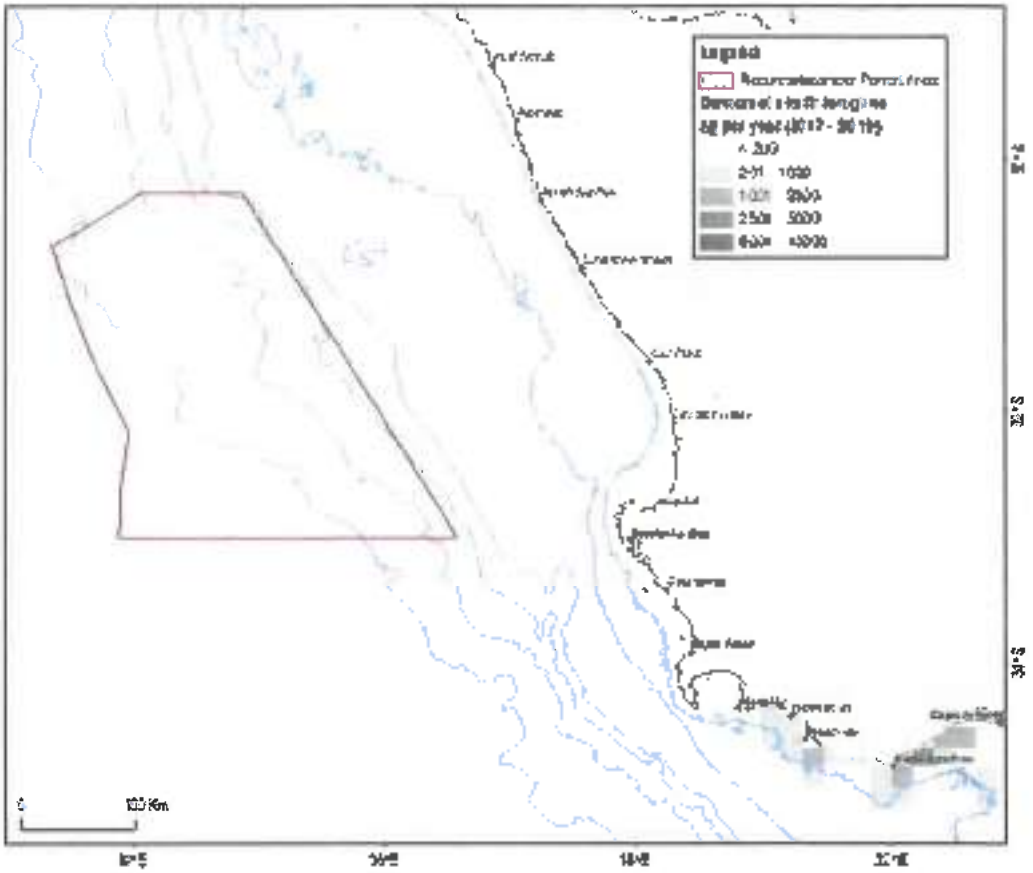


Figure 3.16: An overview of the spatial distribution of fishing effort expended by the shark-directed demersal longline sector in relation to the Reconnaissance Permit application area.

3.3.5 SMALL PELAGIC PURSE-SEINE

The pelagic-directed purse-seine fishery targets anchovy (*Engraulis encrasicolus*) and adult sardine (*Sardinops sagax*). Right Holders may also target round herring (*Etrumeus whiteheadi*) and meso pelagic species (Lantern and Lightfish combined) which have industry precautionary upper catch limits (PUCLs) – currently set at 100 000 t for round herring and 50 000 t for Lantern and Lightfish (combined). Bycatch species are mainly juvenile sardine, horse mackerel and chub mackerel. It is the largest South African fishery by volume (tons landed) and the second most important in terms of economic value. The wholesale value of catch landed by the sector during 2017 was R2.164 Billion, or 22% of the total value of all fisheries combined.

The total combined catch of anchovy, sardine and round herring landed by the pelagic fishery has decreased by 38% from 395 000 t in 2016 to just 243 000 t in 2021 (Figure 3.17). This is below both long-term (338 000 t) and short-term (294 000 t) averages.

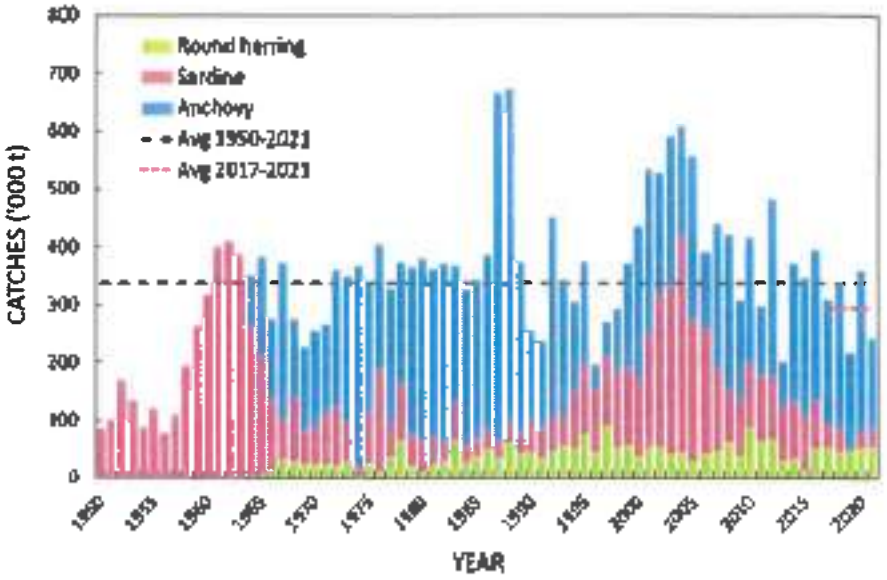


Figure 3.17: The annual combined catch of anchovy, sardine and round herring. Also shown is the average combined catch since the start of the fishery (1950-2021: black dashed line) and for the past five years (red solid line). Source DFFE, 2022.

The abundance and distribution of small pelagic species fluctuates considerably in accordance with the upwelling ecosystem in which they exist. Fish are targeted in inshore waters, primarily along the West and South Coasts of the Western Cape and the Eastern Cape coast, up to a maximum offshore distance of about 100 km.

The fleet consists of approximately 100 wooden, glass-reinforced plastic and steel-hulled vessels ranging in length from 11m to 48 m. The targeted species are surface-shoaling and once a shoal has been located the vessel will steam around it and encircle it with a large net, extending to a depth of 60 m to 90 m (Figure 3.18). Netting walls surround aggregated fish, preventing them from diving downwards. These are surface nets framed by lines: a float line on top and lead line at the bottom. Once the shoal has been encircled the net is pursed, hauled in and the fish pumped on board into the hold of the vessel. It is important to note that after the net is deployed, the vessel has no ability to manoeuvre until the net has been fully recovered on board and this may take up to 1.5 hours. Vessels usually operate overnight and return to offload their catch the following day.

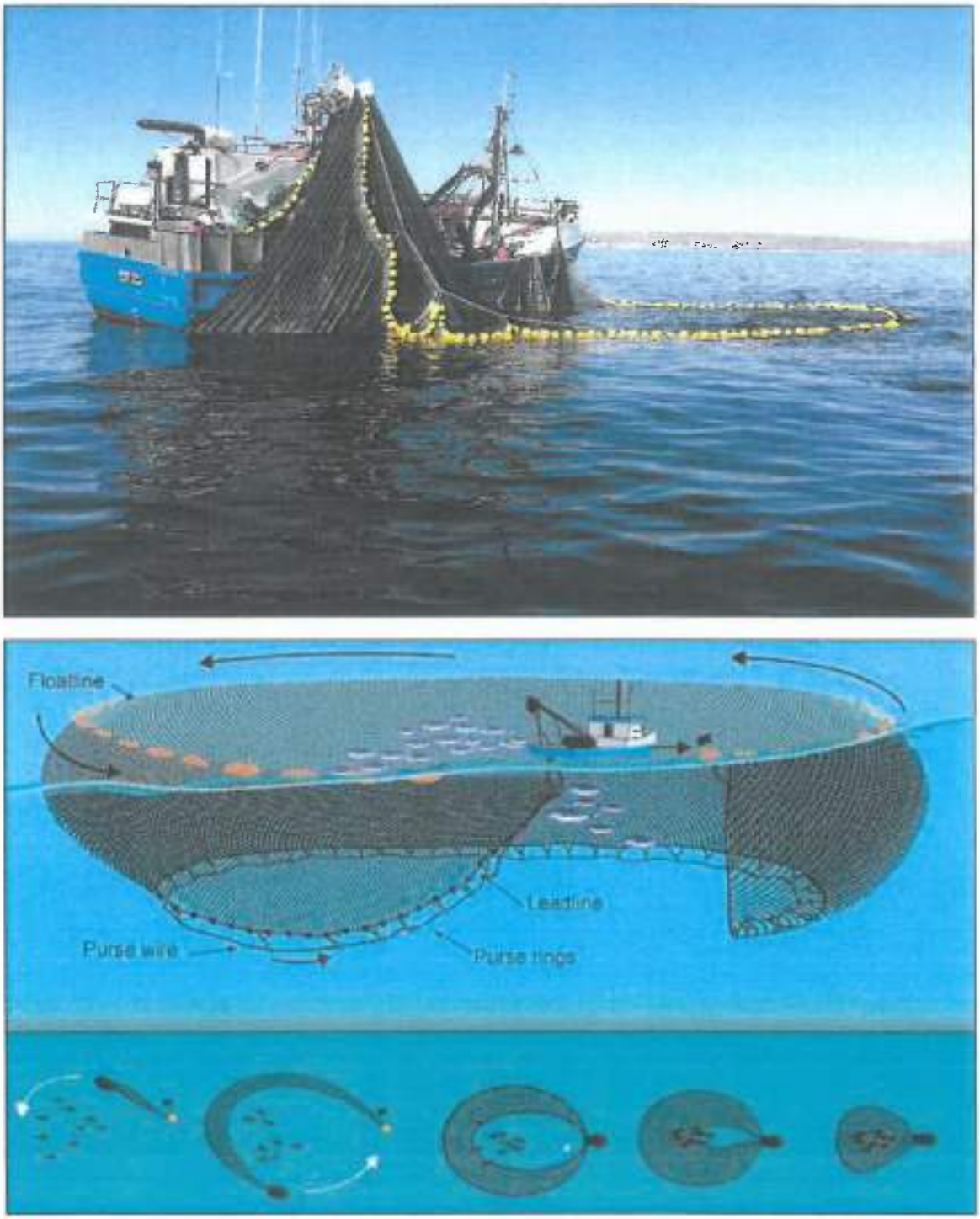


Figure 3.18: (Above) Photograph of a purse-seine vessel registered to fish for small pelagic species. (Below) Typical configuration and deployment of a small pelagic purse seine for targeting anchovy, sardine and round herring as used in South African waters. Source: http://www.afma.gov.au/portfolio-item/purse-seine

The majority of the fleet operate from St Helena Bay, Lasiplek, Saldanha Bay and Hout Bay with fewer vessels operating on the South Coast from the harbours of Gansbaai, Mossel Bay and Port Elizabeth. Ports of deployment correspond to the location of canning factories and fish reduction plants along the coast. The geographical distribution and intensity of the fishery is largely dependent on the seasonal

fluctuation and distribution of the targeted species. The sardine-directed fleet concentrates effort in a broad area extending from Lambert's Bay, southwards past Saldanha and Cape Town towards Cape Point and then eastwards along the coast to Mossel Bay and Port Elizabeth. The anchovy-directed fishery takes place predominantly on the South-West Coast from Lambert's Bay to Kleinbasi (19.5°E) and similarly the intensity of this fishery is dependent on fish availability and is most active in the period from March to September. Round herring (non-quota species) is targeted when available and specifically in the early part of the year (January to March) and is distributed from Lambert's Bay to south of Cape Point. This fishery may extend further offshore than the sardine and anchovy-directed fisheries. The catch and effort statistics for this sector are recorded by skippers on a grid block basis therefore the resolution of 10 by 10 nautical minutes.

The fishery operates throughout the year with a short seasonal break from mid-December to mid-January. Seasonality of catches is shown in Figure 3.19 with an increase in fishing effort and landings evident during the winter months.

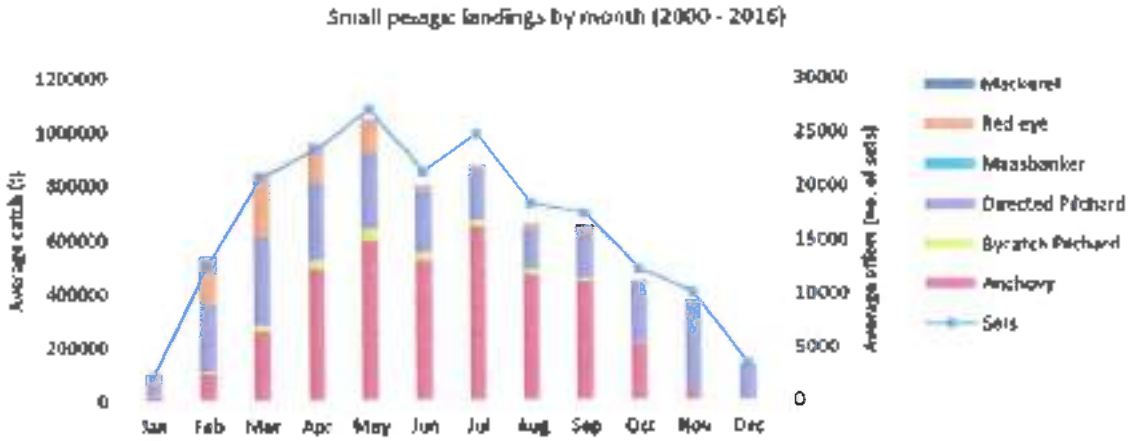


Figure 3.19: Graph showing monthly catch (tons) and effort (number of sets) reported for the small pelagic purse-seine fleet over the period 2000 to 2016 (cumulative).

Figure 3.20 shows the spatial extent of fishing grounds used by the sector over the period 2000 to 2016 in relation to the Reconnaissance Permit application area. The majority of fishing effort takes place in waters shallower than 200 m along the coastline of the Western Cape. Fishing grounds lie at least 60 km inshore of the Reconnaissance Permit application area and there is no overlap.

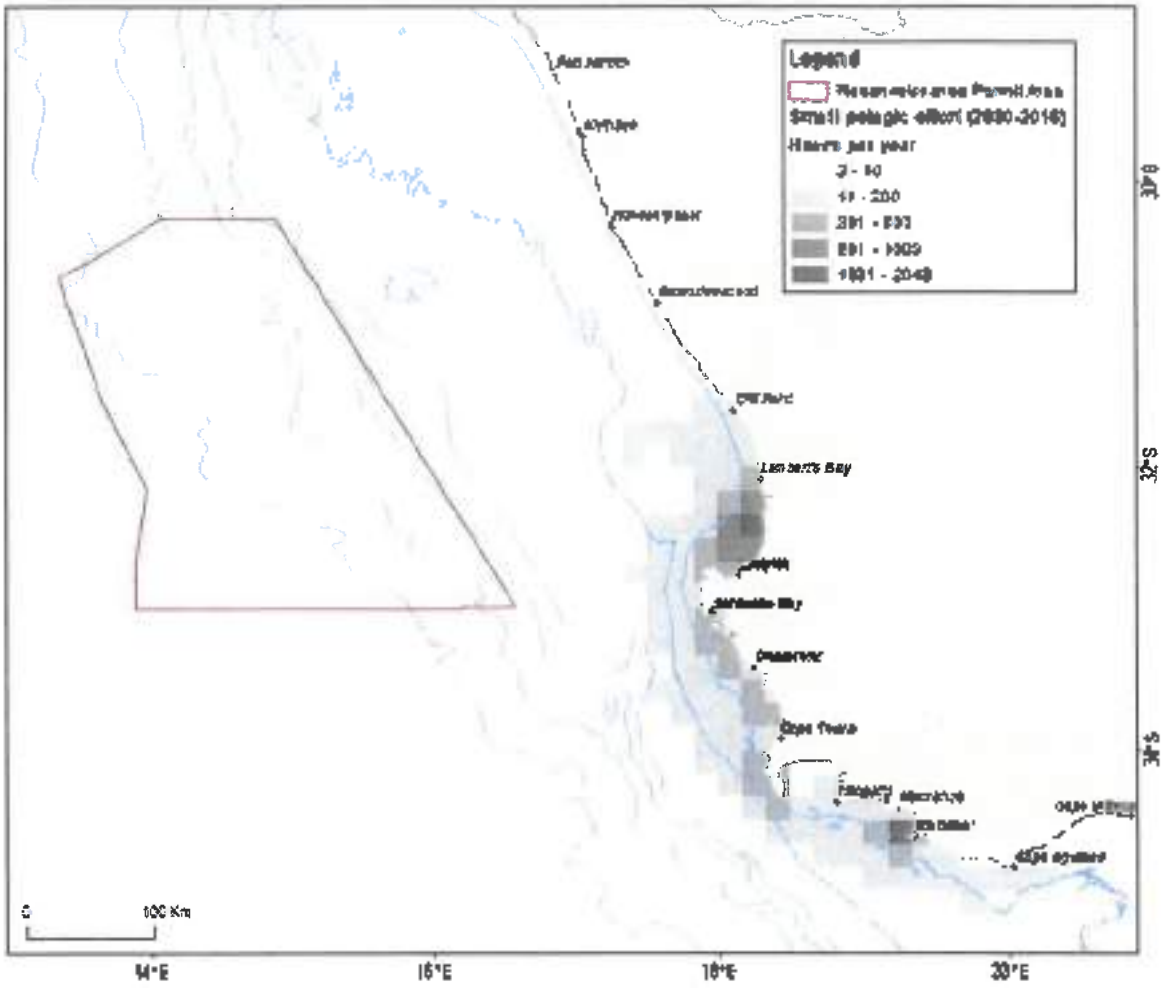


Figure 3.20: An overview of the spatial distribution of fishing effort recorded by the purse-seine sector targeting small pelagic species in in relation to the Reconnaissance Permit application area.

3.3.6 LARGE PELAGIC LONGLINE

Highly migratory tuna and tuna-like species are caught on the high seas and seasonally within the South African Exclusive Economic Zone (EEZ) by the pelagic longline and pole fisheries. Targeted species include albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*), yellowfin tuna (*T. albacares*) and swordfish (*Xiphias gladius*). The wholesale value of catch landed by the sector during 2017 was R154.2 Million, or 1.6% of the total value of all fisheries combined, with landings of 2541 tons (2017) and 2815 tons (2018). During the period 2000 to 2016, the sector landed an average catch of 4527 tons and set 3.55 million hooks per year. Catch and effort figures reported by the South African large pelagic longline fishery for the years 2000 to 2018 are shown in Figure 3.21. Catch by species and number of active vessels for each year from 2005 to 2018 are given in Table 3.5.

Catches landed by the South African fleet operating in the ICCAT region (i.e. off the West Coast) from 1998 – 2020 are shown in Figure 3.22.

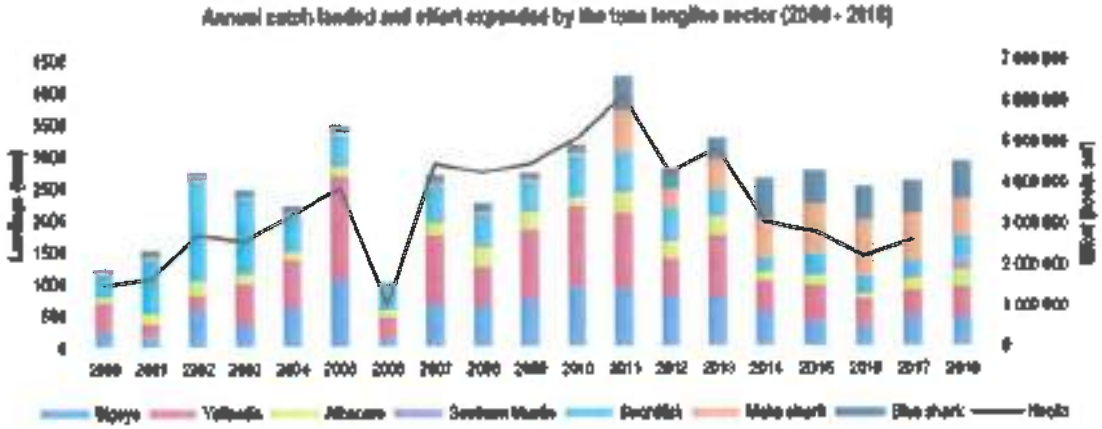


Figure 3.21: Inter-annual variation of catch landed and effort expended by the large pelagic longline sector in South African waters as reported to the two regional management organisations, ICCAT and IOTC (2000 - 2018).

Table 3.6: Total catch (t) and number of active domestic and foreign-flagged vessels targeting large pelagic species for the period 2005-2018 (Source: DEFF, 2019).

Year	Bigeye tuna	Yellowfin tuna	Albacore	Southern bluefin tuna	Swordfish	Shortfin mako shark	Blue shark	Number of active vessels	
								Domestic	Foreign-flagged
2005	1077	1608	189	27	408	700	225	13	12
2006	138	337	123	10	323	457	121	19	0
2007	677	1086	220	48	445	894	259	22	12
2008	640	630	340	49	398	471	283	15	13
2009	765	1096	309	30	378	631	286	19	9
2010	949	1262	165	34	528	691	312	19	9
2011	907	1182	339	49	584	646	642	16	15
2012	822	607	245	79	446	314	339	16	11
2013	882	1091	291	51	471	482	349	15	9
2014	544	486	114	31	229	610	573	16	4
2015	399	564	151	11	341	778	531	Fleets merged under SA flag with only a few foreign boats . up to 30 boats operating	
2016	315	439	85	18	275	883	528		
2017	497	400	172	47	246	726	523		
2018	478	478	238	208	313	613	582		

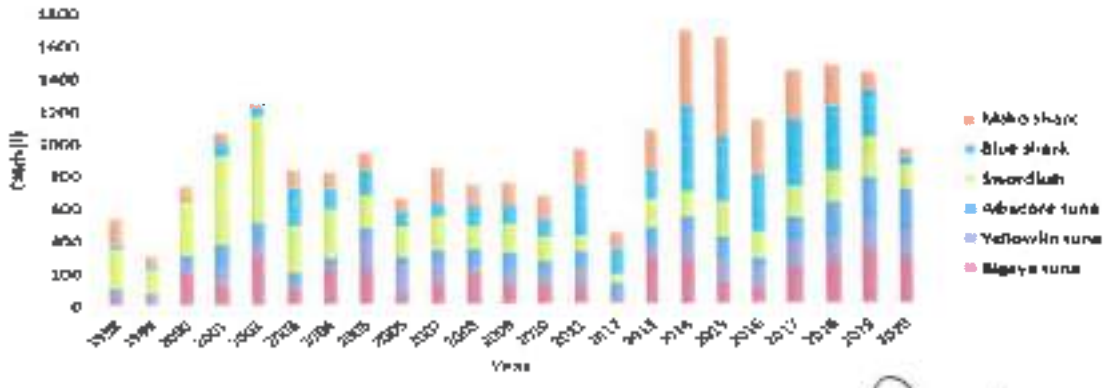


Figure 3.22: Inter-annual variation of catch landed by the large pelagic longline sector operating in the ICCAT region of South African waters (i.e. West of 20°E) (1998 – 2020).

Tuna, tuna-like species and billfishes are migratory stocks and are therefore managed as a "shared resource" amongst various countries under the jurisdiction of the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission (IOTC). In the 1970s to mid-1990s the fishery was exclusively operated by Asian fleets (up to 130 vessels) under bilateral agreements with South Africa. From the early 1990s these vessels were banned from South African waters and South Africa went through a period of low fishing activity as fishing rights issues were resolved. Thereafter a domestic fishery developed and 50 fishing rights were allocated to South Africans only. These rights holders now include a fleet of local longliners and several Japanese vessels fishing in joint ventures with South African companies. In 2017, 60 fishing rights were allocated for a period of 15 years. The total number of active longline vessels within South African waters is 22, 18 of which fished in the Atlantic (West of 20°E) during 2017. These were exclusively domestic vessels, with three Japanese vessels fishing exclusively in the Indian Ocean (East of 20°E) during 2017 (DAFF, 2018).

Gear consists of monofilament mainlines of between 25 km and 100 km in length which are suspended from surface buoys and marked at each end. As gear floats close to the water surface it would present a potential obstruction to surface navigation as well as a snagging risk to the gear array towed by the seismic survey vessel. The main fishing line is suspended about 20 m below the water surface via dropper lines connecting it to surface buoys at regular intervals. Up to 3500 baited hooks are attached to the mainline via 20 m long trace lines, targeting fish at a depth of 40 m below the surface. Various types of buoys are used in combinations to keep the mainline near the surface and locate it should the line be cut or break for any reason. Each end of the line is marked by a Dahn Buoy and radar reflector, which marks the line position for later retrieval. Typical configuration of set gear is shown in Figure 3.23 and Figure 3.24.

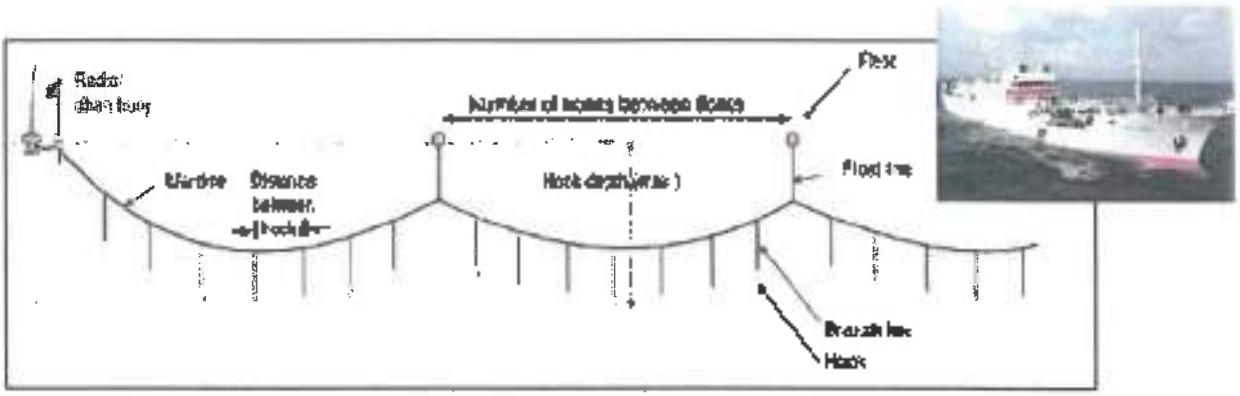


Figure 3.23: Schematic diagram showing typical configuration of longline gear targeting pelagic species (left), and photograph of typical high seas longline vessel (upper right).

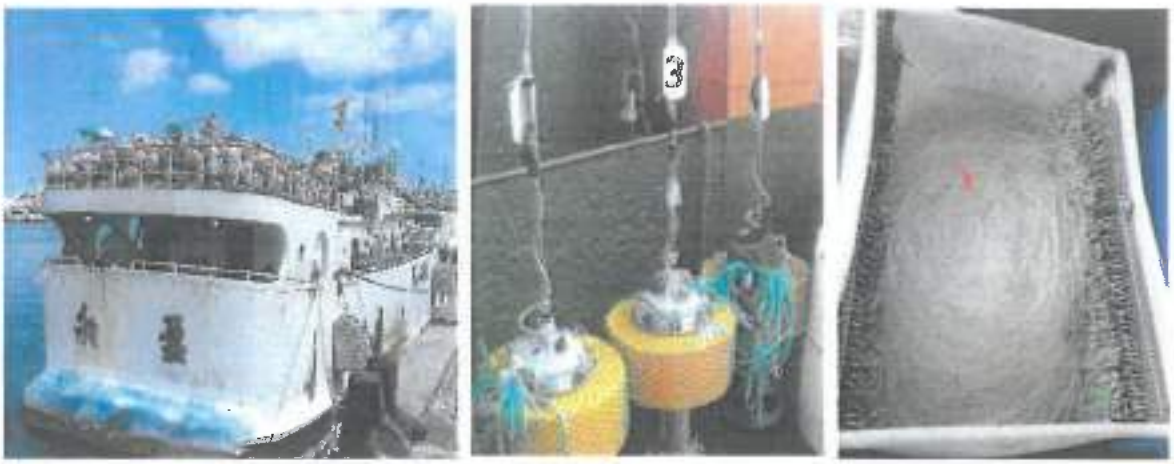


Figure 3.24: Photographs showing marker buoys (left), radio buoys (centre) and monofilament branch lines (right) (Source: CapMarine, 2015).

Lines are usually set at night, and may be left drifting for a considerable length of time before retrieval, which is done by means of a powered hauler at a speed of approximately one knot. During hauling, vessel manoeuvrability is severely restricted. In the event of an emergency, the line may be dropped and hauled in at a later stage.

The fishery operates year-round with a relative increase in effort during winter and spring. Catch per unit effort (CPUE) variations are driven both by the spatial and temporal distribution of the target species and by fishing gear specifications. Variability in environmental factors such as oceanic thermal structure and dissolved oxygen can lead to behavioural changes in the target species, which may in turn influence CPUE (Punsly and Nakano, 1992).

Fishing areas are subdivided into the SE Atlantic (reporting to ICCAT) and the SW Indian Ocean (reporting to IOTC) along 20°E, and the West, Southwest, South and East sampling areas are shown. Bubble size is proportional to the numbers of hooks set per line. CT, Cape Town; PE, Port Elizabeth; EL, East London; DBN, Durban; RB, Richards Bay.

The numbers of hooks set by foreign vessels peaked between May and October each year, whereas local vessels fished throughout the year, with marginally fewer hooks set in January and February than other months (Figure 3.25b). Foreign vessels ventured further southwards than local vessels, which tended to remain within the EEZ (Figure 3.26; Jordaan *et al.*, 2016).

Local vessels fish in all four areas, but in the East their range is limited to the northern half of the area, near a landing site at Richards Bay. Foreign vessels fished mainly in the SW Indian Ocean, with the bulk of all hooks set in the South (58%) and East (33%) areas, and the remaining 9% in the SE Atlantic (Figure 3.25b). Foreign vessels set an average of 2 493 ± 597 (SD) hooks per line, compared to only 1 282 ± 250 hooks per line used by local vessels.

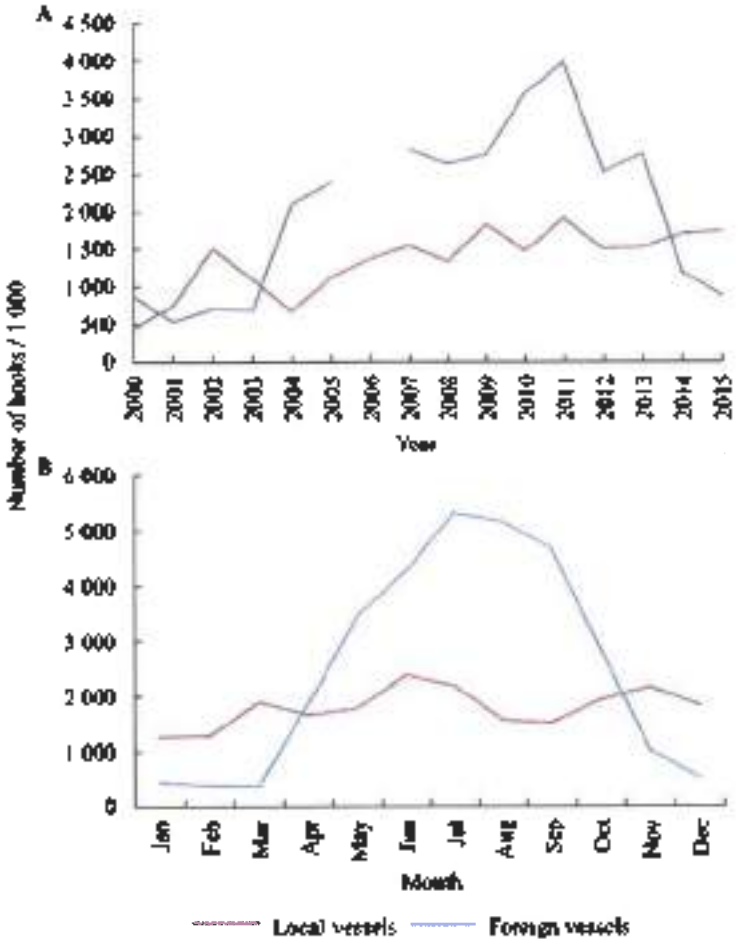


Figure 3.25: Numbers of hooks set per (A) year (2000–2015) and (B) per calendar month, as reported by local and foreign pelagic longliners fishing in the study area (Jordaan et al., 2018).

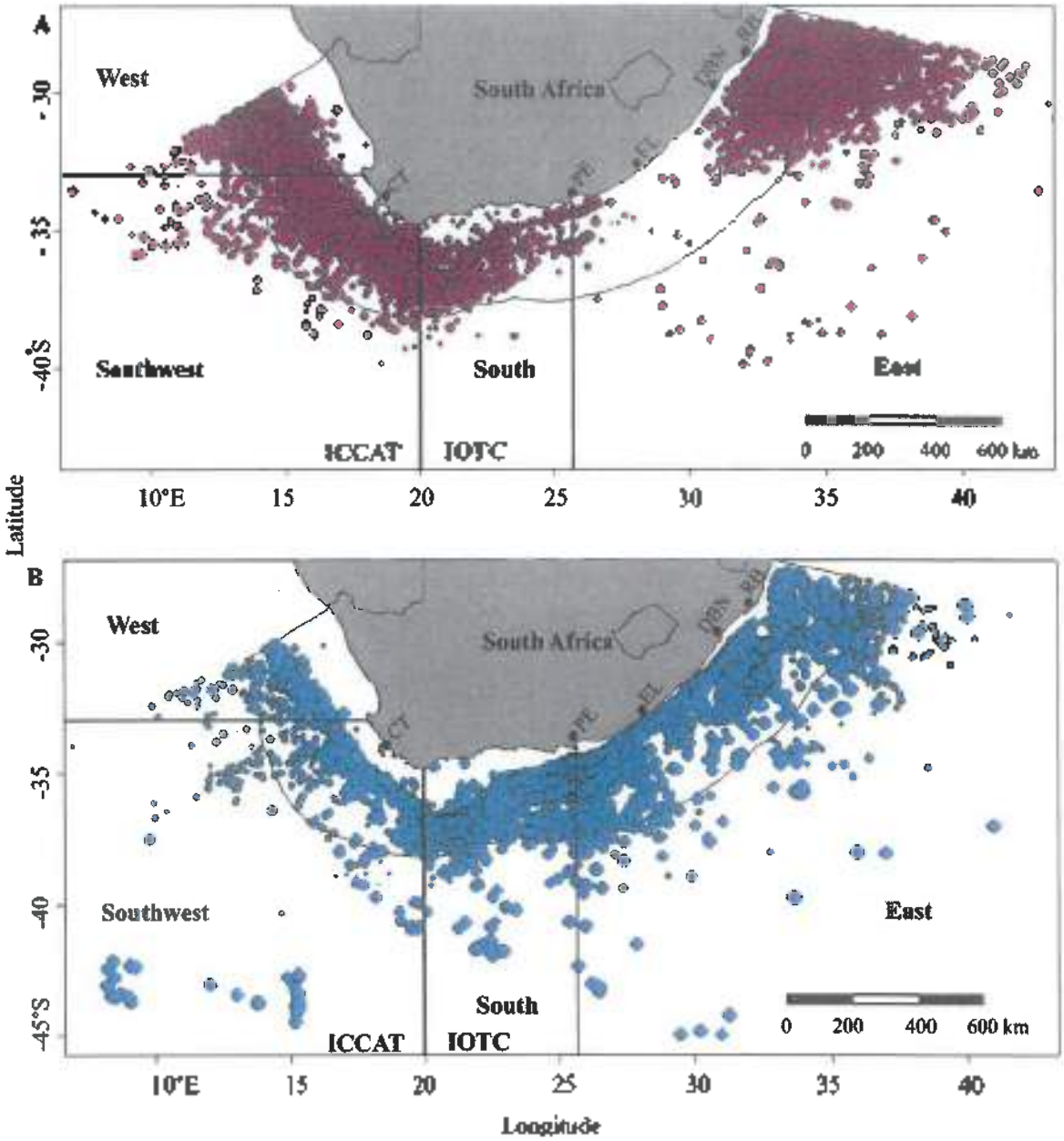


Figure 3.26: Geographical distribution of fishing effort by (A) local and (B) foreign pelagic longliners from 2000 to 2015, based on logbook data provided by vessel skippers (Jordaan *et al.*, 2018).

Rights Holders in the large pelagic longline fishery are required to complete daily logs of catches, specifying catch locations, number of hooks, time of setting and hauling, bait used, number and estimated weight of retained species, and data on bycatch. The fishery operates extensively within the South African EEZ, primarily along the continental shelf break and into deeper waters. The recent spatial distribution of catch (2017 to 2019) in relation to the Reconnaissance Permit area is shown in Figure 3.27. Over this period, an average of 423 lines per year were set within the area yielding 579 tons of catch. This is equivalent to 10.29% of the overall effort and 8.1% of the total catch reported by the sector at a national scale.

Pelagic longline fishing activity can be expected along the inshore extent of the Reconnaissance Permit area especially in the northern extent of the area. Lines of up to 100 km in length are set along the

continental shelf break, and are left to drift in surface currents for several hours before retrieval. They therefore cover a large area whilst they drift and pose a significant risk of entanglement with a towed seismic array.

Average monthly catch and effort within the Reconnaissance Permit area is shown in Figure 3.28. This shows that catch is highest during the months of Jun and July, associated with an increase in fishing effort by the sector.

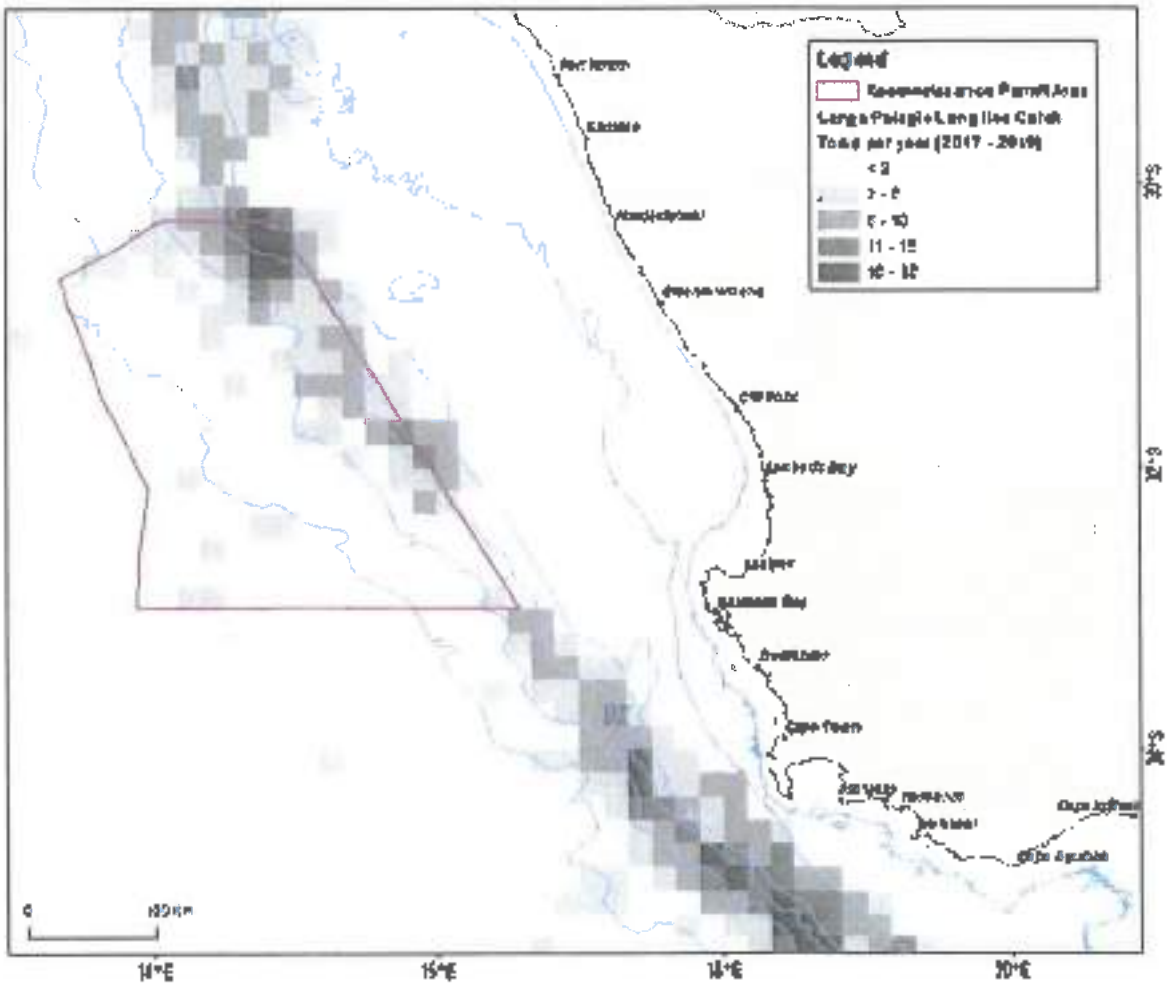


Figure 3.27: An overview of the spatial distribution of fishing effort expended by the longline sector targeting large pelagic fish species in relation to the Reconnaissance Permit application area.

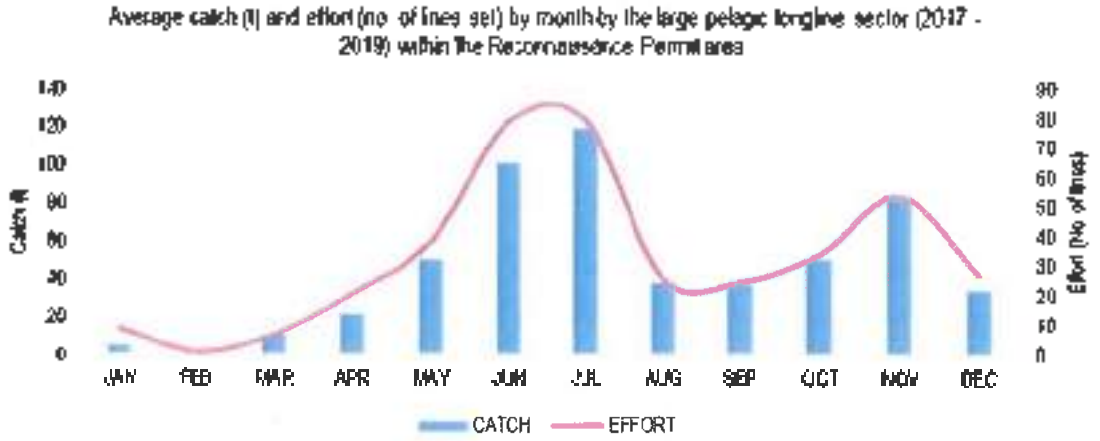


Figure 3.28: Average catch (t) and effort (no. of lines set) by month reported by the large pelagic longline sector in the vicinity of the Reconnaissance Licence area (2017-2019).

3.3.7 TUNA POLE-LINE

Poling for tuna is predominantly based on the southern Atlantic longfin tuna stock also referred to as albacore (*T. alalunga*). Other catch species include yellowfin tuna, bigeye tuna, skipjack tuna (*Katsuwonus pelamis*). The fishery is seasonal with vessels active predominantly between November and June and peak catches recorded from November to January. Due to the seasonality of tuna in South Africa's waters the tuna pole fishery is also allowed access to snoek (*Thyrsites atun*) and yellowtail (*Seriola lalandi*). Snoek-directed fishing activity is seasonal, taking place in coastal areas during the period March to July, with a peak in activity during the months of April and May. Access to these additional species has caused conflict with the traditional linefish sector.

The reported wholesale value of the fishery in 2018 was R124 Million in 2018, or 1.2% of the total value of all fisheries combined. In 2020, landings of albacore amounted to 3941 tons. A historical time series of catch and effort reported by the South African sector operating within the Atlantic region is shown in Table 3.6. The total effort of 4131 catch days within the ICCAT convention area in 2019 represents an increase in effort of 9% compared to 2018. The total reported annual pole fleet catch of the main target species albacore and yellowfin tuna showed for the first time relative increases since 2015 and 2014, respectively.

Table 3.7: Total number of fishing days (effort), active vessels and total catch (t) of the main species caught by South African-flagged tuna pole-line vessels in the ICCAT region (West of 20E), 2008 – 2020 (ICCAT, 2022).

	Total Effort		Catch (t)			
Year	Fishing days	Active vessels	Albacore	Yellowfin tuna	Bigeye tuna	Skipjack tuna
2008	3052	115	2083	347	8	4
2009	4431	123	4586	223	17	4
2010	4408	116	4087	177	8	1
2011	5001	118	3166	629	15	5
2012	5157	123	3483	162	12	8
2013	4114	107	3492	374	142	3
2014	4416	95	3620	1351	50	5
2015	4738	91	3898	885	57	2

2016	4908	98	2001	599	10	2
2017	3062	92	1640	235	22	7
2018	3751	92	2353	242	14	2
2019	4131	93	2190	378	91	2
2020	3975	97	3941	534	71	1

The active fleet consists of approximately 92 pole-and-line vessels (also referred to as "baitboat"), which are based at the ports of Cape Town, Hout Bay and Saldanha Bay. Vessels normally operate within a 100 nm radius of these locations with effort concentrated in the Cape Canyon area (South-West of Cape Point), and up the West Coast to the Namibian border with South Africa.

Vessels are typically small (an average length of 16 m but ranging up to 25 m). Catch is stored on ice, refrigerated sea water or frozen at sea and the storage method often determines the range of the vessel. Trip durations average between four and five days, depending on catch rates and the distance of the fishing grounds from port. Vessels drift whilst attracting and catching shoals of pelagic tunas. Sonars and echo sounders are used to locate schools of tuna. Once a school is located, water is sprayed outwards from high-pressure nozzles to simulate small baitfish aggregating near the water surface. Live bait is then used to entice the tuna to the surface (chumming). Tuna swimming near the surface are caught with hand-held fishing poles. The ends of the poles are fitted with a short length of fishing line leading to a hook. In order to land heavier fish, lines may be strung from the ends of the poles to overhead blocks to increase lifting power (see Figure 3.30).

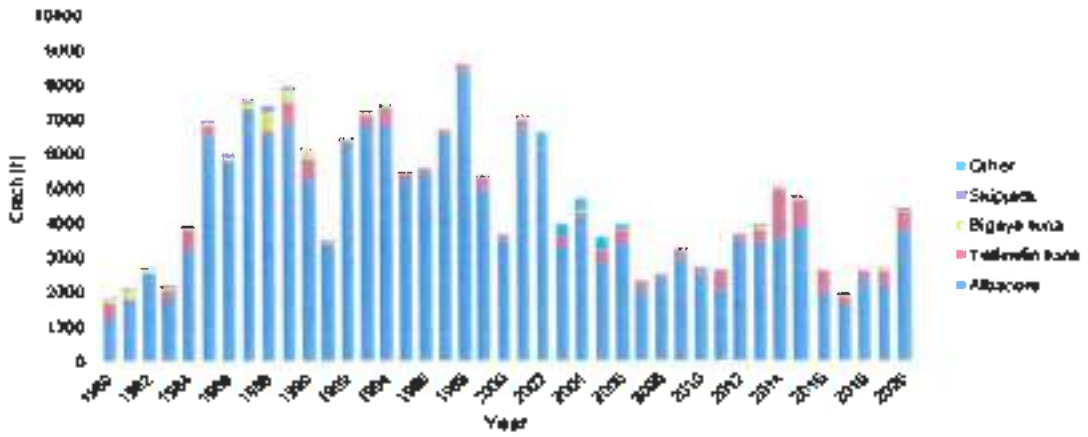


Figure 3.29: Catches (tons) of pelagic species by the South Africa pole-line ("Baitboat") fleet between 1980 and 2020 (ICCAT, 2022).

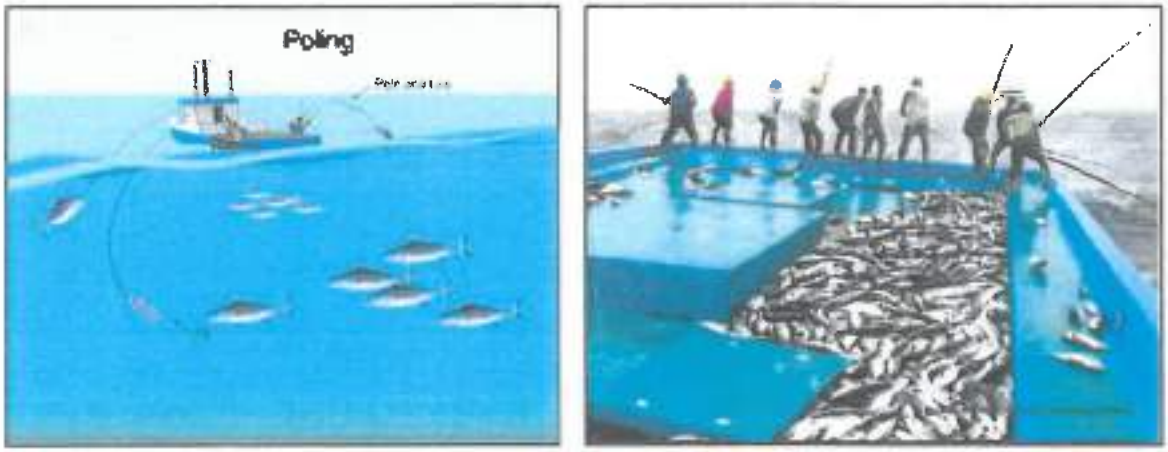


Figure 3.30: Schematic diagram of pole and line operation (Source: http://www.afma.gov.au/portfolio-item/minor-lines).

The nature of the fishery and communication between vessels often results in a large number of vessels operating in close proximity to each other at a time. The vessels fish predominantly during daylight hours and are highly manoeuvrable. However, at night in fair weather conditions the fleet of vessels may drift or deploy drogues to remain within an area and would be less responsive during these periods.

Figure 3.31 shows the location of fishing activity in relation to Reconnaissance Permit application area. Fishing activity for tuna occurs along the entire West Coast beyond the 200 m bathymetric contour, along the shelf break with favoured fishing grounds including areas north of Cape Columbine and between 60 km and 120 km offshore of Saldanha Bay. Fishing records received from DFFE for the reporting period 2017 to 2019 show that tuna-directed fishing takes place inshore of the Reconnaissance Permit application area within minimal activity within the area itself. An average of 24 fishing events per year were set within the area yielding 25 tons of albacore (although it is likely that some of this activity may be errors in the reporting of fishing positions and the likelihood of fishing activity within the area is considered to be low). The catch and effort within the area is equivalent to 0.87% and 0.95%, respectively, of the overall catch and effort reported by the sector at a national scale.

Albacore-directed fishing activity within deeper waters adjacent to the Reconnaissance Permit area shows a peak during February and March (see Figure 3.32). Snoek-directed fishing activity is coastal and seasonal in nature – taking place inshore of the 100 m depth contour during the period March to July, with a peak in activity during the months of April and May. Snoek-directed fishing activity is situated at least 140 km inshore of the application area and there is therefore no overlap of the survey expected with snoek-directed fishing activity.

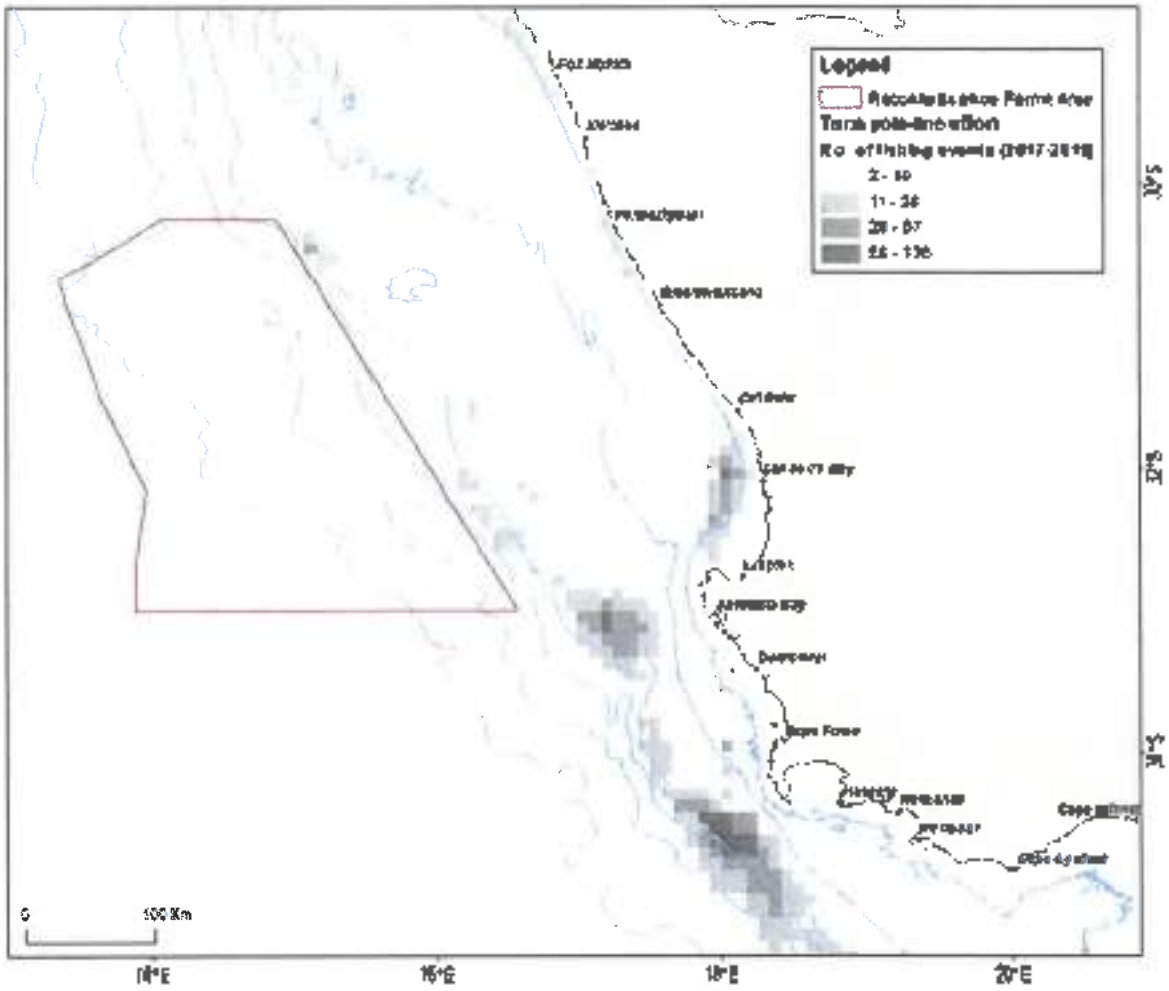


Figure 3.31: An overview of the spatial distribution of fishing effort expended by the pole- line sector targeting pelagic tuna (offshore areas) and snoek (inshore areas) in relation to the Reconnaissance Permit application area.

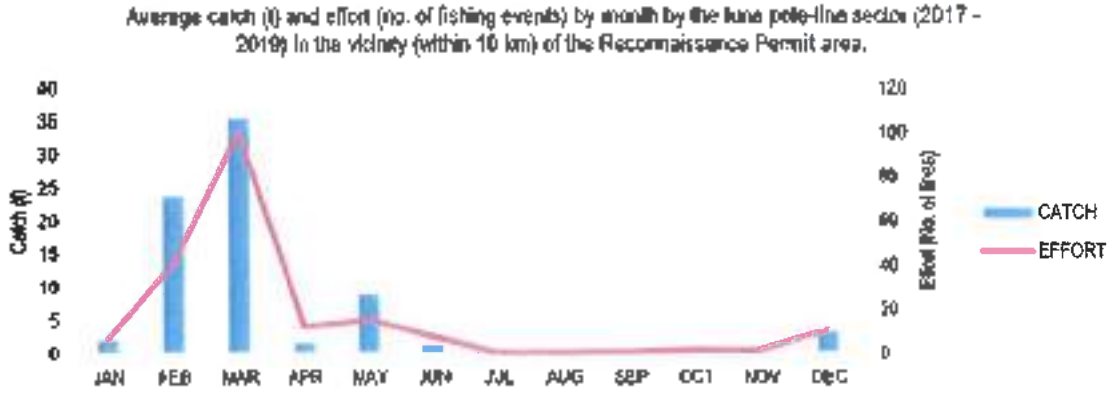


Figure 3.32: Average catch (t) and effort (no. of fishing events) by month reported by the tuna pole-line sector in the vicinity (within 10 km) of the Reconnaissance Licence area (2017-2019).

3.3.8 TRADITIONAL LINEFISH

The commercial linefish sector has its origins from the recreational sector. Essentially recreational linefishers commercialised resulting in a systematic decline in the "linefish" stocks. The Minister of Fisheries in the 1980's reformed the sector. This was done by creating a small commercial linefish sector, as well as introducing a moratorium on exploiting many species that were collapsed or near collapse. The commercial linefish sector now only allows a limited number of key species to be exploited.

Of all South African marine fisheries, the linefishery is the most vulnerable to external impacts. Linefish recources are at risk of overcapacity as they area directly or indirectly exploited by other sectors, including the recreational, small-scale linefishery, inshore and offshore trawl fisheries, tuna pole-line fishery, the inshore netfishery and the demersal shark longline fishery (DEFF, 2020). The increased expectation of commercial access to linefish resources combined with the localised anticipation of community ownership by small-scale fishers may impact linefish stocks.

The traditional linefishery is the country's third most important fishery in terms of tonnage landed and economic value. It is a long-standing, nearshore fishery based on a large assemblage of different species using hook and line, but excludes the use of longlines. Within the Western Cape the predominant catch species is snoek (*Thyrsites atun*) while other species such as Cape bream (hottentot) (*Pachymetopon blochii*), geelbek (*Atractoscion aequidens*), kob (*Argyrosomus japonicus*) and yellowtail (*Seriola lalandi*) are also important. Towards the East Coast the number of catch species increases and includes resident reef fish (Sparidae and Serranidae), pelagic migrants (Carangidae and Scombridae) and demersal migrants (Sciaenidae and Sparidae). Table 3.7 lists the catch of important linefish species for the years 2010 to 2022.

Figure 3.33 shows the variability in catches of the eight most importance species by the linefishery over the period 1985 to 2021.

Table 3.7: Annual catch (t) of the eight most important linefish species for the period 2010 to 2021 (DEFF, 2022).

Year	Snoek	Yellowtail	Kob	Carpenter	Slinger	Hottentot seabream	Geelbek	Santer	Total catch
2010	6760	171	419	263	190	144	408	69	12648
2011	6205	204	332	363	214	216	286	67	12510
2012	6809	382	223	300	149	160	337	82	11855
2013	6690	212	157	481	209	173	263	84	9142
2014	3859	986	144	522	201	197	212	74	6849
2015	2045	594	121	519	175	142	238	68	4421
2016	1643	474	133	690	211	209	246	65	4289
2017	2055	377	111	844	218	204	158	74	4991
2018	2089	654	213	723	173	213	214	68	5304
2019	1679	439	454	604	215	186	132	78	N/A*
2020	1956	548	695	534	189	222	158	66	N/A*
2021	2747	289	352	441	196	151	88	64	N/A*

*total catches unavailable at date of this report

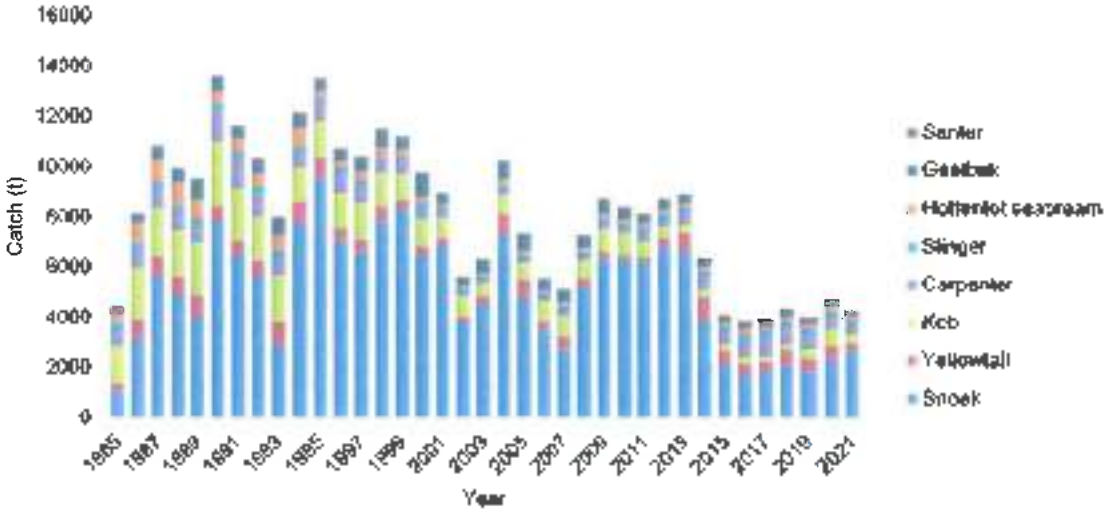


Figure 3.33: Annual catch (t) of the eight most important linefish species for the period 1985-2021 (DFFE, 2022).

The traditional commercial line fishery is a relatively low-cost and labour-intensive industry, therefore important from an employment and human livelihood point of view. Although the commercial linefishery has the largest fleet, it contributes only 6% of the total estimated value of all South African marine fisheries (DFFE, 2020). In 2017, the wholesale value of catch was reported as R122.1 million.

The commercial line fishery is a nearshore boat-based activity which is currently managed through a total allowable effort (TAE) allocation, based on boat and crew numbers. Since December 2000 it has consisted of 3450 crew operating from 455 commercial vessels. The number of rights holders is 425 (valid rights until 31 December 2020 and subsequently extended until 31 December 2021[2]). For the 2019/2020 fishing season, 395 vessels and 3007 crew was apportioned to commercial fishing, whilst 60 vessels and 443 crew was apportioned to small-scale fishing (refer to Section 3.3.10). DFFE proposed an increase in the apportionment of TAE to small-scale fishing from 13% to 50% commencing in 2021 in order to boost economic possibilities for coastal communities.

Annual catches prior to the reduction of the commercial effort were estimated at 16 000 tons for the traditional commercial line fishery. Almost all of the traditional line fish catch is consumed locally. The fishery is widespread along the country's shoreline from Port Nolloth on the West Coast to Cape Vidal on the East Coast. Effort is managed geographically with the spatial effort of the fishery divided into three zones. Zone A extends from Port Nolloth to Cape Infanta, Zone B extends from Cape Infanta to Port St Johns and Zone C covers the KwaZulu-Natal region.

Table 3.8 lists the annual Total Allowable Effort (TAE) and activated effort per line fish management zone from 2007 to 2019. Most of the catch (up to 95%) is landed by the Cape commercial fishery, which operates on the continental shelf from the Namibian border on the West Coast to the Kei River in the Eastern Cape.

[2] Extension to existing rights until DFFE has concluded a Fishing Rights Allocations Process ('FRAP') which, at the time of this report, is still underway.

Table 3.8: Annual total allowable effort (TAE) and activated commercial line fish effort per management zone from 2008 to 2019 (DEFF, 2020).

Total TAE boats (fishers). Upper limit: 455 boats or 3450 crew			Zone A: Port Nolloth to Cape Infanta		Zone B: Cape Infanta to Port St Johns		Zone C: KwaZulu-Natal	
Allocation	455 (3182)		301 (2130)		103 (692)		51 (354)	
Year	Allocated	Activated	Allocated	Activated	Allocated	Activated	Allocated	Activated
2008	455	372	301	239	103	82	51	51
2009	455	344	300	227	103	78	52	44
2010	455	335	298	210	105	82	53	43
2011	455	328	298	207	105	75	53	46
2012	455	296	298	193	105	61	53	42
2013	455	289	301	189	103	62	51	38
2014**	455	399	340	293	64	58	51	48
2015**	455	356	340	291	64	61	51	45
2016**	455	278	340	274	64	59	51	45
2017**	455	329	340	232	64	60	51	37
2018**	455	324	340	232	64	50	51	42
2019**	455	306	340	218	64	50	51	38

** In the finalisation of the 2013 commercial Traditional Linefish appeals, the effort apportioned for the small-scale fisheries sector was allocated to the commercial sector. All the small-scale rights were considered to be activated on allocation

Crew use hand line or rod-and-reel to target approximately 200 species of marine fish along the full 3 000 km coastline, of which 50 species may be regarded as economically important. To distinguish between line fishing and long lining, line fishers are restricted to a maximum of 10 hooks per line. Target species include resident reef-fish, coastal migrants and nomadic species. Many species allocated to the small-scale fisheries "baskets" are primary targets of the commercial and recreational linefish sectors, and these shared resources must be carefully monitored given the increased fishing pressure expected. A revision of the linefish management protocol (LMP) is also underway to ensure the future sustainability of linefish stocks.

Vessels range in length between 4.5 m and 11 m and the offshore operational range is restricted by vessel category to 40 nautical miles (75 km). Fishing effort at this outer limit is sporadic. Operating ranges vary greatly but most of the activity is conducted within 15 km of a launch site. Fishing takes place throughout the year but there is some seasonality in catches.

Snoek is an important linefish species as it makes up the largest annual catch in terms of biomass, contributing more than 80% to the total catch west of Cape Infanta. Snoek spawning occurs offshore during winter-spring, along the shelf break (150-400 m) of the western Agulhas Bank and the South African west coast. Prevailing currents transport eggs and larvae to a primary nursery ground north of Cape Columbine and to a secondary nursery area to the east of Danger Point; both shallower than 150 m. Juveniles remain on the nursery grounds until maturity, growing to between 33 and 44 cm in the first year (3.25 cm/month). Onshore-offshore distribution (between 5- and 150-m isobaths) of juveniles is determined largely by prey availability and includes a seasonal inshore migration in autumn in response to clupeoid recruitment. Adults are found throughout the distribution range of the species, and although they move offshore to spawn - there is some southward dispersion as the spawning season progresses - longshore movement is apparently random and without a seasonal basis (Griffiths, 2002). Snoek are caught within the inshore zone along most of the South African coastline with the majority of catches being made along the West and South-West Coast of South Africa. Although snoek can be caught year-round, during the snoek seasonal migration (between April and July) when they shoal nearshore, they are caught more frequently using handlines by the linefishery. Snoek are not distributed offshore of the 1000 m depth contour and therefore not targeted or caught by the commercial linefishery in the Reconnaissance Permit area.

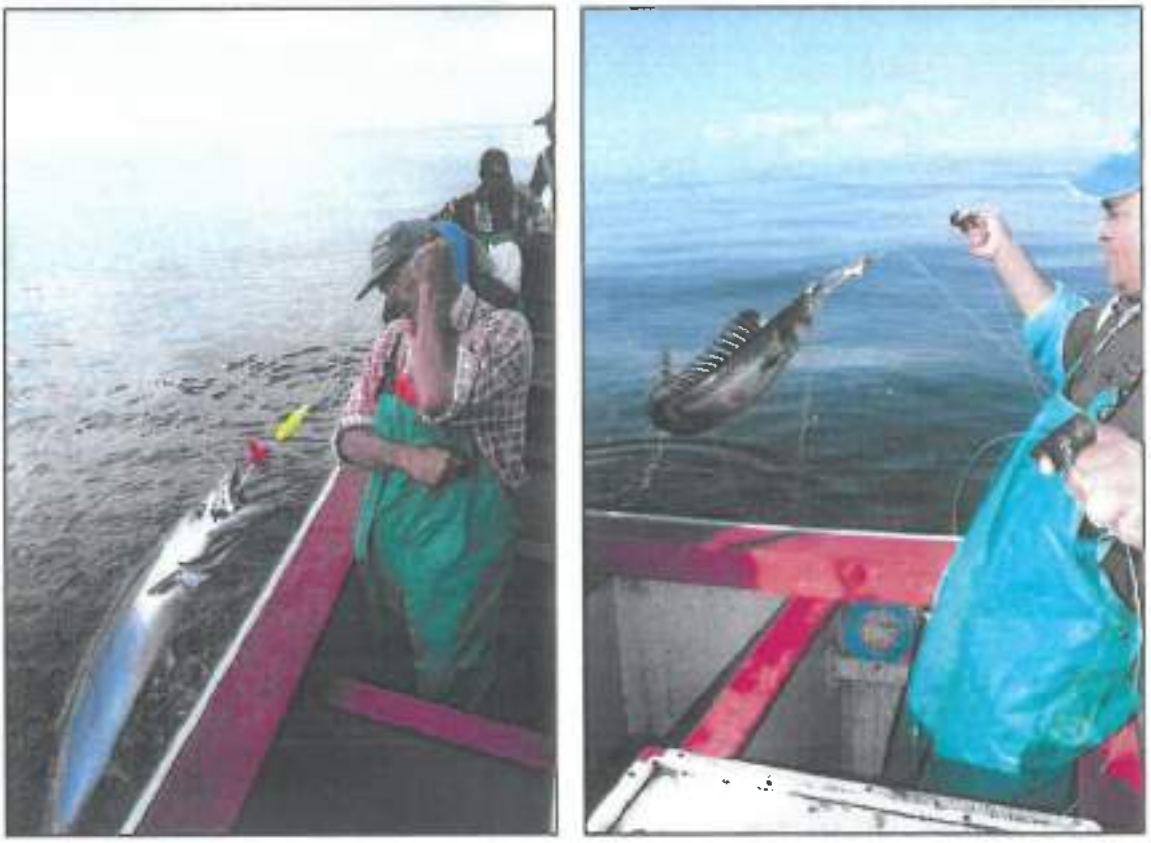


Figure 3.34: Fishermen landing snoek on board a vessel operating in the traditional linefishery (photo credit Jaco Barendse).

Spatial mapping of effort and catches in the line fishery is less accurate than in other sectors because of the reporting structure implemented by DFFE. Fishing locations are described by skippers in relation to numbered sections along the coast and estimated distance offshore. No bearings are given, and no GPS data are recorded. Furthermore, due to the large number of vessels, associated reporting complexities and also the unwillingness of local fisherman to share fishing locations, inaccuracies in the spatial representation are to be expected[3]. This fishery's operational footprint may at times be limited by operating costs and is sensitive to local reports of fish availability. Further, in regard to migratory species, such as longfin tuna and snoek, economic and regulatory aspects relating to distances fished offshore is pertinent (i.e. such as the requirements of the South African Maritime Safety Authority (SAMSA)) in particular that "B" class certified vessels can operate up to 40 nm offshore.

Figure 3.35 shows the spatial extent of traditional linefish grounds in relation to the Reconnaissance Permit application area. Snoek-directed fishing effort is coastal, with vessels operating in waters shallower than 100 m. However, there are records of fishing up to an offshore distance of 55 km off Saldanha Bay where tuna are targeted in the vicinity of Cape Canyon. Note that small-scale fishers are not permitted to target tuna (i.e. the species is not part of the basket allocation), thus would not be

[3] Inaccuracies in reported fishing positions are unlikely to impact on the validity of the current assessment as a precautionary approach has already been adopted in assessing the maximum range of fishing grounds offshore with respect to the Reconnaissance Permit application area.

expected to operate at the Cape Canyon. There is no overlap of fishing grounds with the Reconnaissance Permit application area, which is situated at least 120 km offshore and at least 100 km from fishing grounds targeted by the linefish sector.

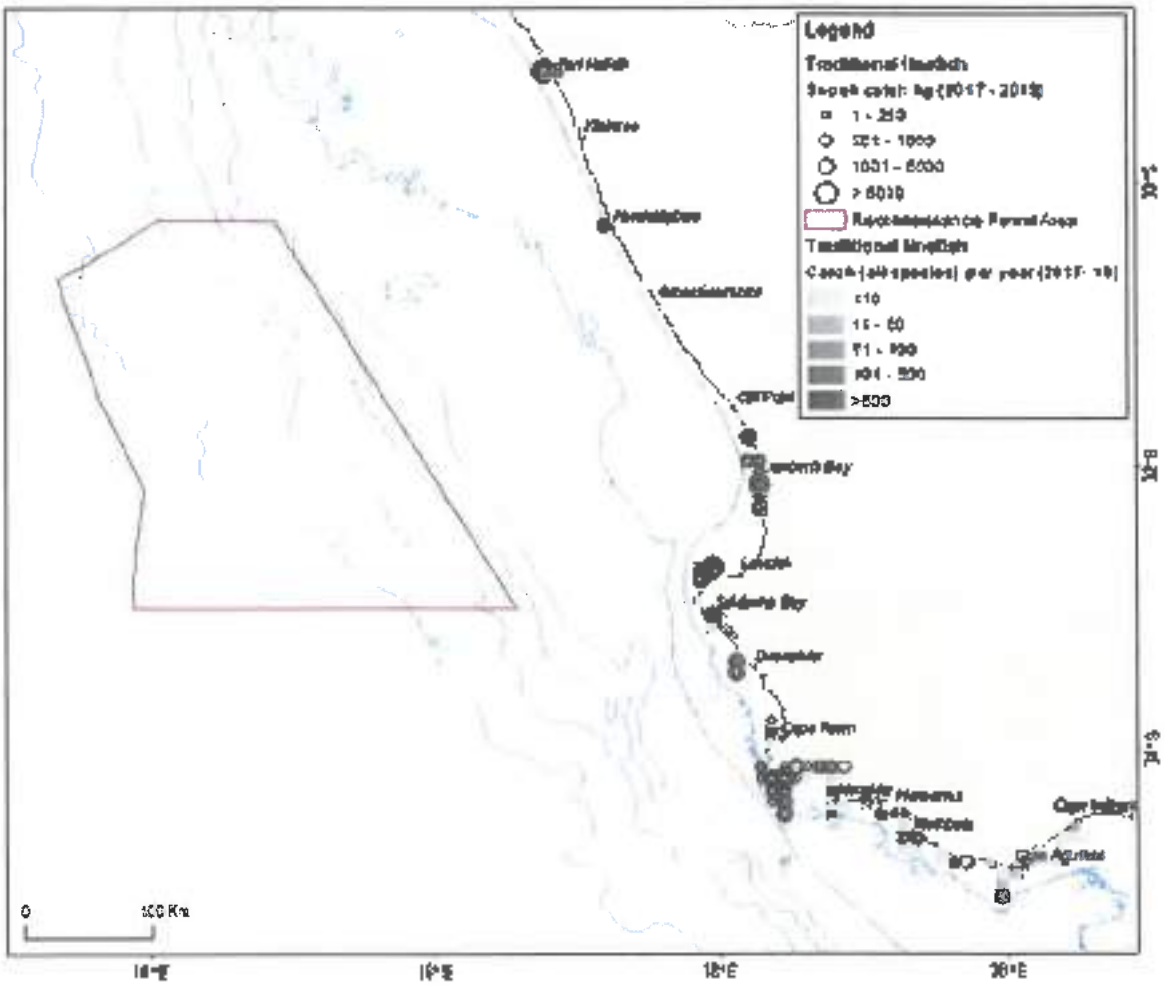


Figure 3.35: An overview of the spatial distribution of catch taken by the linefish sector in relation to the Reconnaissance Permit application area. The snoek component of catch is shown as well as total catch of all species.

3.3.9 WEST COAST ROCK LOBSTER

The West Coast rock lobster (*Jasus lalandii*) is a valuable resource found off the South African West Coast and consequently an important income source for West Coast fishermen providing employment for about 4200 people. The resource occurs inside the 200 m depth contour along the West Coast from Namibia to East London on the East Coast of South Africa. Fishing grounds stretch from the Orange River mouth to east of Cape Hangklip in the South-Eastern Cape although the commercial viability is focused mainly southwards from Management Zone B (see Figure 3.38).

The fishery is comprised of four sub-sectors – commercial offshore, commercial nearshore, small-scale and recreational, all of which have to share from the same national TAC. The 2021/22 TAC was set at 600 tonnes and apportionment of TAC by sub-sector is listed in Table 3.9. The TAC for the 2021/2022 fishing season was reduced by 29% from the previous fishing season (2020/2021). The updated stock assessment for the resource has indicated that it is further depleted than was thought to be the case

two years ago, and poaching[4] is one of the major contributors to the recently exacerbated depleted status of the resource. The resource has over recent decades been at about 2.5% of the pristine level, but that over the last few years this had dropped to about 1.5%.

Annual TAC and average monthly landings over the period 2006 to 2020 are shown in Figures 3.36 and Figure 3.37, respectively. A historical time-series of TACs and landings is listed in Table 3.10.

Table 3.9: Apportionment of TAC of rock lobster by sub-sector (modified DFFE, 2021).

Description	2019/2020 TAC (t)	2020/2021 TAC (t)	2021/2022 (t)
Commercial fishing (offshore)	563.91	435.88	301.28
Commercial fishing (nearshore)	170.25	131.03	100.92
Recreational fishing	38.76	30.08	21.57
Subsistence (interim relief measure) fishing	170.25	131.03	100.92
Small-scale fishing sector (nearshore)			
Small-scale fishing sector (offshore)	140.83	108.97	75.32
Total	1084	837.0	600

Table 3.10: Total allowable catch, fishing sector landings and total landings for West Coast rock lobster (DEFF, 2020).

	TAC (t)					
Season	Global TAC	Offshore allocation	Nearshore allocation	Interim Relief	Recreational	Total catch[2]
2000/01	2 018	1614		230	174	2154
2001/02	2 353	2151		[1]	202	2410
2002/03	2 957	2713		[1]	244	2706
2003/04	3 336	2422	594	[1]	320	3258
2004/05	3 527	2614	593	[1]	320	3222
2005/06	3 174	2294	560	[1]	320	2291
2006/07	2 857	1997	560	[1]	300	3366
2007/08	2 571	1754	560	[1]	257	2258
2008/09	2 340	1632	451	[1]	257	2483
2009/10	2 399	1632	451	180	129	2519
2010/11	2 286	1528	451	200	107	2208
2011/12	2 428	1541	451	253	183	2275
2012/13	2 276	1391	451	251	183	2308
2013/14	2 167	1356	451	276	83	1891
2014/15	1 800	1120	376	235	69	1688
2015/16	1 924	1243	376	235	69	1524
2016/17	1 924	1204	376	274	69	1564
2017/18	1 924	994	305	554	69	1355
2018/19	1 084	564	170	170	39	
2019/20	1 084	564	170	170	39	
2020/21	837	436	131	131	30	
2021/22	600	301	101	101	22	

[1] No Interim Relief allocated
[2] Interim Relief accommodated under Recreational allocation

[4] In 2017, the poached rock lobster was estimated at 2 747 tonnes.

* Total catch by all sectors

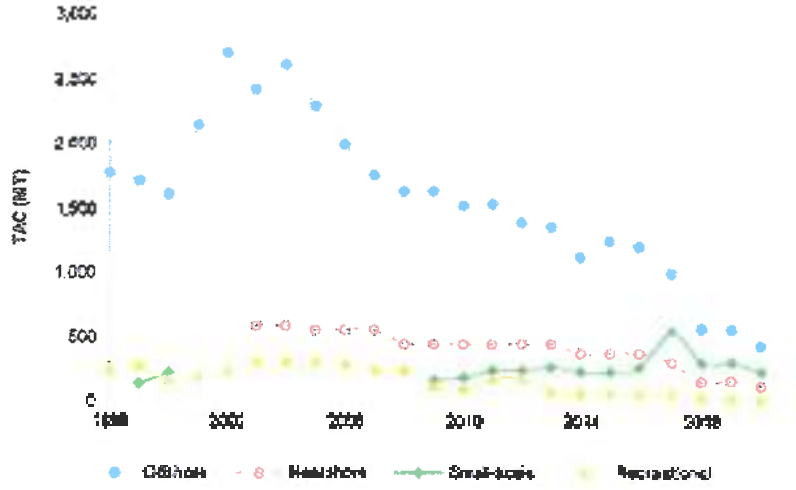


Figure 3.36: Graph showing the total allowable catch (TAC) of west coast rock lobster.

Figure 3.37: Graph showing the average monthly catch (tonnes) and effort (number of traps hauled) reported by the offshore (trapboat) and inshore (bakkie) rock lobster sectors over the period 2006 to 2020.

The resource is managed geographically, with TACs set annually for different management areas. The commercial and small-scale fishing sectors are authorised to undertake fishing for four months in each management zone therefore closed seasons are applicable to different management zones. The start and end dates for the 2021/22 fishing season per sector and zone are shown in Table 3.11.

Table 3.11: Start and end dates for the fishing season 2021/22 by management zone. Special Project Report on the review of the TAC for West Coast Rock Lobster for the 2021/22 fishing season by the Consultative Advisory Forum for Marine Living Resources.

Area	Catch period	
	Commercial nearshore, interim relief, small-scale: nearshore	Commercial offshore, small-scale: offshore
Area 1 + 2	15 Oct, Nov, Dec, Jan, 15 Feb	
Area 3 + 4	15 Nov, Dec, Jan, Feb, 15 Mar	15 Nov, Dec, Jan, Feb, 15 Mar
Area 5 + 6	15 Nov, Dec, Jan, Feb, 15 Mar	
Area 7		Dec, Jan, Feb, Mar

Areas 8 and 11	15 Nov, Dec, Jan, Feb, 15 Mar	Jan, Mar, Apr, May
Area 8 (deep water)		Jun, Jul
Areas 12, 13 and 14	15 Nov, Dec, Jan, Feb, 15 Mar	

The commercial offshore sector operates at a depth range of approximately 30 m to 100 m, making use of traps consisting of rectangular metal frames covered by netting. These traps are set at dusk and retrieved during the early morning. Approximately 138 vessels participate in the offshore sector.

The commercial nearshore sector makes use of hoop nets to target lobster at discrete suitable reef areas along the shore at a water depth of up to 15 - 30 m. These are deployed from a fleet of small dinghies/bakkies which operate from the shore and coastal harbours. Approximately 653 boats participate in the sector.

The delineation of management zones is shown in Figure 3.38. The five super-areas are: areas 1-2, corresponding to zone A; areas 3-4, to zone B; areas 5-6, to zone C; area 7, being the northernmost area within zone D; and area 8+, comprising area 8 of zone D as well as zones E and F.

Figure 3.39 shows rock lobster catch by management zone for the commercial offshore and nearshore sub-sectors. The Reconnaissance Permit area is situated at least 115 km from the closest rock lobster fishing grounds and there is no spatial overlap (see Figure 3.40).

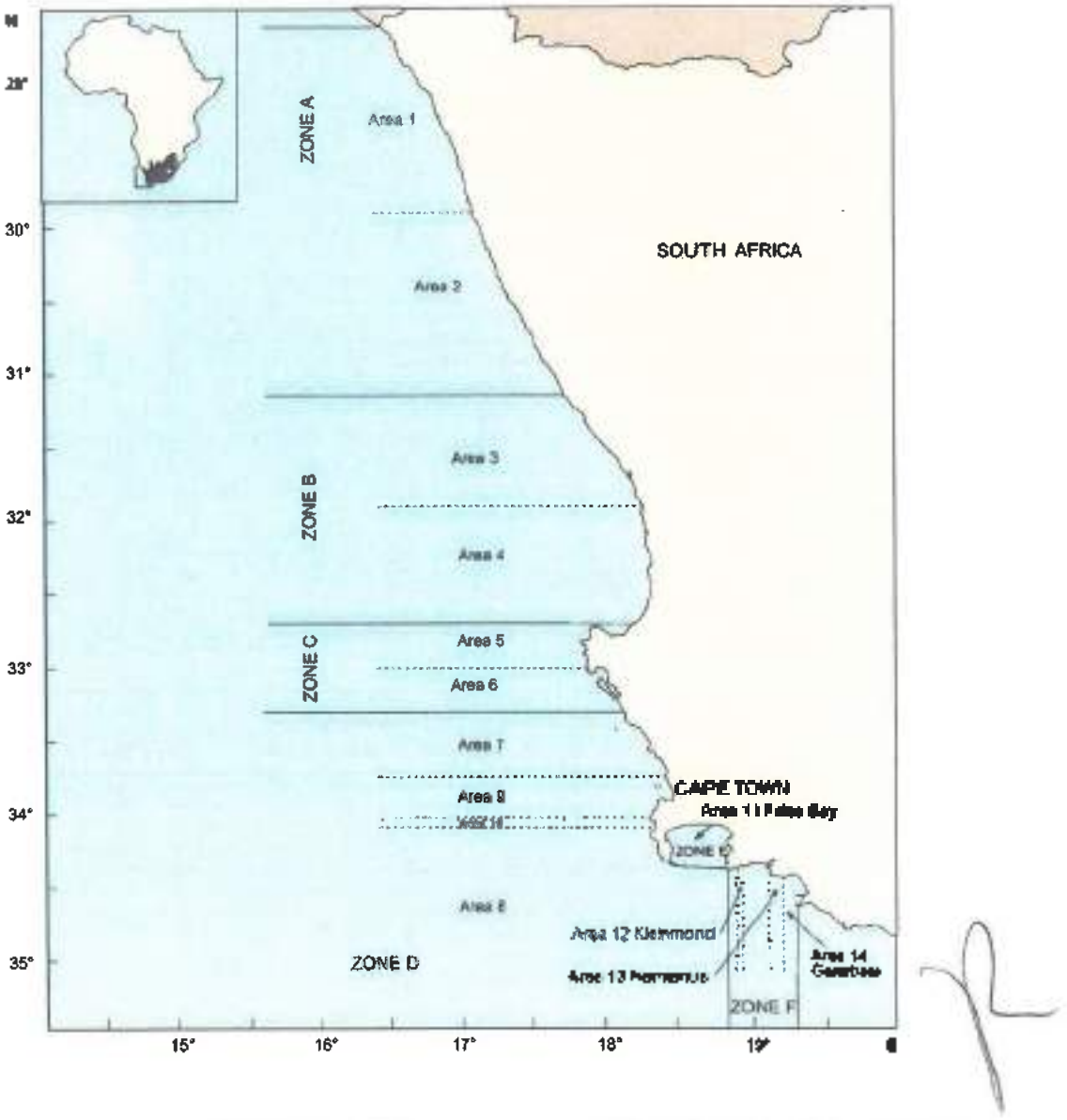
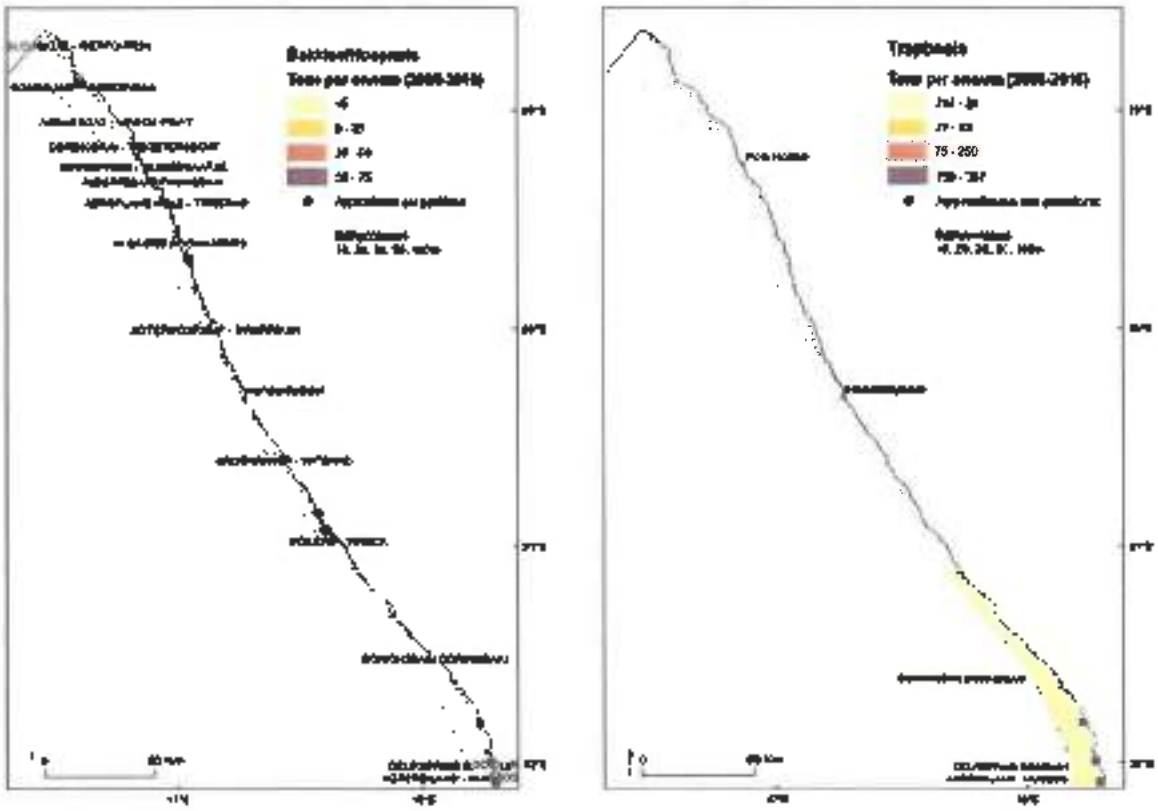


Figure 3.36: West Coast rock lobster fishing zones and areas. The five super-areas are: areas1–2, corresponding to zone A; areas 3–4, to zone B; areas 5–6, to zone C; area 7, being the northernmost area within zone D; and area 8+, comprising area 8 of zone D as well as zones E and F.



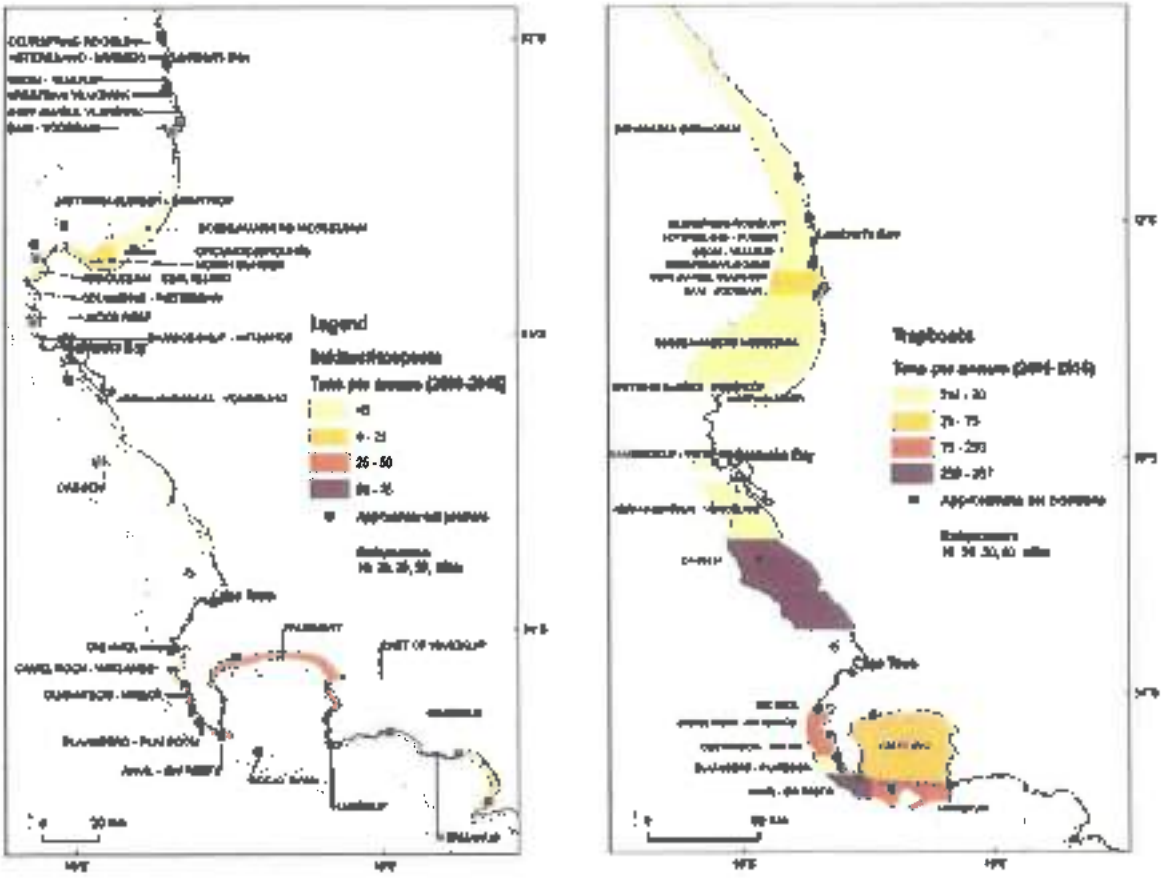


Figure 3.39: An overview of the spatial distribution of fishing effort expended by the west coast rock lobster inshore (bakkies/hoopnets) (left panel) and offshore (trapboat) (right panel) sectors within demarcated lobster management zones.

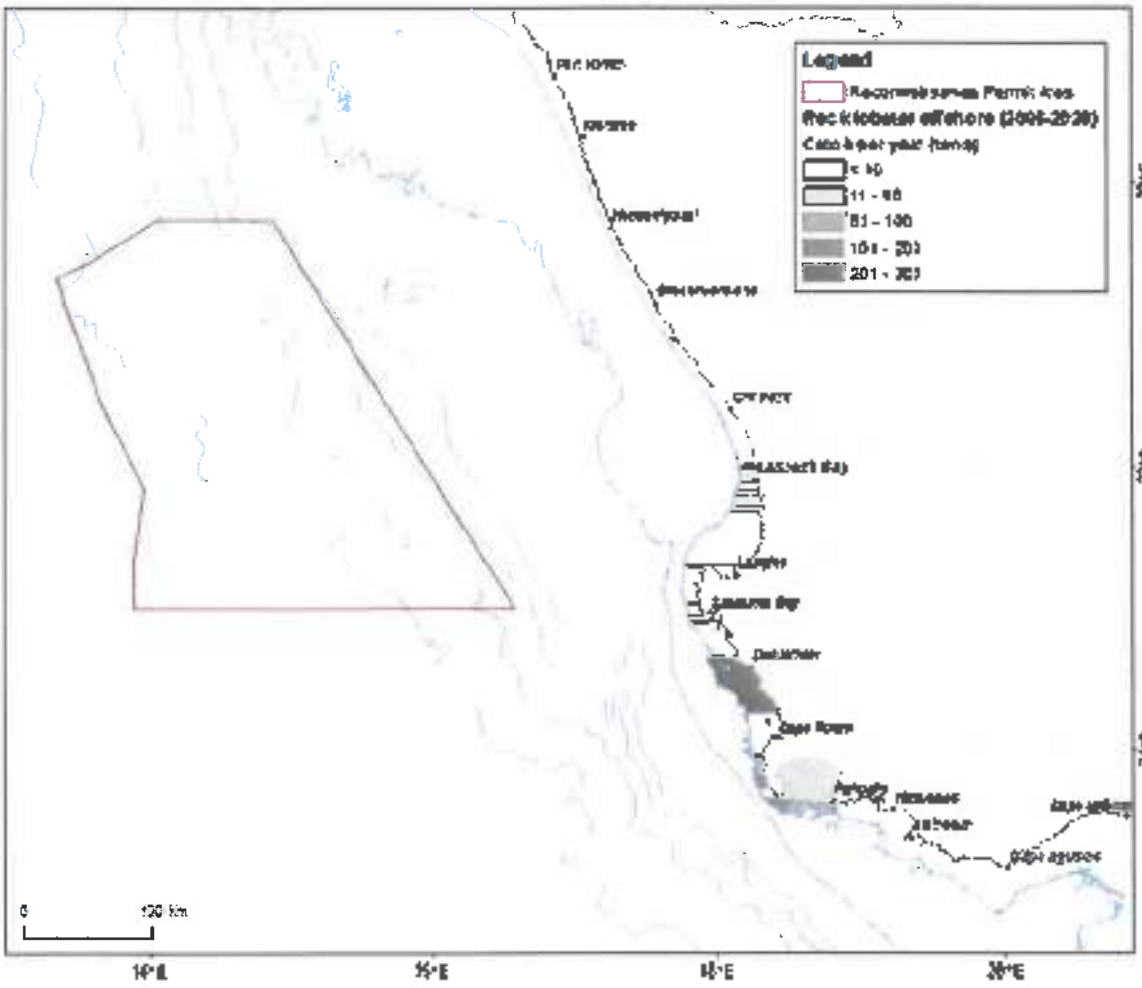


Figure 3.40: Spatial distribution of fishing effort expended by the west coast rock lobster offshore (trapboat) sector in relation to the Reconnaissance Permit application area.

3.3.10 SMALL-SCALE FISHERIES[5]

The concept of Small-Scale Fisheries (SSF) is a relatively new addition to the fisheries complexity in South Africa. The concept has its origin in a global initiative supported by the Food and Agricultural Organisation of the United Nations (FAO). In South Africa, there is a long history of coastal communities utilizing marine resources for various purposes. Many of these communities have been marginalized through apartheid practices and previous fisheries management systems. In 2007 government was compelled through an equality court order to redress the inequalities suffered by these traditional fishers[6]. The development of a SSF sector aims in part to compensate previously disadvantaged fishing communities that have been displaced either politically, economically or by the development of large-scale commercial fisheries. This led to the development of the Small-Scale Fisheries Policy (SSFP), the aim of which is to redress and provide recognition of the rights of small-scale fishers (DAFF, 2015). The

[5] In regard to SSF, this assessment is guided by several key documents, namely the Marine Living Resources Act of 1998 (as amended), the Small Scale Fisheries Policy (2016) and in particular the Small Scale Fisheries Regulations of 2016. See also : Small-Scale Policy implementation Plan available at http://www.smallscalefisheries.co.za/useful-resource

[6] See also the Thesis of Pretorius, G. (2022)

SSFP was gazetted in May 2019 under the Marine Living Resources Act, 1998 (Act No. 18 of 1998). It is only now (2021/2022) in an advanced process of implementation. It is a challenging process that has been exacerbated by the conflict and overlap with another fisheries-related process of fishing rights allocations (known as Fishery Rights Allocation Process or "FRAP"). As of February 2022, neither process has been concluded and the issues at stake are highly politicised. The SSF overlaps other historical fisheries in South Africa, leading to legal challenges where the SSF rights allocations are in conflict with other established commercial fishing sectors, most notably the commercial squid fishing sector. SSF is defined as a fishery although specific operations and dynamics are not yet fully defined as they are subject to an ongoing process by DFFE. The SSF regulations (DAFF, 2016) do however define the fishing area for SSF as "'near-shore', meaning "the region of sea (including seabed) within close proximity to the shoreline". The regulations further specify under Schedule 5 *Small-scale fishing areas and zones in which* "5. (1) In order to facilitate the establishment of areas where smallscale fishers may fish, the Department must set up a procedure to engage and consult with the small-scale fishing community in proposing demarcated areas that may be established as areas where small-scale fishers may fish" and which under section 5 (2)b. *"take into account the mobility of each species in the allocated basket of species with sessile species requiring smaller fishing areas while nomadic and migratory species requiring larger area.*

Small-scale fishers fish to meet food and basic livelihood needs, but may also directly be involved in fishing for commercial purposes[7]. These fishers traditionally operate on nearshore fishing grounds to harvest marine living resources on a full-time, part-time or seasonal basis. Fishing trips are usually of short-duration and fishing/harvesting techniques are labour intensive[8].

Small-scale fishers are an integral part of the rural and coastal communities in which they reside and this is reflected in the socio-economic profile of such communities. In the Eastern Cape, KwaZulu-Natal and the Northern Cape, small scale fishers live predominantly in rural areas while those in the Western Cape live mainly in urban areas (Harris et. al. 2002; Sunde & Pedersen C. 2007; Sunde 2016.).

Many communities living along the coast have, over time, developed local systems of rules to guide their use of coastal lands, forests and waters. These local rules are part of their systems of customary law. Rights to access, use, and own different natural resources arise from local customary systems of law. These systems of law are not written down as in Western law, but are passed down from generation to generation through practice (https://www.masifundise.org/wp-content/uploads/2011/06/vissernet-eng-news-3-final.pdf). South Africa's Constitution recognises customary law together with common law and state law. Section 39 (3) makes provision for a community that has a system of customary rights arising from customary law to be recognised as long as these rights comply with the Bill or Rights. In line with this, the SSFP also recognises rights arising in terms of customary law. Customary fishers are

[7] There is no formal designation of artisanal (or traditional/subsistence) fishing in South Africa, which is generally considered as fishing or resource extraction for own use. As fisheries have evolved and the commercial benefit realised, subsistence fishers have increasingly moved to commercialisation aimed at supporting their livelihoods. This group can now, therefore, also include shore and boat-based anglers and spear-fishers who target a wide range of fine fish species, some of which are also targeted by commercial operations, skin divers who collect rock lobsters and other subtidal invertebrates, bait collectors (mussels, limpets, red bait) and non-subsistence collectors of intertidal organisms. The high value of many intertidal and subtidal resources (e.g. rock lobster, abalone and mussels) has resulted in an increase in their production through aquaculture and small-scale harvesting in recent years (Clark et. al. 2010).

[8] The equipment used by small scale fishers includes rowing boats in some areas, motorized boats on the south and west coast and simple fishing gear including hands, feet, screw drivers, hand lines, prawn pumps, rods with reels, gaffs, hoop nets, gill nets, seine/trek nets and semi-permanently fixed kraal traps.

normally associated with discrete groups (tribes or communities with unique identities and associations with the sea) who may be defined by traditions and beliefs (see also Pretorius, 2022). These traditions are increasingly being challenged as stocks and marine resources have been depleted. This would include, for example, intertidal harvesting of seaweed, mussels, oysters, cephalopods and virtually any species available to these communities. These fishers are generally localised and do not range far beyond the areas in which they live[9].

SSF resources are managed in terms of a community-based co-management approach that aims to ensure that harvesting and utilisation of the resource occurs in a sustainable manner in line with the ecosystems approach. The SSF is to be implemented along the coast in series of community co-operatives. Only a co-operative is deemed to be a suitable legal entity for the allocation of small-scale fishing rights[10]. Applicants for small-scale fishing rights must have a historical involvement in traditional fishing operations, including the catching, processing or marketing of fish for a cumulative period of at least 10 years. They also need to show a historical dependence on deriving the major part of their livelihood from traditional fishing operations.

More than 270 communities have registered an Expressions of Interest (EOI) with the Department. DFFE has split SFF by communities into district municipalities and local municipalities. The location of these coastal communities and the number of fishers per community are shown in Figure 3.41.

- In the Northern Cape, there are 103 fishers registered in the Namakwa district, comprising the Richtersveld and Kamiesberg local municipalities.
- Western Cape districts include 1) West Coast (Berg River, Saldanha Bay, Cederberg, Matzikama and Swartland local municipalities; 2) Cape Metro; 3) Overberg (Overstrand and Cape Agulhas); and 4) Eden (Knysna, Bitou and Hessequa). In total there are 2748 fishers registered in the province.
- In the Eastern Cape, the communities are again split up, broadly as 1) Nelson Mandela Bay, 2) Sarah Baartman, 3) Buffalo City, 4) Amathole, 5) O.R. Tambo and 6) Alfred Nzo. There are 5154 fishers registered in the province.
- KwaZulu-Natal has 2008 registered small-scale fishers divided by district into 1) Ugu, 2) Ethekwini Metropolitan, 3) Ilembe, 4) King Shwetshayo/Uthungulu, and 5) Umkhanyakude.

Approximately 10 000 small-scale fishers have been identified around the coast. The licence block is situated offshore of the West Coast, City of Cape Town and Overberg municipal districts. Between Saldanha Bay and Cape Agulhas, 68 communities have been registered for small-scale fishing rights, these co-operatives comprise a total of 2031 fishers. At this point in time, no discreet co-operatives are active, except for on the West Coast in Port Nolloth.

The SSFP requires a multi-species approach to allocating rights, which entails the allocation of rights for a basket of species that may be harvested or caught within particular designated areas[11]. Section 6 of the regulations covers access *Management of the rights* of access and includes amongst other parts

Co-operatives can only request access to species found in their local vicinity. DFFE recommends five basket areas: 1. Basket Area A – The Namibian border to Cape of Good Hope – 57 different resources

[9] It can include foot-fishers, but also boat fishers who may have difficult or restricted options for launching sites. Note that in some areas fishers are increasingly using more sophisticated technology such as fish finders and larger motorised boats. This ability means their activities may be increasingly commercialised and may overlap with more established commercial fishery sectors.

[10] A co-operative is jointly owned and democratically controlled by small-scale fishers.

[11] Under the SSF regulations the species that may be included in the "basket" are provided in Annexures 2, 3 & 4 that includes fish species that are listed on the non-saleable list, and those that 2 shall only be caught for own consumption within the corresponding limits.

2. Basket Area B – Cape of Good Hope to Cape Infanta – 109 different resources 3. Basket Area C – Cape Infanta to Tsitsikamma – 107 different resources 4. Basket Area D – Tsitsikamma to the Pondoland MPA – 139 different resources 5. Basket Area E – Pondoland MPA to the Mozambican border – 127 different resources.

The mix of species to be utilised by small-scale fishers includes species that are exploited nearshore by existing commercial sectors viz; traditional linefish, west coast rock lobster, squid, hake handline[12], abalone, KZN beach seine, netfish (gillnet and beach-seine), seaweed and white mussel. An apportionment of TAE/TACs for these species will be transferred from existing commercial rights to SSF[13], whereas white mussels will become the exclusive domain of SSF. Species nominated for commercial use will be subject to TAE and/or TAC allocation. Species nominated for own use will be available to all members of a particular co-operative, but subject to output controls.

The small-scale fishery rights cover the nearshore area (defined in section 19 of the MLRA as being within close proximity of shoreline). Small-scale fishermen along the Northern Cape and Western Cape coastlines are typically involved in the traditional line, west coast rock lobster and abalone fisheries, whereas communities on the South Coast would be involved in traditional line, squid jig and oyster harvesting. The small-scale communities on the West Coast, with long family histories of subsistence fishing, prioritise the harvest of nearshore resources (using boats) over the intertidal and subtidal resources (Clark, Hauk et al. 2002, Harris, Salo, & Russell 2010).

Figure 3.41: Fishing boats outside the Hondeklipbaai small-scale community co-operative (photo credit Carika van Zyl).

[12] Hake handline is a small subsector of the hake fishery and requires a fishing right apportionment. The fishery has in recent years not been active because of resource availability. It is perceived as having potential for allocation as part of the SSF and as part of their "basket".

[13] DFFE proposes that, commencing January 2021, 50% of the overall TAE and TAC for the traditional linefish and abalone sectors, respectively, will be apportioned to small-scale fishing whereas 25% of the overall TAE for squid will be apportioned to small-scale fishing (DEFF 2020)

Snoek (*Thyrsites atun*), Cape bream / hottentot (*Pachymeropon blochii*) and yellowtail (*Seriola lalandi*) are important linefish species that are targeted by small-scale fishers operating nearshore along the West and South-West Coast of South Africa (refer to Section 3.3.8). Snoek are targeted by small-scale fishers during the snoek seasonal migration between April and June, during which time they shoal nearshore and are therefore available to handline fishermen[14]. Snoek availability coincides with peaks in the availability of other small pelagic species, notably anchovy and sardine (Nepgen, 1979). As shown by Crawford et al. (1987) [15][16] snoek stay inshore on their southward migration (see Figure 3.5) i.e. April through to June and then move offshore into deeper waters to spawn[17] in July and August (and are not available to linefishers).

Small-scale fishers also target west coast rock lobster (*Jasus lalandii*) using hoopnets set by small "bakkies" on suitable reefs at a water depth of less than 30 m. Fishing activity may range up to 100 m water depth by the larger vessels that participate in the offshore commercial rock lobster trap sector (refer to Section 3.3.9).

Small-scale fishermen along the Northern Cape and Western Cape coastlines are unlikely to range beyond 20 km from the coastline; thus, inshore of the Reconnaissance Permit area (refer to Figure 3.42). This assessment is however cognisant of the ongoing issues related to the perceived areas fished and species targeted by SSF off the West Coast of South Africa[18] e.g. that cultural practice of SSF may occur to 55 km offshore. While SSF regulations clearly specify that fishing is required to take place "nearshore" the actual differentiation between SSF and other fishing operations that might include SSF, such as the commercial "traditional linefish" and "pole and line" and the extent to which these commercial fisheries might include SSF, remains unclear. As such the offshore extent to which SSF may operate requires a precautionary approach in this assessment and consideration that the possibility exists (albeit a remote possibility that cannot be verified through the information made available on these fisheries), that SSF may have occurred historically and potentially in the future further offshore than suggested by the information made available for this assessment i.e. there is a remote possibility that some SSF may have targeted certain species (of which tuna and snoek are the main candidate

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[14] Snoek are known to undertake migrations in a southward direction from the waters of the northern Benguela into the southern Benguela towards the cape west and southern coasts. These migrations have certainly been long taken advantage of by fishers, including traditional linefishers and communities along the west coast. Commercial fishers as well as the Small Scale Fishery (SSF) sector capitalise on the inshore availability, but this opportunity is lost once the snoek move offshore in mid-winter and start their northward migration. Snoek are primarily a "winter" fish, moving systematically southwards in autumn and commercial linefish, recreational and community-based boats exploit this shoaling species mostly in the nearshore. Snoek are also caught by the hake trawl fleets in significant numbers at times as snoek may undertake diurnal migrations feeding or spawning in deeper waters (and are not accessible to surface line fishers at these times). There is however no definitive description of snoek migrations with regard to their exact spatial and temporal movements.

[15] The Benguela ecosystem : Part IV. pgs 438

[16] See also Nepgen (1979) in Fish. Bull. S Afr, 12:35-43

[17] Snoek spawning occurs offshore during winter-spring, along the shelf break (150–400 m) of the western Agulhas Bank and the South African west coast. Prevailing currents transport eggs and larvae to a primary nursery ground north of Cape Columbine and to a secondary nursery area to the east of Danger Point; both shallower than 150 m. Juveniles remain on the nursery grounds until maturity, growing to between 33 and 44 cm in the first year (3.25 cm/month). Onshore-offshore distribution (between 5- and 150-m isobaths) of juveniles is determined largely by prey availability and includes a seasonal inshore migration in autumn in response to clupeoid recruitment. Adults are found throughout the distribution range of the species, and although they move offshore to spawn - there is some southward dispersion as the spawning season progresses - longshore movement is apparently random and without a seasonal basis (Griffiths, 2002). Refer to Figure 3.5.

[18] On 22/08/22 the Western Cape High Court ruled that the process of designating SSF in the Western Cape had been "unlawful" and had to be redone.

species) further offshore than 20 km. The distance fished offshore by SSF and the associated risks determined in this assessment further necessarily considers practical aspects, notably that bottom fishing is impractical in waters deeper than 100 m and as such any bottom fishing, whether SSF or commercial, is highly unlikely beyond a precautionary depth being the 100 m depth contour. Further, in regard to migratory species, such as longfin tuna and snoek, economic and regulatory aspects relating to distances fished offshore is pertinent [i.e. such as the requirements of the South African Maritime Safety Authority (SAMSA)] in particular that most SSF are not likely to be "B" class certified (i.e. can operate up to 40 nm offshore and are longer than 9m) are likely limited to "C" class being mainly vessels of <9 m[19] permitted to only operate < 15 nm offshore.

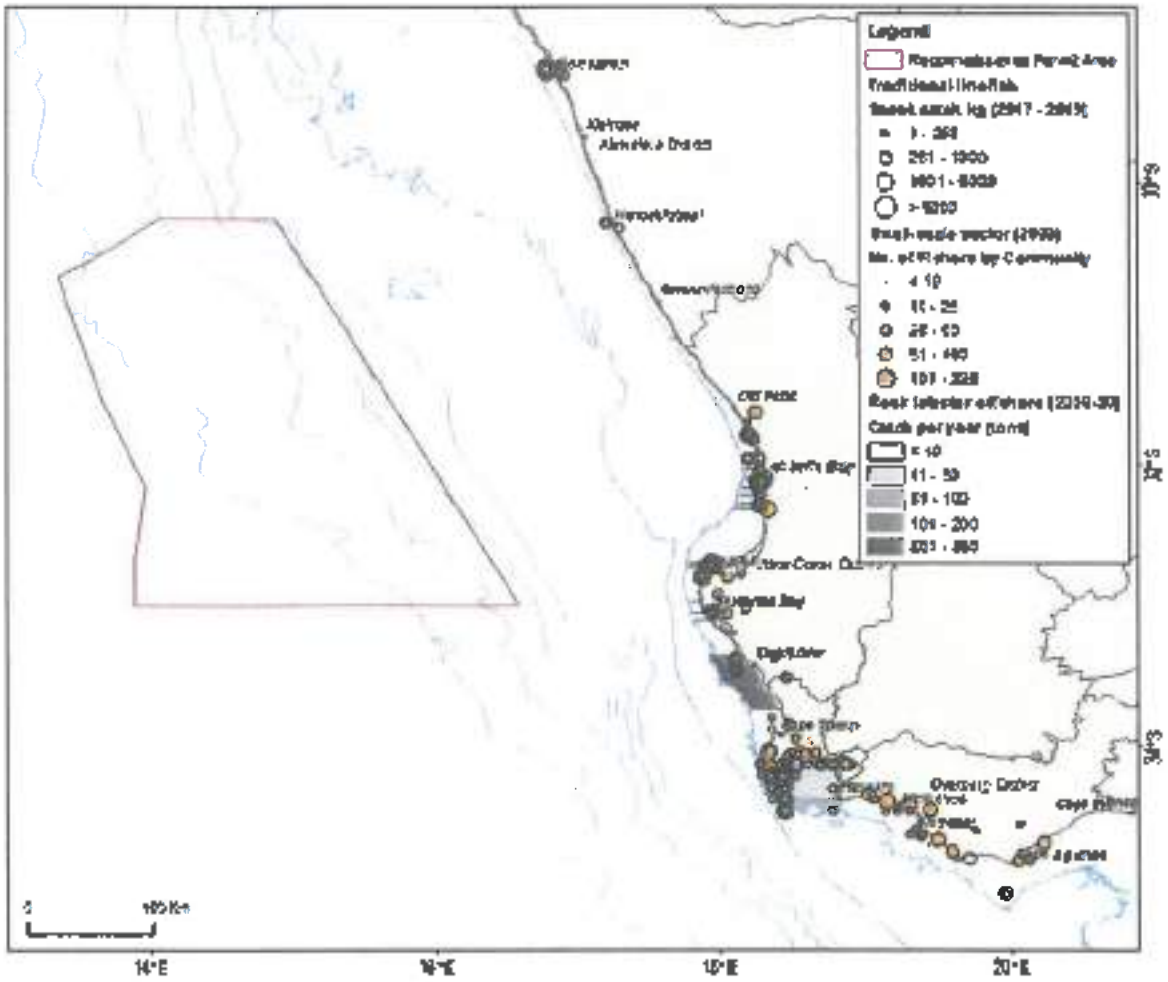

Figure 3.42: Overview of spatial distribution of small-scale fishing communities and number of participants per community along the South African west coast. The location of snoek catches reported by the linefish sector for the period 2017 to 2019 are shown.

[19] See https://www.samsa.org.za/Marine%20Notices/2011/MN%2013%20of%202011%20Small%20vessels%20Policy.pdf

3.3.11 BEACH-SEINE AND GILLNET FISHERIES (NETFISH)

There are a number of active beach-seine and gillnet operators throughout South Africa (collectively referred to as the "netfish" sector). Initial estimates indicate that there are at least 7 000 fishermen active in fisheries using beach-seine and gillnets, mostly (86%) along the West and South coasts. These fishermen utilize 1 373 registered and 458 illegal nets and report an average catch of about 1 600 tons annually, constituting 60% harders (also known as mullet, *Chelon richardsonii*), 10% St Joseph shark (*Callorhinchus capensis*) and 30% "bycatch" species such as galjoen (*Dichistius capensis*), yellowtail (*Seriola lalandii*) and white steenbras (*Lithognathus lithognathus*). Catch-per-unit-effort declines eastwards from 294 and 115 kg·net-day^{-1} for the beach-seine and gill-net fisheries respectively off the West Coast to 46 and 5 kg·net-day^{-1} off KwaZulu-Natal. Consequently, the fishery changes in nature from a largely commercial venture on the West Coast to an artisanal/subsistence fishery on the East Coast (Lamberth *et al.* 1997).

Figure 3.43: An example of a typical Sestern Cape "trek-net" (beach-seine) operation (Source: https://www.iol.co.za/capetimes/news/picture-essay-being-hooked-on-fishing-no-easy-way-of-life-14145539).

The fishery is managed on a Total Allowable Effort (TAE) basis with a fixed number of operators in each of 15 defined areas (see Table 3.12 for the number of rights issued and Figure 3.44 for the fishing areas). The number of Rights Holders operating on the West Coast from Port Nolloth to False bay is listed as 28 for beach-seine and 162 for gillnet (DEFF, 2020). Permits are issued solely for the capture of harders, St Joseph and species that appear on the 'bait list'. The exception is False Bay, where Right Holders are allowed to target linefish species that they traditionally exploited.

Table 3.12: Recommended Total Allowable Effort (TAE, number of rights and exemption holders) and rights allocated in 2016-17 for each netfish area. Levels of effort are based on the number of fishers who could maintain a viable income in each area (DAFF 2017).

Area	Locality	Beach-seine	Gillnet	Total	Rights allocated

A	Port Nolloth	3	4	7	4
B	Hondeklipbaai	0	1	1	0
C	Olifantsriviermond-Wadrifsoutpansmond	2	8	10	4
D	Wadrifsoutpansmond-Elandsbaai-Dassiehoek	3	6	9	6
E	Dassiehoek, (Rocherpan)-Cape Columbine, including Paternoster	4	80	84	84
F	Saldhana Bay	1	5	6	5
G	Langebaan Lagoon	0	10	10	10
H	Yzerfontein	2	2	4	1
I	Bokpunt (Melkbos)-Milnerton	3	0	3	1
J	Hoetbey beach	2	0	2	0
K	Longbeach-Scarborough	3	0	3	1
L	Smitswinkel Bay, Simonstown, Fishoek	2	0	2	2
M	Muizenberg-Strandfontein	2	0	2	2
N	Macassar*	0	0	0	(1)
OE	Olifants River Estuary	0	45	45	45

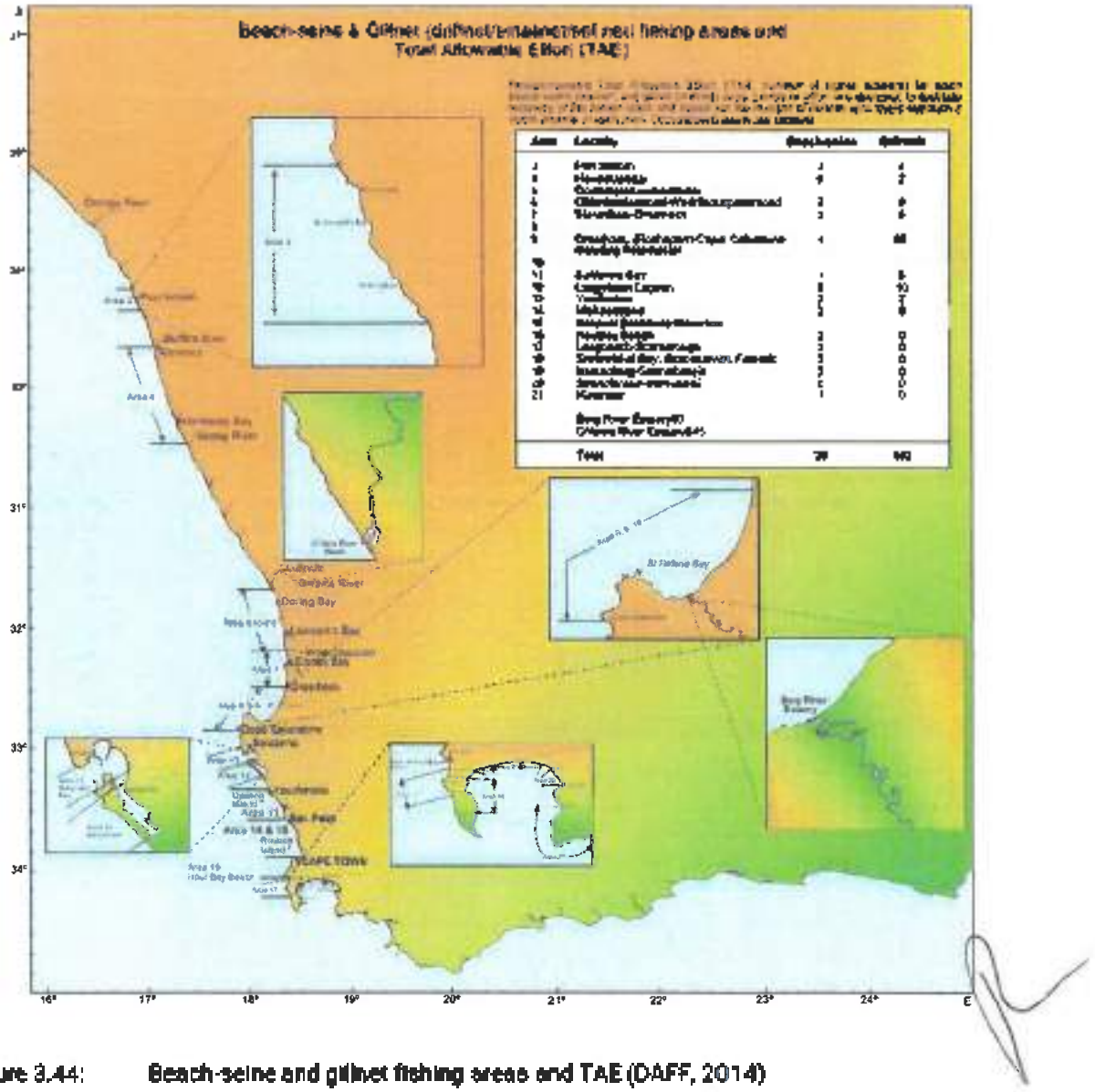

Figure 3.44: Beach-seine and gillnet fishing areas and TAE (DAFF, 2014)

The beach-seine fishery operates primarily on the West Coast of South Africa between False Bay and Port Nolloth (Lamberth 2006) with a few permit holders in KwaZulu-Natal targeting mixed shoaling fish during the annual winter migration of sardine (Fréon *et al.* 2010). Beach-seining is an active form of fishing in which woven nylon nets are rowed out into the surf zone to encircle a shoal of fish. They are then hauled shorewards by a crew of 6–30 persons, depending on the size of the net and length of the haul. Nets range in length from 120 m to 275 m. Fishing effort is coastal and net depth may not exceed 10 m (DAFF 2014b).

The gillnet fishery operates from Yzerfontein to Port Nolloth on the West Coast. Surface-set gillnets (targeting mullet) are restricted in size to 75 m x 5 m and bottom-set gillnets (targeting St Joseph shark) are restricted to 75 m x 2.5 m (da Silva *et al.* 2015) and are set in waters shallower than 50 m. The spatial distribution of effort is represented as the annual number of nets per kilometre of coastline.

The range of gillnets (50 m) and that of beach-seine activity (20 m) will not overlap with Reconnaissance Permit area. Figure 3.45 shows the expected range of gillnet fishing activity off the west coast of South Africa, situated at least 220 km from the Reconnaissance Permit area.

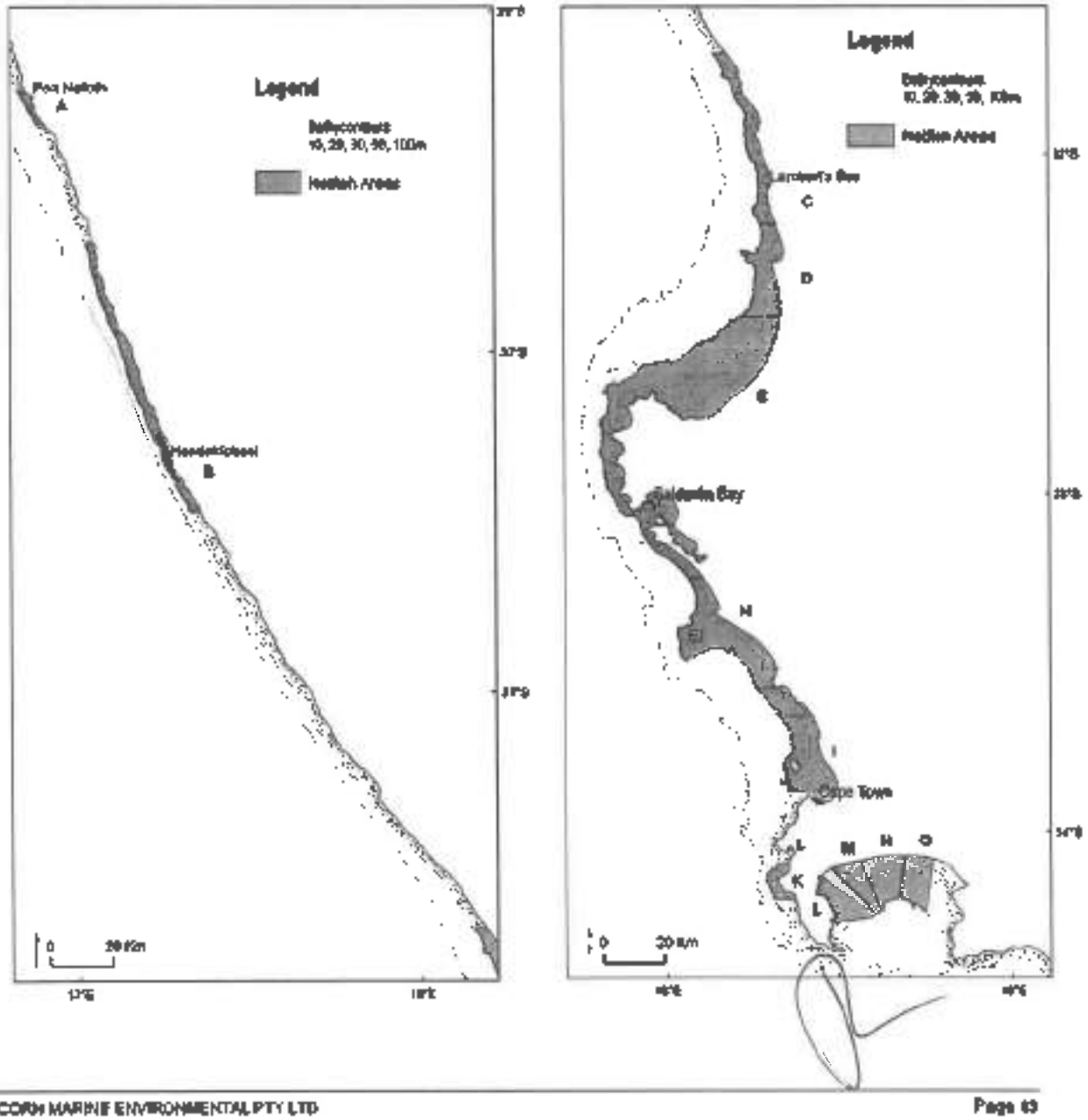

Figure 3.45: Netfish (gillnet and beach-seine) fishing areas (DAFF, 2016/17)

3.3.12 FISHERIES RESEARCH

Swept-area trawl surveys of demersal fish resources are carried out twice a year by DAFF in order to assess stock abundance. Results from these surveys are used to set the annual TACs for demersal fisheries. First started in 1985, the West Coast survey extends from Cape Agulhas (20°E) to the Namibian maritime boarder and takes place over the duration of approximately one month during January/February. The survey of the Southeast coast (20°E – 27°E longitude) takes place in April/May. Following a stratified, random design, bottom trawls are conducted to assess the biomass, abundance and distribution of hake, horse mackerel, squid and other demersal trawl species on the shelf and upper slope of the South African coast. Trawl positions are randomly selected to cover specific depth strata that range from the coast to the 1 000 m isobath. On occasion, trawls are targeted in waters deeper than 1 000 m. Figure 3.46 shows the distribution of research trawls undertaken in relation to the Reconnaissance Permit area, with several deepwater trawls having been undertaken within the area.

The biomass of small pelagic species is assessed bi-annually by an acoustic survey. The first of these surveys is timed to commence in mid-May and runs until mid-June while the second starts in mid-October and runs until mid-December. The timing of the demersal and acoustic surveys is not flexible, due to restrictions with availability of the research vessel as well as scientific requirements. During these surveys the survey vessels travel pre-determined transects (perpendicular to bathymetric contours) running offshore from the coastline to approximately the 200 m isobaths, but selected transect run to the to 1 000 m contour in places. The surveys are designed to cover an extensive area from the Orange River on the West Coast to Port Alfred on the East Coast and the DFFE survey vessel progresses systematically from the Northern border Southwards, around Cape Agulhas and on towards the east. Figure 3.46 shows the research effort undertaken off the West Coast during the November 2020 spawner biomass survey and May 2021 recruitment survey of small pelagic species. The Reconnaissance Permit area is situated at least 60 km offshore of the deepwater extent of research survey transects and there is no spatial overlap expected.

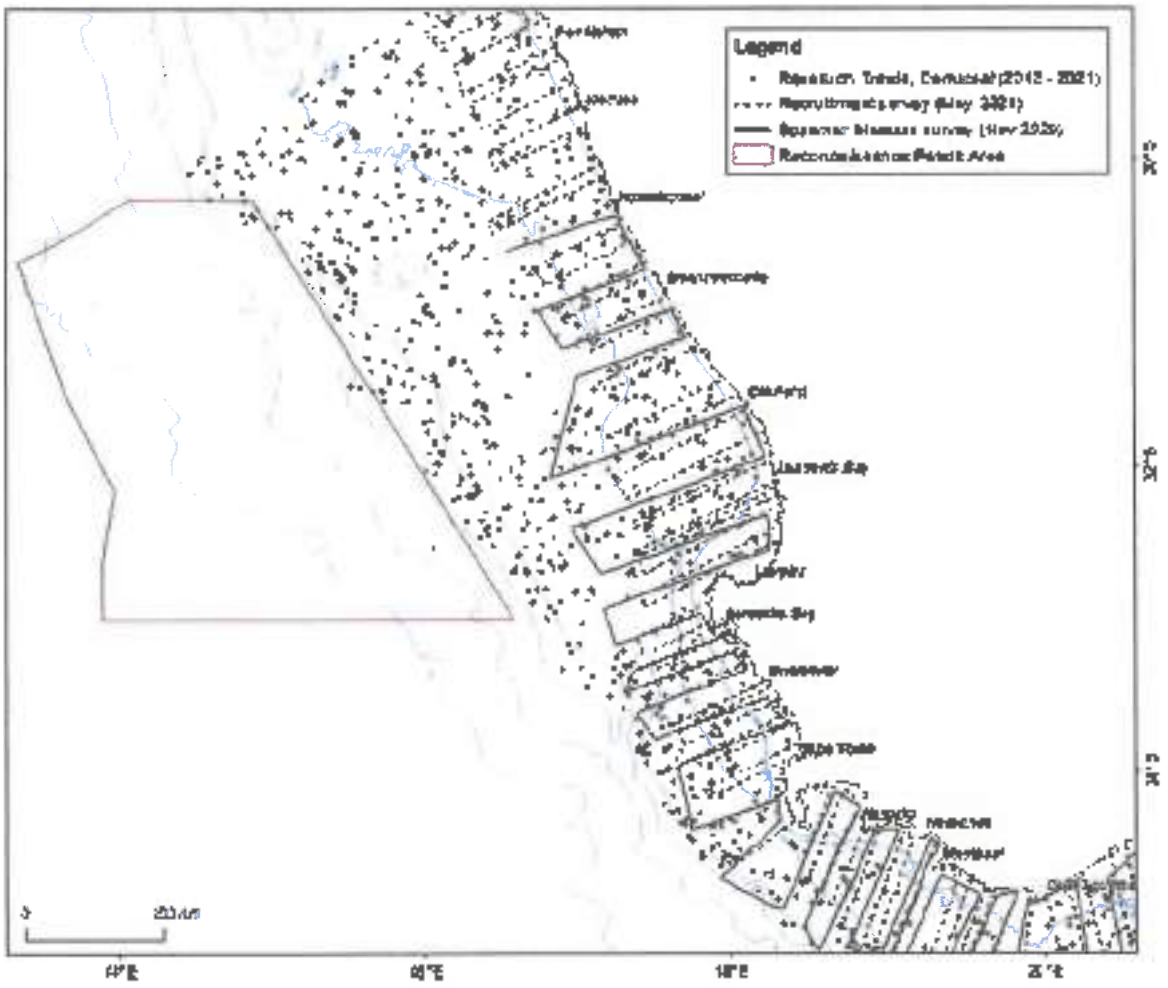

Figure 3.46: Spatial distribution of trawl start positions undertaken by DFFE from 2013 to 2021 to assess the biomass of demersal fish species along the West Coast. Also shown are the survey transects of recruitment and spawner biomass research surveys undertaken by DFFE in May 2021 and November 2020, respectively, in relation to the Reconnaissance Permit application area.

3.4 SUMMARY OF SEASONALITY IN FISHERIES

The seasonality of each of the main commercial fishing sectors that operate off the west coast (west of 20°E) of South Africa is indicated in Table 3.13. Fishing intensity within the Reconnaissance Permit application area is presented for each sector in Table 3.14.

Table 3.13: Summary table showing seasonal variation in fishing effort expended by each of the main commercial fisheries sectors operating off the West Coast of South Africa.

Sector	Fishing Intensity by Month (H = High, M = Low to Moderate, N = None)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Demersal Trawl	H	H	H	H	H	H	H	H	H	H	H	H
Midwater Trawl	H	H	H	H	H	H	H	H	H	H	H	H

Sector	Fishing Intensity by Month (H = High, M = Low to Moderate, N = None)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Demersal Longline	M	H	H	H	H	H	H	H	H	H	H	H
Small Pelagic Purse-Seine	M	H	H	H	H	H	H	H	H	H	H	M
Large Pelagic Longline	M	M	M	M	H	H	H	H	H	H	H	M
Tuna Pole-Line	H	H	H	H	H	M	M	M	M	M	H	H
Traditional Linefish	H	M	M	M	M	M	M	M	M	M	M	H
West Coast Rock Lobster	H	H	H	H*	H*	H*	M*	N	N	M	M	H
Small-scale (linefish & rock lobster sectors)	M	M	M	H	H	H	M	M	M	M	M	M
Research survey (trawl)	M	M	M	N	N	N	N	N	N	N	N	N
Research survey (acoustic)	N	N	N	N	M	M	N	N	N	M	M	M

*Areas 8 and 11 only; # Area 8 only

Table 3.14: Summary table showing seasonal variation in relative intensity of fishing effort by fisheries sector within the Reconnaissance Permit application area.

Sector	Fishing Intensity by Month (H = High, M = Low to Moderate, N = None)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Demersal Trawl	N	N	N	N	N	N	N	N	N	N	N	N
Midwater Trawl	N	N	N	N	N	N	N	N	N	N	N	N
Demersal Longline	N	N	N	N	N	N	N	N	N	N	N	N
Small Pelagic Purse-Seine	N	N	N	N	N	N	N	N	N	N	N	N
Large Pelagic Longline	M	M	M	M	M	H	H	M	M	M	M	M
Tuna Pole-Line	M	H	H	M	M	M	M	N	N	N	N	
Traditional Linefish	N	N	N	N	N	N	N	N	N	N	N	N
West Coast Rock Lobster	N	N	N	N	N	N	N	N	N	N	N	N
Small-scale (linefish & rock lobster nearshore sectors)	N	N	N	N	N	N	N	N	N	N	N	N
Research survey (trawl)	M	M	M	N	N	N	N	N	N	N	N	N
Research survey (acoustic)	N	N	N	N	N	N	N	N	N	N	N	N

4 IMPACT ASSESSMENT

4.1 EXCLUSION FROM FISHING GROUNDS

Description and Source of Impact

The project activities that will result in exclusion to fishing grounds are listed below.

Activity phase	Activity
Mobilisation	N/A

Activity phase	Activity
Operation	Operation of survey vessel with seismic array
Demobilisation	N/A

A purpose-built seismic vessel would be contracted to conduct the 3D seismic survey. The acoustic source (airgun array) would consist of up to 20 active airguns with an overall operating pressure of 2 000 pound-force per square inch (psi). The acoustic source would be situated approximately 50 m behind the seismic vessel at 7 m to 8 m below the water surface. The receiver array for the 3D survey would consist of up to 10 streamer cables, 8 km in length, towed in parallel with a separation of 150 m. The streamer cables would be towed at a depth of between 6 m and 10 m and would therefore not be visible to other vessels. A tailbuoy would mark the far end of each of the streamer cables and would be marked by AIS.

Figure 4.1: Schematic diagram showing side-view of the airgun array and hydrophone cable ("streamer") towed in a 2D seismic survey.

The acquisition of high quality seismic data requires that the position of the survey vessel and the array be accurately known. Seismic surveys consequently require accurate navigation of the sound source over pre-determined survey transects. This, and the fact that the airgun array and the hydrophone streamer need to be towed in a set configuration behind the tow-ship, means that the survey operation has little manoeuvrability whilst operating. For this reason, the vessel is considered as a fixed marine feature that is to be avoided by other vessels.

The safety zones aim to ensure the safety of navigation, avoiding or reducing the probability of damage to the towed streamer cables. The temporary exclusion of vessels from entering the safety zone around a seismic survey vessel poses a direct impact to fishing operations in the form of loss of exclusion from fishing grounds.

Project Controls

Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part A, Rule 10), a seismic survey vessel that is engaged in surveying is defined as a "vessel restricted in its ability to manoeuvre" which requires that power-driven and sailing vessels give way to a vessel restricted in her ability to manoeuvre. In addition to a statutory 500 m safety zone, a seismic contractor would request a safe operational limit (that is greater than the 500 m safety zone) that it would like other vessels to stay beyond. Typical safe operational limits for 2D and 3D surveys are illustrated in Figure 4.2.

A safety zone would be enforced around the seismic vessel for the duration of the project, resulting in the temporary exclusion of fishing operations in the vicinity of this zone around the vessel and towed array. The dimensions of the exclusion would be approximately 6 Nm ahead and astern and 2 Nm to

either side of the survey vessel, resulting in a safety zone of approximately 165 km² around the survey vessel.

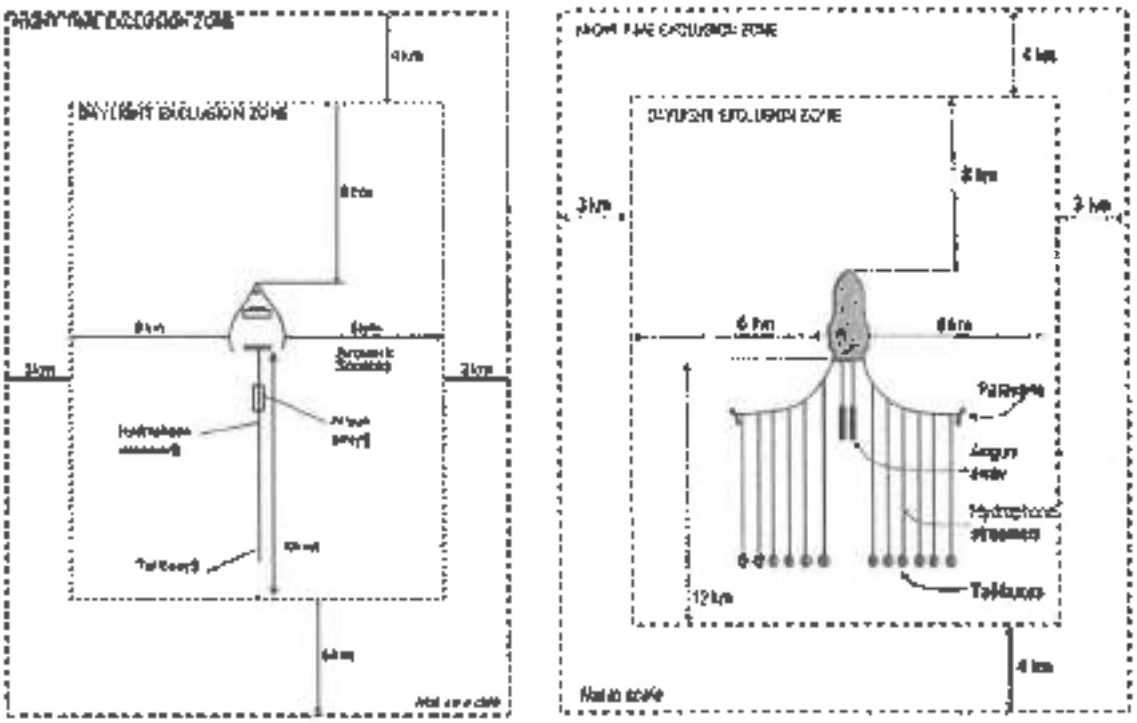

Figure 4.2 Typical configuration and safe operational limits for a 2D (left) and 3D (right) seismic survey operation (SLR Consulting).

The 500 m safety zone and proposed safe operational areas would be communicated to key stakeholders well in advance of the proposed seismic survey. During the survey, notice of the exclusion zone would be issued as a Coastal Navigational Warning (CNW) and/or NAVAREA warning via NAVTEX by the South African Navy Hydrographic Office (SANHO).

At least one escort vessel equipped with appropriate radar and communications would be used to patrol the area during the seismic survey to ensure that other vessels adhere to the safe operational limits. The support vessel would assist in alerting other vessels (e.g. fishing, transport, etc.) about the proposed survey and the lack of manoeuvrability of the seismic vessel.

During adverse weather conditions, the survey vessel may move outside of the boundaries of the seismic acquisition area. Although the acoustic source would not be active during production downtime, it is unlikely that the towed array would be retrieved during these times, meaning that an exclusion zone would still be required.

Sensitivity of Receptors

Sensitivity herein considers the extent of fishing ground, ability of the fishing industry to operate as expected considering a project-induced change to their normal fishing operations (linked in part to fishing gear type and vessel manageability), as well as the vulnerability of the targeted fish species.

An overview of the South African fishing industry and a description of each commercial sector is presented in Sections 3.1 and 3.3. The affected fisheries sectors (receptors) have been identified based

on the extent of overlap of fishing grounds with the seismic acquisition area. Only the large pelagic longline sector operates across the extent of the Reconnaissance Permit area, with activity increasing towards the continental shelf break. Tuna pole-line vessels would be expected to operate seasonally (February/March) in the vicinity of the Reconnaissance Permit area (inshore of licence area) but there likelihood that vessels would be active in the area itself is considered to be low.

Sensitivity herein considers the extent of the fishing ground and the ability of a particular sector to operate as expected considering a project-induced change to their normal fishing operations. The vulnerability of a particular fishing sector to the impact of the safety zone would differ according to the degree of disruption to that particular type of fishing operation. The current assessment considers this to be related to the type of gear used and the probability that the fishing operation can be relocated away from the affected area into alternative fishing areas. For instance, the pelagic longline sector deploys sets unanchored, baited lines which drift with the surface water currents. These are set for an extended period before being recovered by the vessel. Gear may cover a large area during this time and may become entangled with a towed seismic array. Whilst setting or hauling a longline the vessel's manoeuvrability is restricted. Thus, a vessel cannot easily manoeuvre out of the way of an approaching survey vessel.

For this reason, as well as the proportion of catch and effort in the Reconnaissance Permit area, the sensitivity of the large pelagic longline sector is considered to be high[20]. The sensitivity of the tuna pole-line sector, which is a mobile operation, and has an overall low proportion of spatial overlap with the survey area, has been rated as low[21]

Impact Assessment

Based on the location of the Reconnaissance Permit application area, there is no impact of exclusion from fishing grounds expected on the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, linefish, west coast rock lobster or small-scale fisheries. There is a high probability that the large pelagic longline sector (targeting tuna, swordfish and shark) will experience loss of access to fishing ground over the duration of the proposed 70 day survey. Although the Reconnaissance Permit area is situated offshore of the continental shelf break, this being an area of peak fishing activity, there is a high probability that vessels and drifting lines could be expected within the Reconnaissance Permit area. The extent of the impact is considered to be regional due to the large area (57 400 km^2) within which the survey could take place[22]. The impact of exclusion is assessed to be of high magnitude[23]. Based on the combination of extent, duration and magnitude of the impact, and considering the high probability that the impact would occur, the overall significance of the impact is considered to be MEDIUM NEGATIVE. Due to the low probability of the operations of the tuna pole-line sector within the Reconnaissance Permit area, the overall significance of the impact on the sector is considered to be LOW NEGATIVE.

[20] Receptors are not resilient to Project impacts and will not be able to adapt to such changes without substantive adverse consequences.

[21] Receptors are not fully resilient to Project impacts but are generally able to adapt to such changes.

[22] Also noting that during a 3D seismic survey the vessel would acquire the data progressively across the designated area i.e. the area of exclusion area is localised at any one point in time. However, the impact rating has been assessed based on the cumulative impact of exclusion across the full extent of the Reconnaissance Permit area.

[23] Where fishing operations in the affected area could temporarily cease

Mitigation

The potential for mitigation includes effective communications with fishing sectors which could allow vessel operators the opportunity to plan fishing operations in areas unaffected by the presence of the survey vessel. During survey operations, it may be possible for operators to relocate fishing effort into areas of the Reconnaissance Application area that are unaffected by the presence of the survey area if adequate and up-to-date survey information is provided on a daily and/or weekly basis to key fishing fleets. Furthermore, it is recommended that the survey is timed to avoid taking place during the months of high seasonal fishing activity by the large pelagic longline sector, this being the months of June and July (refer to Figure 3.28). A Fisheries Liaison Officer (FLO) should be present on site for the duration of the survey, either stationed on board the survey vessel or the escort vessel. Such a person should be familiar with the types of fisheries sectors in the region i.e. knowledge of the types of operations and gear in use, as well as be able to communicate in the local languages of English and Afrikaans.

Table 4.1:Recommended Measures to Mitigate the Impact of Exclusion on Fishing Operations.

No.	Mitigation Measure
1	Timing of the seismic survey to avoid periods of peak fishing activity during June and July is recommended in order to reduce the probability of disruption to the large pelagic longline fishing sector.
2	At least three weeks prior to the commencement of seismic survey activities the following key stakeholders should be consulted and informed of the proposed seismic survey programme (including navigational co-ordinates of location, timing and duration of proposed activities) and the likely implications thereof (specifically the exclusion and safety zone around the seismic vessel): Fishing industry associations: SA Tuna Association; SA Tuna Longline Association, Fresh Tuna Exporters Association, South African Deepsea Trawling Industry Association (SADSTIA), South African Hake Longline Association (SAHLLA). Other key stakeholders: South African Navy Hydrographic Office (SANHO), South African Maritime Safety Association, Ports Authority and the DFFE Vessel Monitoring, Control and Surveillance Unit in Cape Town. These stakeholders should again be notified at the completion of the project when the survey and support vessels are off location.
3	Request, in writing, the SANHO to broadcast a navigational warning via Navigational Telex (Navtex) and Cape Town radio for the duration of the seismic survey activity. Distribute a Notice to Mariners prior to the commencement of the seismic survey operations. The Notice to Mariners should give notice of (1) the co-ordinates of the survey area, (2) an indication of the proposed survey timeframes, (3) the dimensions of the towed gear array and dimensions of the safety zone around the seismic vessel, and (4) provide details on the movements of support vessels servicing the project. This Notice to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.
4	An experienced Fisheries Liaison Officer (FLO) should be placed on board the seismic or escort vessel to facilitate communications with fishing vessels in the vicinity of the seismic survey area.
6	The lighting on the seismic and support vessels should be managed to ensure that they are sufficiently illuminated to be visible to fishing vessels, as well as ensure that it is reduced to a minimum compatible with safe operations.
7	Ensure project vessels fly standard flags and lights to indicate that they are engaged in towing surveys and are restricted in manoeuvrability.
7	Notify any fishing vessels at a radar range of 12 nm from the seismic vessel via radio regarding the safety requirements around the seismic vessel.
8	Implement a grievance mechanism in case of disruption to fishing or navigation.

Residual Impact

This potential impact cannot be eliminated because the seismic vessels are needed to undertake the survey and a safety zone will be enforced around the vessel during routine operations. Timing the survey to avoid taking place during the months of June and July (periods of seasonally high fishing effort; see Figure 3.28) could lead to a residual impact of LOW NEGATIVE significance on the large pelagic longline sector (see Table 4.2).

Table 4.2: Impact of Exclusion of the Large Pelagic Longline Sector from access to Fishing Ground.

Impact of Exclusion of Large Pelagic Longline Operations within the Reconnaissance Permit area		
Aspect	Rating	Residual Impact
Nature	Negative	Negative
Extent	Regional (Extends between 5 and 50 km from the site)	Regional (Extends between 5 and 50 km from the site)
Duration	Immediate (Over the duration of the survey ~70 days)	Immediate (Over the duration of the survey ~70 days)
Magnitude/Intensity	High (Where fishing operations are altered to the extent that they could temporarily cease within the affected area)	High (Where fishing operations are altered to the extent that they could temporarily cease within the affected area)
Reversibility	Reversible (Without additional time or cost)	Reversible (Without additional time or cost)
Probability	High (>75% probability of occurring)	Medium (>50% and <75% probability of occurring)
Significance	**Medium Negative** **(The impact could be a significant risk)**	**Low Negative** **(This impact is unlikely to be a significant risk)**
Cumulative Potential	**Medium Negative**	**Medium Negative**

Table 4.3: Impact of Exclusion of the Tuna Pole-Line Sector from access to Fishing Ground.

Impact of Exclusion of Tuna Pole-Line Operations within the Reconnaissance Permit area		
Aspect	Rating	Residual Impact
Nature	Negative	Negative
Extent	Regional (Extends between 5 and 50 km from the site)	Regional (Extends between 5 and 50 km from the site)
Duration	Immediate (Over the duration of the survey ~70 days)	Immediate (Over the duration of the survey ~70 days)
Magnitude/Intensity	Low (Where fishing operations may be slightly affected)	Low (Where fishing operations may be slightly affected)
Reversibility	Reversible	Reversible

	(Without additional time or cost)	(Without additional time or cost)
Probability	Low (>25% and <50% probability of occurring)	Low (>25% and <50% probability of occurring)
Significance	**Low Negative** (The impact is unlikely to be a significant risk)	**Low Negative** (This impact is unlikely to be a significant risk)
Cumulative Potential	**Low Negative**	**Low Negative**

4.2 IMPACT OF SOUND ON CATCH RATES

Source of Impact

The project activities that can result in an impact on catch rates are listed below.

Activity phase	Activity
Mobilisation	N/A
Operation	Seismic acquisition operations
Demobilisation	N/A

The airgun array for the 3D seismic survey is proposed to be the Sercel G-Gun II 2 620 CUI Source Array. The array consists of 20 active airgun units, has a towing depth of 6.0 m and an operating pressure of 2 000 pounds per square inch (PSI).

The primary output of a seismic airgun source typically has most of the energy in the frequency bandwidth between 5 and 300 Hz. The maximum sound pressure levels at the source of airgun arrays in use today in the seismic industry are in the range 230-255 dB re 1 µPa at 1 m, with the majority of their produced energy being low frequency of 10-100 Hz (McCauley 1994; NRC 2003). For the current project, the peak sound pressure levels (Pk SPL) for the 3D array is expected to be 256.4 dB re 1 µm @ 1m. The sound exposure levels (SEL) is expected to be 232.4 dB re 1 µm @ 1m

Description of Impact

In addition to the potential impacts of exclusion to fishing areas, international research has shown that the noise energy generated during seismic surveys may cause mortality, physiological damage, masking effects and/or behavioural responses in fish and invertebrates (Carroll *et al* 2017). As such, the possible effects of seismic sound on species relevant South African fisheries are considered. Differences in morphology and behaviour between species means that species vary in their vulnerability to seismic noise, and generalisations across groups are not easily made. The potential impact of elevated underwater sound on fish can be grouped into four types of affects:

- **Mortality or lethal effects:** life-threatening physical injuries, including death and severe physical injury. Fish mortality is associated with very high source noise levels and fish in close proximity to the noise source (for example, underwater explosions). Susceptibility to mortality at a particular sound level can vary between fish species, for example shellfish and fish without swim bladders can typically survive higher noise levels.
- **Physical (or physiological) effects:** non-life-threatening physical injuries, such as temporary or permanent auditory damage. The type and severity of physiological effects at different noise

levels can differ between species. Some fish detect and respond to sound predominantly by detecting particle motion in the surrounding fluid while others are capable of detecting sound pressure via the gas bladder.

- **Masking effects:** the reduction in the detectability of a sound as a result of the simultaneous occurrence of another noise. Masking noise interferes with the ability of the animal to detect and respond to biologically important sounds.
- **Behavioural effects:** include perceptual, stress and indirect effects, of which the most common are startle responses or avoidance of an area. Behavioural responses can vary between species and sometimes extend over large distances, until the noise decreases below the background sound level.

Summarised below are some of the main findings relevant to the assessment of effects on fisheries:

- Generally, fish species with specialisations for sound pressure detection (e.g. swim bladder) have lower sound pressure thresholds and respond at higher frequencies than fishes lacking these morphological adaptations.
- Evidence suggests that pelagic species have more sensitive hearing (thresholds at lower frequencies) than demersal species.
- Cartilaginous fishes (e.g. sharks) have the highest sensitivity to low frequency sound (~20 Hz to ~1500 Hz) (Myrberg, 2001). Since this group lacks a swim bladder, their detection capabilities are restricted to the particle motion component of sound (Myrberg, 2001; Casper et al., 2012).
- A range of damaging physical effects due to airgun noise have been described for fish, including swim-bladder damage, transient stunning, short-term stress responses, temporary hearing loss, haemorrhaging, eye damage and blindness. However, studies have shown that physical damage to fish caused from seismic sources occurs only in the immediate vicinity of the airguns, in distances of less than a few meters (Gausland 2003).
- Adult and juvenile fish have been shown to display several behavioural responses to seismic sound. These include leaving the area of the sound source by swimming away and changing depth distribution, changing schooling behaviour and startle responses to short range start up. Behavioural responses to seismic sound could lead to decreased catch rates if fish move out of important fishing grounds (Hirst and Rodhouse 2000).
- Studies indicate that offshore seismic survey activity had no effect on catch rates of crustaceans in the surrounding area (Andriguetto-Filho et al. 2005; Parry & Gason 2006), and little effect on reef invertebrates (crustaceans, echinoderms and molluscs) exposed to commercial seismic airgun noise (Wardle et al. 2001).
- The abundance and spatial distribution of fish and invertebrate larvae and eggs is highly variable and dependent on factors such as fecundity, seasonality in production, tolerances to temperature, length of time spent in the water column, hydrodynamic processes and natural mortality. Due to their importance in commercial fisheries, numerous studies have been undertaken experimentally exposing the eggs and larvae of various species to airgun sources (reviewed in McCauley, 1994). Physiological effects on eggs and larvae of a seismic array have been demonstrated to a distance of 5 m from the acoustic source (Kostyuchenko 1971). When compared with total population sizes and natural daily mortality rates, the impact of seismic sound sources on fish eggs and larvae could be considered insignificant (McCauley, 1994; Dalen and Maested 2008). The wash from ships propellers and bow waves can be

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expected to have a similar, if not greater, volumetric effect on plankton than the sounds generated by airgun arrays.

- For squid and other cephalopods a 2 - 5 km zone of acoustic influence is assumed around the acoustic source point.

Threshold levels for underwater noise impacts on fish have been the subject of research over many years, however much of that research has focused on the potential for physiological effects (injury or mortality) rather than on quantifying and relating noise levels with behavioural effects. A review of the literature and guidance on appropriate thresholds for assessment of underwater noise impacts is provided in the 2014 Acoustical Society of America (ASA) Technical Report *Sound Exposure Guidelines for Fishes and Sea Turtles* (Popper et al., 2014)[24].

The ASA Technical Report includes thresholds for mortality (or potentially mortal injury) as well as degrees of impairment such as temporary or permanent threshold shifts (TTS or PTS, indicators of hearing damage). Separate thresholds are defined for peak noise and cumulative impacts (due to continuous or repeated noise events) and for different noise sources (e.g. explosives, pile driving, and continuous vessel noise, drilling or dredging). In relation to fish behavioural impacts, the ASA Technical Report includes a largely qualitative discussion, focusing on long term changes in behaviour and distribution rather than startle responses or minor movements. The ASA qualitative approach to responses to seismic airguns includes definitions of effects at three distances from the source defined in relative terms: Near (N): this distance typically refers to fish within tens of meters from the noise source; Intermediate (I): distances within hundreds of meters from the noise source; and Far (F): fish within thousands of meters (kilometres) from the noise source. The risk is described qualitatively as low, moderate or high.

Sensitivity and hearing range is highly variable amongst fish species. Fish species which may be affected by underwater disturbances may broadly be grouped into three categories; cartilaginous fish without gas-filled chambers or swim bladders, fish with swim bladders where hearing is independent of gas-filled chambers or swim bladders, and lastly fish which are most sensitive to sound pressure through otophysic connections between pressure receptive organs and the inner ear (Carroll *et al.* 2017). Data indicates that fish possessing a swim bladder are more sensitive to impulsive sounds, such as those generated by airguns, than fish without swim bladders (Popper *et al.*, 2014). Table 4.4 lists the peak SPL and cumulative SEL at which different types of effects have been identified for each of these categories of fish (Popper *et al.*, 2014). Based on these noise exposure criteria, relatively high to moderate behavioural risks to fish without a swim bladder are expected at near to intermediate distances (tens to hundreds of meters) from the source location. Relatively low behavioural risks are expected at far field distances (thousands of meters) from the source location. For fish species with a swim bladder that is involved in hearing, relatively high behavioural risk is expected at near to intermediate distances, and moderate behavioural risk at far field distances from the source.

Studies have shown that physical damage to fish caused from acoustic sources occurs only in their immediate vicinity, in distances of less than a few meters (Gausland 2003). Whilst adult fish can flee from this noise, eggs and larvae are unable to do so and therefore may be affected by an acoustic pulse.

As a general guideline, the sound ranges of 161 to 166 dB re 1 µPa RMS may be used as a suitable indicator sound pressure level at which behavioural modifications of fish start to take place. Behavioural effects are generally short-term, however, with duration of the effect being less than or equal to the

[24] See also: Hawkins, A.D., Pembroke, A.E. and A.N. Popper. 2014. Information gaps in understanding the effects of noise on fishes and invertebrates. Rev Fish Biol Fisheries (2015) 25:39-64

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duration of exposure, although these vary between species and individuals, and are dependent on the properties of the received sound.

Table 4.4: Noise exposure criteria for seismic airguns and acoustic thresholds for fish (Popper et al., 2014)

Type of animal	Mortality and potential mortal injury	Impairment			Behaviour
		Recovery injury	TTS	Masking	
Fish: no swim bladder (particle motion detection)	>219 dB SEL_{24hr} or >213 dB Pk SPL	>216 dB SEL_{24hr} or >213 dB Pk SPL	>>186 dB SEL_{24hr}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: swim bladder is not involved in hearing (particle motion detection)	210 dB SEL_{24hr} or >207 dB Pk SPL	209 dB SEL_{24hr} or >207 dB Pk SPL	>>186 dB SEL_{24hr}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: swim bladder involved in hearing (primarily pressure detection)	207 dB SEL_{24hr} or >207 dB Pk SPL	203 dB SEL_{24hr} or >207 dB Pk SPL	186 dB SEL_{24hr}	(N) Low (I) Low (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae	>210 dB SEL_{24hr} or >207 dB Pk SPL	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Notes: peak sound pressure levels (Pk SPL) dB re 1 µPa; Cumulative sound exposure level (SEL_{24hr}) dB re 1 μPa^2-s. Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

Behavioural responses to impulsive sounds are varied and include leaving the area of the noise source (Dalen and Raknes 1985; Dalen and Knutsen 1987; Løkkeborg 1991; Skalski et al. 1992; Løkkeborg and Soldal 1993; Engås et al. 1996; Wardle et al. 2001; Engås and Løkkeborg 2002; Hassel et al. 2004), changes in depth distribution and feeding behaviour (Chapman and Hawkins 1969; Dalen 1973; Pearson et al. 1992; Slotte et al. 2004), spatial changes in schooling behaviour (Slotte et al. 2004), and startle response to short range start up or high level sounds (Pearson et al. 1992; Wardle et al. 2001). Behavioural responses could lead to decreased catch rates if fish move out of important fishing grounds (Hirst and Rodhouse 2000) or if they reduce interest in bait or change fish's behaviour such that usual capture methods are less effective (Hirst & Rodhouse, 2000). Table 4.4 provides a summary list of studies showing reductions in catch rates of fish during and after seismic surveys.

The observed declines in catch rates differed considerably from study to study as did the distance from the seismic sound source at which reductions in catch rates were measured. Hirst and Rodhouse (2000) compiled the results of a number of results from experiments, which indicated a range from 1 km to greater than 33 km. The observed duration of impacts ranged from approximately 12 hours to up to 10 days. Variability in findings is related to the sensitivity of different fish species to noise, the gear-type used across different fisheries, and abiotic factors e.g. water depth, which affects the transmission of sound in water. Table 4.5 summarises catch reductions for Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*) and rockfish (*Sebastes spp.*).

Table 4.5: Summary list of studies showing evidence of a reduction in fish catch rates as a result of seismic survey activity (Council, A.M.C. 2014).

Species	Gear type	Noise level of seismic testing	Catch reduction	Source
Atlantic cod (*Gadus morhua*)	Trawl	250 dB	46-69% lasting at least 5 days	Engas et al. 1993
	Longline	250 dB	17-45% lasting at least 5 days	Engas et al. 1993
	Longline	Undetermined, 9.32 miles from source	55-79% lasting at least 24 hours	Løkkeborg and Soldal, 1993
Haddock (*Melanogrammus aeglefinus*)	Trawl	250 dB	70-72% lasting at least 5 days	Engas et al. 1993
	Longline	250 dB	49-73% lasting at least 5 days	Engas et al. 1993
Rockfish (*Sebastes* spp.)	Longline	223 dB	52% - effect period not determined	Skalski et al. 1992

Avoidance effects or behavioural alterations from seismic surveys involving many fish species do not automatically imply risk factors and thus do not necessarily cause a disturbance to the fishery[26] (McCauley et al., 2000). A recent large-scale experiment conducted by Meekan *et al.* (2021) in Australia showed no short-term or long-term effects on the abundance or behaviour of demersal fish assemblages in response to a commercial seismic source. This suggests that seismic surveys have little impact on demersal fishes. Other studies that found no evidence of significant changes in catch rates or fish abundance include Hassel et al. 2004, Picket *et al.* 1994, Miller and Cripps 2013 and Thomson *et al.* 2014.

A Sound Transmission Loss Modelling (STLM) study for the proposed activities was undertaken by SLR in order to forecast sound levels of various metrics, including peak sound pressure levels (Pk SPLs), root-mean-square sound pressure levels (RMS SPLs), and single-pulse and cumulative sound exposure levels (SELs) at receiving locations within and adjacent to the proposed survey area. These noise levels were used to estimate the threshold distances to potential sound effects on marine species of interest, including fish.

The following components were included in the model:

- Airgun source modelling – modelling of the sound energy emissions from Source Array proposed to be used in the survey, including its far-field signature and power spectral density (PDS), as well as the beam pattern of the source array;
- Short-range modelling – prediction of the received noise levels over a range of up to four kilometres from the selected array source locations at various depths, in order to investigate sound field variations due to the water depth changes. Short range modelling is used to assess the potential high-risk immediate noise impact to marine fauna species of interest;
- Long-range modelling – prediction of the received noise levels over a range of up to two hundred kilometres from the selected array source locations. This modelling assesses the noise impacts from the survey on relevant far-field sensitive marine areas; and

[26] For example, a study conducted by Wardle et al. (2001) monitored the behaviour of fish and invertebrates on a rocky Scottish reef. Here a video system was used to observe potential responses and seismic acoustic source blasts were carefully calibrated to have a peak level of 210 dB re 1 µPa at 15 m from the source and 195 dB re 1 µPa at 109 m from the source. Only minor behavioural responses to seismic activity was observed. However, no animals appeared to leave the reef and more importantly, no permanent changes in the behaviour of the fish or invertebrates on the reef was observed. Meekan et al. (2021), found no evidence to suggest that the use of a commercial seismic source affects the abundance, size-structure, behaviour, or movement of demersal fishes.

- Cumulative noise exposure modelling – prediction of the received cumulative SELs over a 24-hour period (SEL24hr) for selected representative survey scenarios adjacent to marine sensitive areas, to assess the potential cumulative noise impact to marine fauna species of interest.

The results of the STLM study (SLR 2021) were used to identify zones of impact for fish species (amongst other marine fauna species of concern) based on relevant noise impact assessment criteria. The noise effects assessed included physiological effects (physical injury/permanent threshold shift (PTS) and temporary threshold shift (TTS)) and behavioural disturbance due to either immediate impact from single airgun pulses or cumulative effects of exposure to multiple airgun pulses over a period of 24 hours. Table 4.6 outlines the predicted maximum SELs and the estimated Pk SPLs and RMS SPL across the water column for all azimuths as a function of horizontal distance from the seismic airgun source array, for water depth range within the proposed survey area, based on the short range SEL modelling results of the report.

Table 4.6: The maximum SELs, Pk SPLs and RMS SPL across the water column for all azimuths as a function of distance from the source array for water depth range within the survey area (SLR, 2021)

Horizontal distance from the source array, m	The predicted maximum levels across the water column for all azimuths, for water depth range within the survey area (2D/ 3D)		
	SEL, dB re 1 µPa²·s	Pk SPL, dB re 1µPa	RMS SPL, dB re 1µPa
10	209 / 206	230 / 231	227 / 225
20	202 / 201	223 / 224	220 / 218
50	195 / 193	216 / 217	213 / 211
90	191 / 189	212 / 213	209 / 207
100	189 / 187	210 / 211	207 / 205
200	183 / 181	204 / 205	199 / 197
500	174 / 172	195 / 196	186 / 184
800	172 / 169	193 / 194	183 / 181
1 000	169 / 167	190 / 190	179 / 177
2 000	162 / 159	183 / 184	171 / 169
4 000	155 / 153	176 / 177	162 / 160

Project Controls

The Seismic contractor will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and BAT regarding fisheries management.

Sensitivity of Receptors

Sensitivity herein considers the extent of fishing ground, ability of the fishing industry to operate as expected considering a project-induced change to their normal fishing operations (linked in part to fishing gear type and vessel manageability), as well as the vulnerability of the targeted fish species.

The greatest risk of physiological injury from seismic sound sources is for species with swim-bladders (e.g. hake and other demersal species targeted by demersal longline and demersal trawl fisheries). In many of the large pelagic species, swim-bladders are either underdeveloped or absent and the risk of physiological injury through damage of this organ is therefore lower (Pisces, 2021). However, two of the four tuna species targeted in South African fisheries, *Thunnus albacares* (yellowfin) and *T. obesus* (bigeye), do have swim bladders (Collette & Nauen, 1983) and so may be physically vulnerable.

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In the case of the large pelagic longline and tuna pole-line sectors, the targeted fish stock may only be available in a specific area for a specific period of time. Relocation to an alternative area may not be viable as the preferred area is predicated on the resource being available at a specific time and place.

The sensitivity of the large pelagic longline sector is considered to be high. Noise levels are expected to drop to below threshold levels for behavioural disturbance before reaching areas fished by the remaining sectors viz. demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, traditional linefish, west coast rock lobster, small-scale fisheries and netfish sectors (beach-seine and gillnet).

Impact Assessment

The zones of impact on fish of impulsive signal emissions from the array source are presented in Table 4.7. The results relate only to physiological effects on fish. The zones of potential injuries were predicted to be within 160 m from the 3D array for fish species with a swim bladder and 80 m for fish species without a swim bladder. The zone of potential impact was predicted to be within 160 m for fish eggs and larvae.

Based on the noise exposure criteria provided by Popper et al. (2014) for fish that use a swim bladder for hearing, relatively high behavioural risks are expected at near to intermediate distances (tens to hundreds of meters) from the source location. Relatively moderate behavioural risks are expected for at far field distances (thousands of meters) from the source location.

The cumulative sound fields based on one assumed 24-hour survey operation were modelled and the zones of cumulative impact (i.e. the maximum horizontal perpendicular distances from assessed survey lines to cumulative impact threshold levels) are presented in Table 4.6. The zones of potential mortal injuries for fish species with and without a swim bladder, and for fish eggs and larvae are predicted to be within 50 m from the survey lines. For recoverable injury, the zones of impact are predicted to be within 20 m from the survey lines for fish without a swim bladder, and within 200 m for fish with a swim bladder. The zones of TTS effect for fish species with and without swim bladders are predicted to be within 3.5 km from the survey lines for the 3D survey 24-hour operation scenarios considered.

Existing experimental data regarding recoverable injury for fish eggs and larvae is sparse and no guideline recommendations have been provided. However, based on a subjective approach, noise impacts for fish eggs and larvae are expected to be moderate at the near field (i.e. in the distance of tens of meters) from the source location, low at intermediate (i.e. in the distance of hundreds of meters) and far field (i.e. in the distance of thousands of meters) from the source location.

Table 4.7: Zones of immediate impact from single pulses (2D / 3D seismic airgun arrays) for mortality and recoverable injury for fish, fish eggs and fish larvae (SLR, 2021).

Type of animal	Zones of impact – maximum horizontal distances from source to impact threshold levels			
	Mortality and potential mortal injury		Recovery injury	
	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m
Fish: no swim bladder (particle motion detection)	> 213	70 / 80	>213	70 / 80

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Type of animal	Zones of impact – maximum horizontal distances from source to impact threshold levels			
	Mortality and potential mortal injury		Recovery injury	
	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m
Fish: swim bladder is not involved in hearing (particle motion detection)	>207	140 / 160	>207	140 / 160
Fish: swim bladder involved in hearing (primarily pressure detection)	>207	140 / 160	>207	140 / 160
Fish eggs and fish larvae	>207	140 / 160	-	-

Table 4.8: Zones of cumulative impact from multiple pulses (2D / 3D seismic airgun arrays) for mortality and recoverable injury for fish, fish eggs and fish larvae (SLR, 2021).

Type of animal	Zones of impact – maximum horizontal perpendicular distances from assessed survey lines to cumulative impact threshold levels (2D / 3D)					
	Mortality and potential mortal injury		Recoverable injury		TTS	
	Criteria - SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m	Criteria - SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m	Criteria - SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m
Fish: no swim bladder (particle motion detection)	219	< 10	216	15 / 20	186	2 000 / 3 500
Fish: swim bladder is not involved in hearing (particle motion detection)	210	20 / 30	203	80 / 200	186	2 000 / 3 500
Fish: swim bladder involved in hearing (primarily pressure detection)	207	40 / 60	203	80 / 200	186	2 000 / 3 500
Fish eggs and fish larvae	210	20 / 30	-	-	-	-

Pulfrich (2022) concluded that the impact of the acoustic source on fish eggs and larvae accounts for an insignificant amount of mortality compared to the natural mortality rate per day for most fish species at that life stage. The Reconnaissance Permit area does not coincide with spawning areas of key commercial fish species.

The overall effects on the fishing industry of physiological injury to fish as a result of the proposed surveys is considered to be of overall LOW NEGATIVE significance (with mitigation) on the large pelagic longline sector, the only sector that operates within the Reconnaissance Permit application area.

The zones of impact of pulsed sounds on behavioural responses of fish were not modelled in the STLM because of the variability in published findings on the topic. However, if a precautionary approach is adopted, a sound range of 161 to 166 dB re 1 µPa RMS may be used as an indicator of the sound

pressure level at which behavioural modifications of fish start to take place. The STLM results predict a RMS SPL of 162 dB re 1µPa at a horizontal distance of 4 km from the airgun array (SLR 2021). For the purposes of this assessment, we have assumed that the catch rates to a distance of 4 km from the Reconnaissance Permit area could be affected. Based on the location of the Reconnaissance Permit area, the noise generated during the survey would be expected to the large pelagic longline and tuna pole-line sectors. Because the sector operates across the extent of the Reconnaissance Permit area, the affected area is considered to be of regional extent. Behavioural effects are generally immediate, with duration of the effect being less than or equal to the duration of exposure.

The noise generated during the survey would be expected to attenuate to below threshold levels for behavioural disturbance before reaching the fishing grounds of all other sectors viz. demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, traditional linefish, west coast rock lobster, small-scale fisheries and net fisheries. The Reconnaissance Permit area does not overlap with spawning areas of key commercial species (and the timing of the proposed survey is not expected to coincide with peak spawning periods).

Noise would be expected to attenuate to below threshold levels for behavioural disturbance before reaching inshore recruitment and/or nursery areas. Due to the location of the Reconnaissance Permit area in the deepwater environment, sound generated during the survey is not expected to influence the spawning behaviour or migration route of snoek (a species of key importance to the linefish and small-scale fisheries sectors). The Reconnaissance Permit area is situated well offshore of the shelf break which is where snoek are known to spawn during winter-spring.

The impact of sound on the large pelagic longline sector is assessed to be of overall MEDIUM NEGATIVE significance before mitigation, whereas the impact on the tuna pole-line sector is assessed to be of overall LOW NEGATIVE significance. Due to the distance of the Reconnaissance Permit area from fishing grounds, the sound is likely to attenuate to below threshold levels for behavioural disturbance of all other fisheries sectors viz. the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, traditional linefish, west coast rock lobster, small-scale fisheries and netfish sectors. There is no impact expected on these sectors.

Mitigation

The potential for mitigation includes effective communications with fishing sectors which could allow vessel operators the opportunity to plan fishing operations in areas unaffected by the presence of the survey vessel. During survey operations, it may be possible for operators to relocate fishing effort into areas of the Reconnaissance Application area that are unaffected by the presence of the survey area if adequate and up-to-date survey information is provided on a daily and/or weekly basis to key fishing fleets. The mitigation measure proposed in the marine faunal assessment report (Pulfrich 2022) is that the sound source should be ramped up to full operating volume over a period of 20 minutes (termed a "soft-start") thus allowing fish to avoid potential physiological injury. It is unlikely that this would mitigate effects on catch rates in the wider area. Furthermore, it is recommended that the survey is timed to avoid taking place during the months of high seasonal fishing activity by the large pelagic longline sector, this being the months of June and July (refer to Figure 3.28). A Fisheries Liaison Officer (FLO) should be present on site for the duration of the survey, either stationed on board the survey vessel or the escort vessel. Such a person should be familiar with the types of fisheries sectors in the region i.e. knowledge of the types of operations and gear in use, as well as be able to communicate in the local languages of English and Afrikaans. A list of proposed mitigation measures is included in Table 4.9.

Table 4.9: Recommended Mitigation Measures for Noise Effects on Fisheries.

No.	Mitigation measure
1	The seismic survey should avoid taking place during periods of peak fishing activity (June and July) in order to reduce the probability of disruption to the large pelagic longline fishing sector.
2	At least three weeks prior to the commencement of seismic survey activities the following key stakeholders should be consulted and informed of the proposed seismic survey programme (including navigational co-ordinates of location, timing and duration of proposed activities) and the likely implications thereof (specifically the exclusion and safety zone around the seismic vessel): Fishing industry associations: SA Tuna Association; SA Tuna Longline Association and Fresh Tuna Exporters Association. Other key stakeholders: SANHO, SAMSA, National Ports Authority and the DFFE Vessel Monitoring, Control and Surveillance Unit in Cape Town. These stakeholders should again be notified at the completion of the project when the survey and support vessels are off location.
3	Request, in writing, the broadcast by SANHO of a navigational warning via Navigational Telex (Navtex) and Cape Town radio for the duration of the seismic survey activity. Distribute a Notice to Mariners prior to the commencement of the seismic survey operations. The Notice to Mariners should give notice of (1) the co-ordinates of the survey area, (2) an indication of the proposed survey timeframes, (3) the dimensions of the towed gear array and dimensions of the safety zone around the seismic vessel and (4) provide details on the movements of support vessels servicing the project. This Notice to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.
4	An experienced Fisheries Liaison Officer (FLO) should be placed on board the seismic or escort vessel to facilitate communications with fishing vessels in the vicinity of the seismic survey areas.
5	Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source if during daylight hours it is confirmed visually by the MMO during the pre-shoot watch (60 minutes) that there are no shoaling large pelagic fish within 500 m of the seismic source.
6	In the case of shoaling large pelagic fish being observed within the mitigation zone, delay the "soft-start" until animals are outside the 500 m mitigation zone. Terminate seismic shooting on • Observation of slow swimming large pelagic fish (including whale sharks, basking sharks, and manta rays) within the 500 m mitigation zone. • Observation of any obvious mass mortalities of fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO to be as a direct result of the survey. For slow swimming large pelagic fish, terminate shooting until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required).
7	For the duration of the survey, circulate a daily survey schedule (look-ahead), via email, to key fishing associations.
8	Establish a functional grievance mechanism that allows stakeholders to register specific grievances related to operations, by ensuring they are informed about the process and that resources are mobilized to manage the resolution of all grievances, in accordance with the Grievance Management procedure.

Residual Impact

With the implementation of recommended mitigation measures, the residual impact of sound generated during the proposed survey is assessed to be of LOW NEGATIVE overall significance to the large pelagic longline and tuna pole-line sectors. There is no impact expected on the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, traditional linefish, west coast rock lobster, small-scale and netfish sectors.

Table 4.10: Impact of Underwater Sound on the Large Pelagic Longline Sector.

Impact of Underwater Sound on the Large Pelagic Longline Sector		
Aspect	Rating	Residual Impact
Nature	Negative	Negative
Extent	Regional (Extends between 5 and 50 km from the site)	Regional (Extends between 5 and 50 km from the site)
Duration	Immediate (Over the duration of the survey ~ 70 days)	Immediate (Over the duration of the survey ~70 days)
Magnitude/Intensity	High (Where fishing operations are altered to the extent that they could temporarily cease within the affected area)	High (Where fishing operations are altered to the extent that they could temporarily cease within the affected area)
Reversibility	Reversible (Without additional time or cost)	Reversible (Without additional time or cost)
Probability	High (>75% probability of occurring)	Medium (>50% and <75% probability of occurring)
Significance	**Medium Negative** **(The impact could be a significant risk)**	**Low Negative** **(This impact is unlikely to be a significant risk)**
Cumulative Potential	**Medium Negative**	**Medium Negative**

Table 4.11: Impact of Underwater Sound on the Tuna Pole-Line Sector.

Impact of Underwater Sound on the Tuna Pole-Line Longline Sector		
Aspect	Rating	Residual Impact
Nature	Negative	Negative
Extent	Regional (Extends between 5 and 50 km from the site)	Regional (Extends between 5 and 50 km from the site)
Duration	Immediate (Over the duration of the survey ~70 days)	Immediate (Over the duration of the survey ~70 days)
Magnitude/Intensity	Low (Where fishing operations may be slightly affected)	Low (Where fishing operations may be slightly affected)
Reversibility	Reversible (Without additional time or cost)	Reversible (Without additional time or cost)
Probability	Low (>25% and <50% probability of occurring)	Low (>25% and <50% probability of occurring)
Significance	**Low Negative** **(The impact is unlikely to be a significant risk)**	**Low Negative** **(This impact is unlikely to be a significant risk)**
Cumulative Potential	**Low Negative**	**Low Negative**

4.3 UNPLANNED EVENTS

4.3.1 ACCIDENTAL RELEASE OF OIL AT SEA

Description and Source of Impact

The project activities that could result in an accidental release of diesel / oil are listed below are provided below:

Project phase	Activity
Mobilisation	Vessel accident
Operation	Bunkering of fuel
	Vessel accident
Demobilisation	Vessel accident

These activities are described further below:

- Small instantaneous spills of marine diesel at the surface of the sea can potentially occur during operation during bunkering and such spills are usually of a low volume.
- Larger volume spills of marine diesel could occur in the event of a vessel collision or vessel accident.

Oil spilled in the marine environment would have an immediate detrimental effect on water quality, with toxic effects potentially resulting in mortality (e.g. suffocation and poisoning) or sub-lethal (e.g. respiratory damage) effects on marine fauna. An oil spill can also result in several indirect impacts on fishing. These include:

- Exclusion of fisheries from polluted areas and displacement of targeted species from normal feeding / fishing areas, both of which could potentially result in a loss of catch and / or increased fishing effort;
- Mortality of animals (including eggs and larvae) leading to reduced recruitment and loss of stock (e.g. mariculture); and
- Gear damage due to oil contamination.

Oil contamination could potentially have the greatest impact on commercial fisheries for rock lobster and sessile filter feeders (e.g. mussels) and grazers (e.g. abalone). Mortality is expected to be high on filter feeders and, to a lesser extent, grazers. These species have low mobility and no means to escape contamination and ultimately mortality. Thus, mariculture facilities could be impacted if a spill extended into these areas. For a large oil spill, fishing / mariculture activities and revenues could be affected over a wide area until such time as the oil has either been dispersed or broken down naturally.

Project Controls

The operator will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and best available techniques. The primary mitigation measure for avoiding the impacts of an accidental oil spill is to prevent any such spill from taking place. This is done through both technology applications, as well as operational controls. An escort vessel with appropriate radar and communications will be used during the operation to warn vessels that are in danger of breaching the safety/exclusion zone.

In the event of a spill incident, the project will implement an emergency response system to mitigate the consequences of the spill.

- Regulation 37 of MARPOL Annex I will be applied, which requires that all ships of 400 gross tonnage and above carry an approved Shipboard Oil Pollution Emergency Plan (SOPEP). The purpose of a SOPEP is to assist personnel in dealing with unexpected discharge of oil, to set in motion the necessary actions to stop or minimise the discharge, and to mitigate its effects on the marine environment.
- Project vessels will be equipped with appropriate spill containment and clean-up equipment, e.g. dispersants and absorbent materials. All relevant vessel crews will be trained in spill clean-up equipment use and routine spill clean-up exercises.

Sensitivity of Receptors

The sensitivity of the various fishing sectors that operate in the Reconnaissance Permit area is considered to be medium, as a diesel slick would be blown in a north-westerly direction due to the dominant winds and currents off the West Coast, remaining at the surface for less than 36 hours (PRDW 2013). Both Saldanha Bay and St Helena Bay support nearshore mariculture activities. These activities are far removed from the Reconnaissance Permit area and as such the sensitivity for mariculture is considered to be medium.

Impact assessment

The Reconnaissance Permit area coincides with fishing grounds used by the large pelagic longline sector only. Thus, any spill within the Reconnaissance Permit application area, could impact this sector. The dominant wind and current direction will ensure that any spill in the survey area is dispersed in a north-westerly direction away from the more actively fished areas inshore of the Reconnaissance Permit application area. An offshore spill is likely to disperse rapidly (days). Without the implementation of mitigation measures, the potential impact on the offshore fishing sectors is considered to be of local extent for small instantaneous spills, of regional for larger volume spills and of moderate magnitude in the short-term. The potential impact on commercial fishing operations is assessed to be of LOW NEGATIVE significance due to the improbable likelihood of such an event occurring.

In the case of a spill *en route* to the survey area (i.e. during a vessel accident), the spill may reach the coastline. Nearshore fishing (linefish and small-scale fisheries) and mariculture operations (abalone and mussel) would be at risk of the effects of an oil spill (refer to the marine fauna assessment report (Pulfrich, 2022)). The greatest risk of contamination is on sessile filter feeding (e.g. mussels and oysters) and grazing species (e.g. abalone) via physical clogging and or direct absorption of the contaminant, leading to mortality.

Mitigation Measures

Recommended mitigation measures are provided in Table 4.12.

Table 4.12: Recommended mitigation measures for Accidental Release of Oil at Sea.

No.	Mitigation measure
Oil Spills	
1	Ensure personnel are adequately trained in both accident prevention and immediate response, and resources are available on each vessel.
2	Obtain permission from DFFE to use low toxicity dispersants. Use cautiously.
3	Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station.
Bunkering at sea	
4	Ensure offshore bunkering is not undertake in the following circumstances: • Wind force and sea state conditions of ≥6 on the Beaufort Wind Scale; • During any workboat or mobilisation boat operations; • During helicopter operations; • During the transfer of in-sea equipment; and • At night or times of low visibility.
Equipment	
5	Ensure that solid streamers rather than fluid-filled streamers are used. Alternatively, low toxicity fluid-fill streamers could be used.

Residual Impact

With the implementation of the above-mentioned intrinsic mitigation measures (refer to Table 4.12), the residual impact would be of LOW NEGATIVE significance for offshore or for nearshore spills (see Table 4.13).

Table 4.13: Impact of Accidental Release of Oil at Sea on Fisheries Sectors.

Impact on fisheries of accidental release of oil at sea		
Aspect	**Rating**	**Residual Impact**
Nature	**Negative**	Negative
Extent	**Regional** **(Extends between 5 and 50 km from the site)**	Local
Duration	**Short term**	Immediate
Magnitude/Intensity	**Moderate**	**Low**
Reversibility	Reversible (With significant time and cost)	Reversible (With significant time and cost)
Probability	Improbable (>25% probability of occurring)	Improbable (>25% probability of occurring)
Significance	**Low Negative**	**Low Negative**

	(This impact is unlikely to be a significant risk)	(This impact is unlikely to be a significant risk)
Cumulative Potential	**Medium Negative**	**Low Negative**

4.3.2 LOSS OF EQUIPMENT AT SEA

Description and Source of Impact

The project activities are provided below:

Project phase	Activity
Mobilisation	N/a
Operation	Accidental loss of equipment to the water column or seabed
Demobilisation	N/A

These activities (or event) are described further below:

- Irretrievable loss of equipment to the seabed during seismic acquisition; and
- Accidental loss of paravanes, streamers, arrays, and tail buoys during seismic acquisition.

During seismic acquisition, the survey vessel tows a substantial amount of equipment; the deflectors or paravanes, which keep the streamers equally spread are towed by heavy-duty rope, and the streamers themselves are towed by lead-in cables. Each streamer is fitted with a dlit float at the head of the streamer, numerous streamer mounts (birds and fins) to control streamer depth and lateral positioning, and a tail buoy to mark the end of the streamer. Streamers are neutrally buoyant at the required depth, but have buoyancy bags embedded within them that inflate at depth. If streamers are accidentally lost, they would float in the water column for some time before sinking. Dlit floats and tail buoys would ultimately be dragged down under the weight of the streamer. Airguns are suspended under floats by a network of ropes, cables, and chains, with each float configuration towed by an umbilical. Should both the float and umbilical fail, the airguns would sink to the seabed.

The potential impacts (direct) associated with lost equipment include:

- Potential snagging of demersal gear with regards to equipment that sinks to the seabed; and
- Potential entanglement hazards with regards to lost streamers, arrays and tail buoys drifting on the surface or in the water column.

Project Controls

The operator will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice. All gear will be recovered after the survey, unless lost to sea.

Sensitivity of Receptors

Sensitivity here refers to the ability of the sector to operate as expected considering a project-induced events. Floating equipment (e.g. streamer) may become entangled with fishing gear (e.g. pelagic longlines). Thus, the sensitivity of fishing gear to lost equipment is considered to be medium.

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Impact Assessment

The accidental loss of equipment onto the seafloor would provide a localised area of hard substrate in an area of otherwise unconsolidated sediments. The Reconnaissance Permit area does not coincide with fishing grounds of any demersal fishing sectors thus snagging of demersal gear is considered to be unlikely.

The loss of streamers and floats could result in entanglement hazards in the water column before the streamers sink under their own weight. In the unlikely event of streamer loss, associated impact could be highly localised and limited to the site (although would potentially float around regionally) over the short-term. The impact magnitude for equipment lost to the water column is, therefore, considered to be low and of LOW NEGATIVE significance to the large pelagic longline fishery.

Mitigation Measures

The following measures are recommended:

Table 4.14: Recommended Mitigation Measures for Loss of Equipment at Sea.

No.	Mitigation measure
1	Ensuring that loads are lifted using the correct lifting procedure and within the maximum lifting capacity of the crane system
2	Minimise the lifting path between vessels.
3	Undertake frequent checks to ensure items and equipment are stored and secured safely on board each vessel.
4	Retrieval of lost objects / equipment, where practicable, after assessing the safety and metocean conditions. Establish a hazards database listing the type of gear left on the seabed and / or in the survey area with the dates of abandonment / loss and locations and, where applicable, the dates of retrieval.
5	Notify SAHRO of any hazards left on the seabed or floating in the water column, and request that they send out a Notice to Mariners with this information.
6	Ensure at a minimum, one FLO person (speaking English and Afrikaans) is on board each escort vessel to facilitate communication in the local language with the fishing vessels that are in the area.

Residual Impact Assessment

The implementation of the mitigation measures (refer to Table 4.14) will reduce the impact; however, the residual impact will remain of low magnitude and of LOW NEGATIVE significance (refer to Table 4.15).

Table 4.15: Impact on Fisheries Sectors of Loss of Equipment at Sea.

Impact of Loss of Equipment at Sea		
Aspect	Rating	Residual Impact
Nature	Negative	Negative
Extent	Regional (Extends between 5 and 50 km from the site)	Regional (Extends between 5 and 50 km from the site)
Duration	Short term (1 – 5 year)	Immediate (<1 year)
Magnitude/Intensity	Low (Fishing process slightly altered)	Low (Fishing process slightly altered)
Reversibility	Reversible (Without incurring significant time or cost)	Reversible (Without incurring significant time or cost)
Probability	Improbable (<25% likelihood of occurring)	Improbable (<25% likelihood of occurring)
Significance	Low Negative (The impact is unlikely to be a significant risk)	Low Negative (This impact is unlikely to be a significant risk)
Cumulative Potential	Low Negative	Low Negative

4.4 CUMULATIVE IMPACTS

The impacts on each of the above fishing sectors could be increased due to the combination of impacts from other projects that may take place during the same period. Cumulative impacts include past, present and future planned activities which result in change that is larger than the sum of all the impacts. Cumulative effects can occur when impacts are 1. additive (incremental); 2. interactive; 3. sequential or 4. synergistic and would include anthropogenic impacts (including fishing and hydrocarbon industries) as well as non-anthropogenic effects such as environmental variability and climate change[28].

In the Benguela region, it has been suggested that the seasonal movement of Longfin Tuna northwards from the west coast of South Africa into southern Namibia may be disrupted by the noise associated with an increasing number of seismic surveys. While the potential exists to disrupt the movement of Longfin Tuna in the Benguela, this disruption, if it occurs, would be localised spatially and temporarily and would be compounded by environmental variability. In Australia, no direct cause and effect in changes in movement or availability of Bluefin Tuna could be attributed to seismic surveys (Evans et al, 2018), with observed changes being attributed to inter-annual variability. Due to the dearth of information on the impacts of seismic noise on truly pelagic species links between changes in migration patterns and subsequent catches thus remains speculative. In addition to the above the following should also be considered to take account of catch variability and stock declines, which can be attributed to the following (Shomura et al 1995, Kuo-Wie Lan et al 2011, Lehodey et al 2006 and Punt et al 1996):

- Increasing fishing effort exacerbated by improved fish finding technology (vessel monitoring systems, use of sonar, sea surface temperature spatial mapping using satellite technology);
- Environmental variability such as cold and warm water events e.g. Benguela El Niño events have been shown to result in a change in the vertical distribution of tuna stocks within the water column, resulting in reduced catch rates;
- Migration and feeding patterns that change abundance levels annually and are linked to the environment; and
- Inconsistent or irregular catch reporting.

This said, there is the possible chance of an increase in disturbance and disruption to fisheries active in the area and pressure on local services and facilities should additional exploration and mining activities commence (by other applicants or existing exploration right holders) in a relatively short period. There are a number of reconnaissance permit application and EIA / Basic assessments being undertaken for proposed seismic surveys off the West Coast, although it is unlikely that all these will be undertaken as they are targeting similar areas in the Deep Water Orange Basin. Table 4.16 lists the applications for petroleum exploration in the Southern Benguela region (South African West Coast and southern Namibia) since 2007, indicating which of these have been undertaken. Applications for mineral prospecting rights are also shown. Concurrent activities such as other planned speculative or proprietary seismic surveys in the southern Benguela region could add to the cumulative impact on fisheries. Although it is unlikely that concurrent seismic surveys would be undertaken in the same area during the same survey window, the current report includes an assessment of the cumulative impact on fisheries during simultaneous operations of three regional seismic surveys off the west coast. Simultaneous survey operations would result in an increase in the extent and magnitude of the impact

[28] Refer to Augustyn et al. (2018) for a synopsis of climate change impacts on South African Fisheries.

on the large pelagic longline sector. The impact duration would remain unchanged[27]. Three seismic surveys of regional extent, undertaken simultaneously, could be expected to result in an impact of MEDIUM NEGATIVE significance on the large pelagic longline sector and of LOW NEGATIVE significance on the tuna pole-line sector, both with and without the application of mitigation measures. Once completed there is not expected to be any residual impact.

[27] Seismic surveys are undertaken within a window period of December to May as specified by DMRE as part of the EMP conditions to mitigate the impacts on sensitive migration periods for cetaceans.

Table 4.16: Applications for petroleum exploration and mineral prospecting in the Southern Benguela region (South African West Coast and southern Namibia) since 2007, indicating which of these have been undertaken.

YEAR	RIGHT HOLDER / OPERATOR	BLOCK	ACTIVITY	APPROVAL	CONDUCTED / COMPLETED
SOUTH AFRICAN WEST COAST PETROLEUM EXPLORATION					
2007	PASA	Orange Basin	2D Seismic	Yes	2D: Nov-Dec 2007
2008	PASA	West Coast	2D Seismic	Yes	2D: Sep 2008
2008	PetroSA	Block 1	3D Seismic	Yes	3D: Jan-Apr 2009
2011	Forest Oil (Bluewest)	Block 2A	3D Seismic	Yes	3D: May-Jul 2011
2011	PetroSA	Block 5/6 (ER224); Block 7 (ER228)	3D Seismic and CSEM	Yes	2D: Dec 2011 – Feb 2011 3D: Jan-Apr 2020
2011	PetroSA	Block 1	Exploration drilling	Yes	
2012	BHP Billiton (now Ricocure Ajinara & Africa Oil)	Block 3B/4B	2D and 3D Seismic	Yes	check
2013	Spectrum	West Coast regional	2D Seismic	Yes	2D: April 2015
2013	PetroSA	Block 1	2D and 3D Seismic	Yes	3D: Feb-May 2013 (conducted by Carn)
2013	Anadarko	Block 2C	2D and 3D Seismic, MBES, heatflow, seabed sampling	Yes	check
2013	Anadarko	Block 5/6/7	MBES, heatflow, coring	Yes	MBES: Jan-Mar 2013
2014	CK/Shell	Northern Cape Ulua Deep ER274	2D and 3D Seismic, MBES, magnetics, seabed sampling	Yes	2D: Feb-Mar 2021
2014	Shell	Deep Water Orange Basin	Exploration drilling	Yes	Shell relinquished block to TEEPSA
2014	Calm	ER 12/3/083	2D Seismic	Yes (obtained by PetroSA)	2D: Feb-Mar 2014
2014	Calm	Block 1	Seabed sampling	Yes	
2014 - 2015	Thombu	Block 2B (ER105)	Exploration drilling	Yes	Africa Energy preparing to drill in late 2022/23
2014	New Age Energy	Southwest Orange Basin	2D Seismic		
2015	Calm	Block 1	Exploration drilling		
2015	Sunbird	West Coast	Production pipeline (Ibhubesi)	Yes	No activities undertaken. The EA was renewed for an additional 5 years on 30 June 2022
2015	Rhino	Southwest coast (inshore)	2D Seismic, MBES		
2015	Rhino	Block 3617/3717	2D and 3D Seismic, MBES	Yes	

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YEAR	RIGHT HOLDER / OPERATOR	BLOCK	ACTIVITY	APPROVAL	CONDUCTED / COMPLETED
SOUTH AFRICAN WEST COAST PETROLEUM EXPLORATION					
2017	Impact Africa / TEEPSA	Southwest Orange Deep	2D and 3D Seismic		
2018	PGS	West Coast regional	2D and 3D Seismic	Yes	
2019	Anadarko	Block 5/6/7	2D Seismic	Yes	
2021	Searcher	West Coast regional	2D and 3D Seismic	Yes (currently appealed)	2D: Jan 2022
2021	TGS	West Coast regional	2D Seismic	Yes	
2021	Tosaco	Block 1, EP362	3D Seismic	Withdrawn	
2022	Ion	Deep Water Orange Basin	3D Seismic	Application in prep.	
2022	Searcher	Deep Water Orange Basin	3D Seismic	Application in prep	
2022	Shearwater	Deep Water Orange Basin	3D Seismic	Application in prep	
2022	TGS	Deep Water Orange Basin	3D Seismic	Application in prep	
2022	TEEPSA	Block 5/6/7	Exploration drilling	EIA in prep.	
2022	TEEPSA	Deep Water Orange Basin	2D and 3D Seismic, drilling	EIA in prep.	
SOUTHERN NAMIBIA PETROLEUM EXPLORATION					
2011	Signal	Block 2914B (new part of PEL39)	2D and 3D Seismic; development of production facility		
2011	PGS	Block 2815	3D Seismic	Yes	3D: 2011 (MRT)
2013	Spectrum Namibia	Orange Basin multiclient	2D Seismic	Yes	2D: April 2014
2014	Shell Namibia	2913A; 2914B	3D Seismic	Yes	3D: 2015
2016	Spectrum	Southern Namibia regional	2D Seismic	Yes	2D: April 2016
2017	Shell Namibia	PEL39	Exploration drilling	Yes	Dec 2023
2019	Galp Namibia	PEL83	Exploration drilling	Yes	Applying for ECC extension
2019	TEEPNA	Block 2913B (PEL56)	Exploration drilling	Yes	Drilling: Nov 2021 – Mar 2022
2020	TEEPNA	Block 2912, 2913B (PEL91; PEL56)	3D Seismic	Yes	Planned for Jan 2023
2020	TGS-Namibia	Blocks 2711, 2712A, 2712B, 2713, 2811, 2812A, 2812B, 2913B in the Orange Basin	3D Seismic	Pending	
2020	Tullow Namibia (Hermelan Energy Ltd)	Block 2813B (PEL90)	3D Seismic		EIA ongoing

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YEAR	RIGHT HOLDER / OPERATOR	BLOCKS	ACTIVITY	APPROVAL	CONDUCTED / COMPLETED
SOUTH AFRICAN SEA AREAS MINERALS PROSPECTING AND MINING					
2011	Auxmar	SASA 1C-9C SASA 12C, 14C-18C, 20C	Heavy minerals coring	Yes	Jan-Mar 2011 2C-5C: Geophysical & coring 7C-10C: Geophysical & coring 12C, 14C-18C & 20C: Only desktop
2013-2014	Belton Park Trading	SASA 2C-5C	Geophysical surveys, coring, bulk sampling	Yes	Survey: ongoing in 2C and 3C Sampling: ongoing in 2C and 3C Various prospecting operations undertaken over duration of prospecting right
2017	Belton Park Trading	SASA 2C (3C was incorporated into mining right area in 2018)	Mining	Yes	Ongoing prospecting and mining has taken place over various campaigns to date: SASA 2C: 9 Aug – 7 Nov 2018 SASA 2C: 13 Mar – 5 May 2019; SASA 2C: 9 Jul – 25 Oct 2019 SASA 2C & 3C: 27 Feb – 31 Aug 2020 Mining is currently ongoing
2018	De Beers Marine	SASA 6C	Geophysical surveys, coring, bulk sampling	Yes	Survey: May-Jul 2021 Sampling: Dec 2021 – Jan 2022
2020	Belton Park Trading	SASA 14B, 15B, 17B	Geophysical surveys, coring, bulk sampling	Yes but appeal still under review	
2020	Belton Park Trading	SASA 13C, 15C, 16C, 17C, 18C	Geophysical surveys, coring, bulk sampling	Yes but appeal still under review	
2021	De Beers Marine	SASA 4C & 5C	Geophysical surveys, coring, bulk sampling	Application in prep	
2021	Samara Mining	SASA 4C & 5C	Geophysical surveys, coring, bulk sampling	Application converted and withdrawn	
2021-2022	Moonstone Diamond Marketing	SASA 11B, 13B	Geophysical surveys, coring, bulk sampling	Applications delayed. Second round EIAs in prep.	
2022	Trans-Atlantic Diamonds	SASA 14A	Geophysical surveys, coring, sampling	Yes	
2022	Trans-Atlantic Diamonds	SASA 11C	Geophysical surveys, coring, sampling	EIAR submitted to DMRE on 2 March 2022	

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5 CONCLUSIONS AND RECOMMENDATIONS

The potential impacts of the seismic survey programme on fisheries relate to 1) exclusion of fishing vessels from accessing fishing ground, 2) the impact on catch rates as a result of increased noise levels associated with the seismic survey operation, 3) accidental loss of equipment from the survey array and 4) accidental release of marine diesel at sea. Table 5.1 lists the overall significance of each of the identified project impacts before and after the implementation of mitigation measures listed in Table 5.2.

Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part A, Rule 10), a seismic survey vessel that is engaged in surveying is defined as a "vessel restricted in its ability to manoeuvre" which requires that power-driven and sailing vessels give way to a vessel restricted in her ability to manoeuvre. Furthermore, under the Marine Traffic Act, 1981 (No. 2 of 1981), a vessel used for the purpose of exploiting the seabed falls under the definition of an "offshore installation" and as such it is protected by a 500 m safety zone. It is an offence for an unauthorised vessel to enter the safety zone. In addition to a statutory 500 m safety zone, a seismic contractor would request a safe operational limit (that is greater than the 500 m safety zone) that it would like other vessels to stay beyond. Safety clearances for seismic surveys are usually 6 Nm ahead and astern and 2 Nm to either side of the survey vessel, resulting in an exclusion area of approximately 165 km² around the survey vessel. The temporary exclusion of fisheries from the safety zone may reduce access to fishing grounds, which in turn could potentially result in a loss of catch and/or displacement of fishing effort (direct negative impact). The safety zone would be implemented around the seismic vessel for the duration of the project, resulting in an immediate impact that would endure for the duration of the proposed survey (~70 days). The impact of exclusion from fishing ground was assessed on each fishing sector based on the type of gear used and the proximity of fishing areas relative to the Reconnaissance Permit area. With the implementation of the project controls and mitigation measures, the residual impact of the proposed survey is considered to be of LOW NEGATIVE significance to large pelagic longline and tuna pole-line sectors. There is no impact expected on the demersal trawl, midwater trawl, demersal longline, small pelagic purse-seine, linefish, west coast rock lobster, netfish and small-scale fishing sectors.

The impact on catch rates due to sound elevation levels was assessed and sensitivity/vulnerability differences amongst the targeted fish species identified for each sector. Sound generated during the proposed seismic survey is expected to be in the order of 255 dB re 1 µPa at 1 m at an operating frequency range of 5 – 300 Hz. This falls within the hearing range of most fish species. A sound transmission loss modelling study (SLR 2021) identified predicted zones of impact for fish species (amongst other marine fauna species of concern) based on relevant noise impact assessment criteria. The noise effects assessed included physiological effects (physical injury/permanent threshold shift (PTS) and temporary threshold shift (TTS)) and behavioural disturbance due to either immediate impact from single airgun pulses or cumulative effects of exposure to multiple airgun pulses over a period of 24 hours. Based on the current project description, sound levels for the seismic survey could notionally be expected to attenuate to below levels for behavioural disturbance at a distance of 4 km from the source. The spatial extent of the impact of sound (produced by the airgun array) on catch rates is expected to be regional, although localised at any one time. The impact is considered to be of immediate duration and reversible without additional time or cost. Based on the distance of fishing grounds from the Reconnaissance Permit area, only the large pelagic longline and tuna pole-line sectors are considered to be susceptible to the effects of elevated sound. With the implementation of the project controls and mitigation measures, the residual impact due to seismic noise is considered to be of LOW NEGATIVE significance. There is no impact expected on the demersal trawl, midwater trawl,

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demersal longline, small pelagic purse-seine, linefish, west coast rock lobster, netfish and small-scale fishing sectors

The Reconnaissance Permit area is situated in the Orange Basin, offshore of the shelf break and offshore of grounds of importance for many of South Africa's commercial fishing sectors, as well as small-scale and recreational fisheries. The large pelagic longline sector operates across the extent of the Reconnaissance Permit area, with activity focussed along the continental shelf break. The Application Area does not overlap key spawning or nursery areas therefore the risk of noise disturbance to spawning behaviour and fishery recruitment is considered unlikely.

This report has been compiled in accordance with the EIA Regulations, 2014 (Government Notice (GN) R982), as amended. It is the reasoned opinion of the specialist that the reconnaissance activities may be authorised, subject to the implementation of the mitigation measures proposed in Table 5.1.

In order to mitigate the impacts on the large pelagic longline sector, it is recommended that the survey avoid taking place during June and July. Prior to the commencement of survey activities, affected parties should be informed of the navigational co-ordinates of the proposed survey acquisition area, timing and duration of proposed activities and any implications relating to the safety zone that would be requested, as well as the movements of support vessels related to the project. The relevant fishing associations include FishSA, SA Tuna Association, SA Tuna Longline Association and Fresh Tuna Exporters Association.

Other key stakeholders should be notified prior to commencement and on completion of the project. These include; DFFE, the South African Navy Hydrographic Office (SANHO), South African Maritime Safety Association (SAMSA) and Ports Authorities.

For the duration of the survey, a navigational warning should be broadcast to all vessels via Navigational Telex (Navtext) and Cape Town radio. In addition, it is recommended that updates of the scheduled weekly survey plan should be circulated to the operators of affected fishing vessels on a daily basis. A Fisheries Liaison Officer (FLO) should be present on board the seismic vessel or escort vessel for the duration of the survey in order to facilitate communications between the seismic and fishing vessels in the project area.

Table 5.1 Recommended Mitigation Measures for Fisheries.

No.	Mitigation measure: Fisheries Exclusion
1	Avoid operating during June and July, in order to avoid periods of peak fishing effort by the large pelagic longline sector within the Reconnaissance Permit area.
2a	Prior to the commencement of seismic survey activities the following key stakeholders should be consulted and informed of the proposed seismic survey programme (including navigational co-ordinates of location, timing and duration of proposed activities) and the likely implications thereof (specifically the exclusion and safety zone around the seismic vessel):
	Fishing industry associations: SA Tuna Association; SA Tuna Longline Association and Fresh Tuna Exporters Association.
	Other key stakeholders: SAN Hydrographer, South African Maritime Safety Association, Ports Authority and the DFFE Vessel Monitoring, Control and Surveillance Unit in Cape Town.
	These stakeholders should again be notified at the completion of the project when the survey and support vessels are off location.
3	Request, in writing, the SAN Hydrographer to broadcast a navigational warning via Navigational Telex (Navtex) and Cape Town radio for the duration of the seismic survey activity.
4	Distribute a Notice to Mariners prior to the commencement of the seismic survey operations. The Notice to Mariners should give notice of (1) the co-ordinates of the survey area, (2) an indication of the proposed survey timeframes, (3) the dimensions of the towed gear array and dimensions of the safety zone around the seismic

	vessel, and (4) provide details on the movements of support vessels servicing the project. This Notice to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.
	An experienced Fisheries Liaison Officer (FLO) should be placed on board the seismic or guard vessel to facilitate communications with fishing vessels in the vicinity of the seismic survey areas
	The lighting on the seismic and support vessels should be managed to ensure that they are sufficiently illuminated to be visible to fishing vessels, as well as ensure that it is reduced to a minimum compatible with safe operations.
	Notify any fishing vessels at a radar range of 12 nm from the seismic vessel via radio regarding the safety requirements around the seismic vessel
	Implement a grievance mechanism in case of disruption to fishing or navigation.

Table 5.2 continued Recommended Mitigation Measures for Fisheries.

No.	Mitigation measure: Underwater Noise
	Avoid operating during June and July, in order to avoid periods of peak fishing effort by the large pelagic longline sector.
	Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source if during daylight hours it is confirmed visually by the MMO during the pre-shoot watch (60 minutes) that there are no shoaling large pelagic fish within 500 m of the seismic source.
	In the case of shoaling large pelagic fish being observed within the mitigation zone, delay the "soft-start" until animals are outside the 500 m mitigation zone Terminate seismic shooting on • Observation of slow swimming large pelagic fish (including whale sharks, basking sharks, and manta rays) within the 500 m mitigation zone. • Observation of any obvious mass mortalities of fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO to be as a direct result of the survey. For slow-swimming large pelagic fish, terminate shooting until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required).
No.	Mitigation measure: Accidental Oil Spills
	Ensure personnel are adequately trained in both accident prevention and immediate response, and resources are available on each vessel.
	Obtain permission from DFFE to use low toxicity dispersants. Use cautiously
	Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station.
	Ensure offshore bunkering is not undertake in the following circumstances: • Wind force and sea state conditions of ≥6 on the Beaufort Wind Scale; • During any workboat or mobilisation boat operations, • During helicopter operations; • During the transfer of in-sea equipment, and • At night or times of low visibility.
	Ensure that solid streamers rather than fluid-filled streamers are used. Alternatively, low toxicity fluid-fill streamers could be used
No.	Mitigation measure: Accidental Loss of Equipment to Sea
1	Ensuring that loads are lifted using the correct lifting procedure and within the maximum lifting capacity of the crane system.

Minimise the lifting path between vessels.

Undertake frequent checks to ensure items and equipment are stored and secured safely on board each vessel

Retrieval of lost objects / equipment, where practicable, after assessing the safety and metocean conditions. Establish a hazards database listing the type of gear left on the seabed and / or in the survey area with the dates of abandonment / loss and locations and, where applicable, the dates of retrieval

Notify SANHO of any hazards left on the seabed or floating in the water column, and request that they send out a Notice to Mariners with this information.

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APPENDIX 1: ASSESSMENT CONVENTIONS

The EIA Team has adopted a set of conventions for purposes of the integrated assessment of potential impacts, and the determination of impact significance. The impact significance rating methodology, as provided by EIMS, is guided by the requirements of the NEMA EIA Regulations, 2014. The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E + D + M + R) * N}{4}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 17.

Table 17: Criteria for determination of impact consequence

Aspect	Score	Definition
Nature	-1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),

	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected).
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way).
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per

Table 18.

Table 18: Probability scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \times P$$

Table 19: Determination of environmental risk

Consequence	5	5	10	15	[illegible]	[illegible]
	4	4	8	12	16	[illegible]
	3	3	6	9	12	15
	2	2	4	6	8	10

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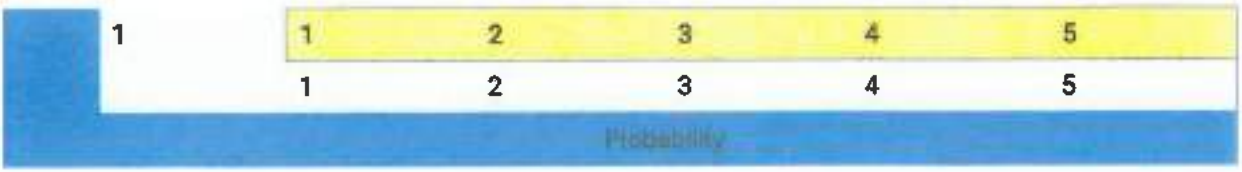

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 20.

Table 20: Significance classes

Risk Score	Description
< 10	Low (i.e. where this impact is unlikely to be a significant environmental risk).
≥ 10; < 20	Medium (i.e. where the impact could have a significant environmental risk).
≥ 20	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/ mitigated.

Further to the assessment criteria presented above it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority / significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/ mitigation impacts are implemented.

Table 21: Criteria for the determination of prioritisation

Cumulative impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.

	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in

Table 21. The impact priority is therefore determined as follows:

$$Priority = CI + LR$$

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 1.5 (refer to Table 22).

Table 22: Determination of prioritisation factor

Priority	Prioritisation Factor
2	1
3	1.125
4	1.25
5	1.375
6	1.5

In order to determine the final impact significance the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is to be able to increase the post mitigation environmental risk rating by a factor of 0.5, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table 23: Environmental Significance Rating

Value	Description
< -10	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ -10 < -20	Medium negative (i.e. where the impact could influence the decision to develop in the area).
≤ -20	High negative (i.e. where the impact would have an influence on the decision not to develop in the area).
0	No impact
< 10	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ 10 < 20	Medium positive (i.e. where the impact could influence the decision to develop in the area).

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Value	Description
≥ 20	High positive (i.e. where the impact must have an influence on the decision process to develop in the area)

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

APPENDIX 2: CURRICULUM VITAE

SARAH WILKINSON SACNASP-Registered Professional Natural Scientist (Membership number 115656)

Geographical information systems, mapping and data analysis of southern African fisheries

Date of Birth: 20 June 1979

Nationality: South African / British

Academic Record: University of Cape Town, South Africa; BSc Honours (2001)
University of Cape Town; BSc (Oceanography and Botany 1998 – 2000)

Employment Record: Capricorn Marine Environmental (Pty) Ltd (2003 – 2019)
Institute of Plant Conservation, University of Cape Town (2002)

Languages: English (First language); Afrikaans & French (Basic written & spoken)

Key Experience:

- Geographical information systems, mapping and data analysis with focus on fisheries, oil and gas specialist assessments.
- Specialist assessments on the impact of offshore hydrocarbon exploration and installation activities on fisheries in South Africa, Namibia, Mozambique and Angola (in accordance with scoping and EIA requirements). **A selection of projects over the last five years is listed overleaf and a full list of project reports is available on request.**
- Management of Marine Mammal Observer (MMO), Passive Acoustic Monitoring (PAM) and Fisheries Liaison Services for seismic survey vessels in the offshore sub-Saharan region (a full list of over 100 deployments is available on request).
- Management of the industry-funded ship-based scientific observer programmes for the South African Pelagic Fishing Industry Association (SAPFIA) and the SA Deepsea Trawling Industry Association (SADSTIA).
- GIS support and analysis of the South African fishery catch and effort for use in the Offshore Marine Protected Area Project - contracted by the South African National Biodiversity Institute (SANBI).
- A review on the effects of trawling on benthic habitat in part fulfilment of the Marine Stewardship Council certification of the South African hake trawl fishery (Client: South African Deepsea Trawling Industry Association (SADSTIA).
- Spatial mapping of the proposed expanded Saldanha Bay Aquaculture Development Zone (ADZ) in line with the goals of operation Phakisa.
- Offshore Marine Protected Areas Project: spatial distribution/ mapping of South Africa's commercial fisheries for the South African National Biodiversity Institute
- Hake longline sector footprint. Spatial distribution of fishing effort and overlap with benthic habitats of the South African Exclusive Economic Zone (2002 – 2012) for WWF South Africa
- "Ringfencing the trawl footprint":- Desktop study for the South African Deepsea Trawling Industry Association

A complete list of Fisheries Impact Assessment Reports and Environmental Monitoring Close-Out Reports is available on request.

SOUTH AFRICA EXPERIENCE : Selected projects undertaken over the past five years

Client	Activity	Area	Date
Total E&P South Africa	Well Drilling	Block 11B/12B	Jun 2020
Total E&P South Africa	Seismic Survey/Well drill	South Outeniqua	Jun 2020
ACER / Equiano Cable System	Subsea Cables (Telecommunications)	Melkbosstrand, West coast, South Africa	Nov 2019
Total E&P South Africa	Seismic Survey	Block 11B/12B	Oct 2019
Total E&P South Africa	Well Drilling	Southeast Coast	Jul 2019
METISS Cable System	Subsea Cables (Telecommunications)	East Coast	Mar 2019
Petroleum Geo-Services	Seismic Survey	West & Southwest Coasts	Oct 2018
Belton Park Trading 127 (Pty) Ltd	Marine Mining	2C & 3C	Sep 2018
IDX	Subsea Cables	South Coast	Jun 2018
De Beers Marine	Marine Mining	6C	Jun 2018
ENI	Well Drilling	East Coast	Jun 2018
Petroleum Geo-Services	Seismic Survey	East & South Coasts	Jan 2018
Alexkor	Marine Mining	1A-C,2A,3A,4A-B	Sep 2017
Impact Africa Ltd	Seismic Survey	Orange Basin	Jul 2017
Sungu Sungu Oil (Pty) Ltd	Seismic Survey	Pletmos Basin	Mar 2017
PetroSA (Pty) Ltd	Subsea Pipeline	E-BK, Block 9	Feb 2017
ACE Cable / MTN (Pty) Ltd	Subsea Cables	West Coast	Sep 2016
West Coast Resources (Pty) Ltd	Marine Mining	6A-8A	Jul 2016
Belton Park Trading 127 (Pty) Ltd	Marine Mining	2C	May 2016
Spectrum ASA	Seismic Survey	West Coast	Jan 2016
Schlumberger	Seismic Survey	East Coast	Nov 2015
Rhino Oil & Gas Exploration	Seismic Survey	Blocks 3617/3717	Nov 2015
Belton Park Trading 127 (Pty) Ltd	Marine Mining	2C-5C	Jan 2015
Aquaculture development zone	Identification of suitable areas for expansion of aquaculture within Saldanha Bay		

NAMIBIAN EXPERIENCE : Selected projects undertaken over the past five years

Client	Activity	Area	Date
Total E&P Namibia	Seismic Survey	2912 & 2913B	Jul 2020
ACER / Equiano	Subsea Cable	Regional	Jun 2020
GALP/Windhoek PEL 23 & 28 B.V.	Well Drilling	PEL82 & PEL83	Jul 2019
Shell Namibia B.V.	Seismic Survey	PEL39	May 2018
Shell Namibia B.V.	Well Drilling	PEL39	Oct 2017
Spectrum Geo Ltd	Seismic Survey	Regional (North)	Jun 2017
GALP	Seismic Survey	PEL82 & PEL83	May 2017
Spectrum Geo Ltd	Seismic Survey	Regional (South)	Oct 2016
LK Mining	Marine Mining	EPL5965	May 2016
Murphy Lüderitz Oil Co. Ltd	Well Drilling	2613A & 2613B	Jul 2015
Xaris Energy Namibia	Subsea Pipeline Installation	Walvis Bay	Jul 2015
Nabinm Energy Services (Pty) Ltd	Seismic Survey	2113A	Jan 2015
Namdeb	Mapping of benthic habitat types, Southern Namibia inshore and nearshore region		

Courses and Symposia :

- 7th and 5th International Symposia on GIS/Spatial Analyses in Fishery and Aquatic Sciences, Hakodate, Japan & Wellington, New Zealand. International Fishery GIS Society

- Joint Nature Conservation Committee-certified Marine Mammal Observer Training (Intelligent Ocean Training Services)
- Passive Acoustic Monitoring Training (Intelligent Ocean Training and Consultancy Services and Seiche Measurements Ltd)
- Bureau of Ocean Energy Management, Regulation and Enforcement Gulf of Mexico: Protected Species Observer Training
- ArcGIS I, II and Spatial Analyst (GIMS: ESRI South Africa)
- Maxsea Navigational Software (TimeZero)
- Marine Stewardship Council Chain of Custody Training Course (Moody Marine Ltd)
- SAQA-approved learning facilitator

Publications:

Massie, P, Wilkinson S & D Japp 2016. Hake longline sector footprint: Spatial distribution of fishing effort and overlap with benthic habitats of the South African Exclusive Economic Zone (2002 – 2012). Capricorn Marine Environmental, Cape Town 15 pages

Sink KJ, Wilkinson S, Atkinson LJ, Leslie RW, Attwood CG and McQuaid KA 2013. Spatial management of benthic ecosystems in the South African demersal trawl fishery. South African National Biodiversity Institute, Pretoria.22 pages.

Sink K, Wilkinson S, Atkinson L, Sims P, Leslie R and C Attwood 2012. The potential impacts of South Africa's demersal trawl fishery on benthic habitats: Historical perspectives, spatial analyses, current review and potential management actions. South African National Biodiversity Institute (SANBI).

Technical Report: Spatial/data layers of South African commercial fisheries (May 2009). Prepared for South African National Biodiversity Institute.

Wilkinson, S. and D. Japp. 2009. Spatial boundaries of the South African hake-directed trawling industry: trawl footprint estimation prepared for the South African Deepsea Trawling Industry Association (SADSTIA) - unpublished

Benguela Current Large Marine Ecosystem State of Stocks Review Report No.1 (2007). Eds D.W. Japp, M.G. Purves and S. Wilkinson, Cape Town.

Description and evaluation of hake-directed trawling intensity on benthic habitat in South Africa: Prepared for the South African Deepsea Trawling Industry Association in fulfilment of the Marine Stewardship Council certification of the South African hake-directed trawl fishery, condition 4. December 2005. Fisheries & Oceanographic Support Services cc, Cape Town

Purves, MG, Wissema J, Wilkinson S, Akkers T & D. Agnew. 2006. Depredation around South Georgia and other Southern Ocean fisheries. Presented at the Symposium: "Fisheries Depredation by Killer and Sperm Whales: Behavioural Insights, Behavioural Solutions", Pender Island, British Columbia, Canada from Oct. 2-5, 2006.

Grémillet D., Pichegru L., Kuntz G., Woakes A.G., Wilkinson S., Crawford, R.J.M. and P.G. Ryan. 2007. A junk-food hypothesis for gannets feeding on fishery waste. Proc. R. Soc. B. doi:10.1098/rspb.2007.1763. Online publication.

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Nationality	South African
Businesses Address	Unit 15 Foregate Square, Table Bay Boulevard, Cape Town, South Africa P.O. Box 50035, Waterfront, Cape Town 8002 Tel. +27 (21) 425 2161

Education:

Institution (Date from - Date to)	Degree(s) or Diploma(s) obtained:
Merchant Navy Academy General Botha, Cape Town (1975 to 1980)	Chief Navigating Officer (Foreign) – July 1980 to 1983
University of Cape Town (undergraduate) 1983 to 1985	Bachelor of Science (Zoology, Marine Biology and Oceanography)
Rhodes University 1986-1986	Bachelor of Science Honours Ichthyology and Fisheries Science (Cum Laude)
Rhodes University 1987 to 1989 and Sea Fisheries Research Institute	Masters Degree in Ichthyology and Fisheries Science (Cum Laude)
Rhodes University MBA 2006	Resource Economics

Key Experience Project Management and Appraisal
Environmental Impact Assessments (marine)
Marine Stewardship Council (MSC) assessor

Relevant Professional Experience (selected)

- South Africa: Head of Offshore Research - Sea Fisheries Research Institute (SFRI / DAFF) undertook 8 years of direct research and training of sea staff on biomass surveys as Chief Scientist;
- Consultant has worked extensively in the region including South Africa, Mozambique, Angola, Mozambique, Uganda, Namibia, Kenya, Tanzania and West Indian Ocean Fisheries Sectors since 1990;
- Benguela System : Benguela Current Commission (BCC) Strategic Impact Assessment (SEA)
- World Bank fisheries consultant – development and implementation of fisheries and aquaculture components - 1) MACEMP (Tanzania); 2) KCDP (Kenya) 3) SWIOFP (West Indian Ocean) 4) SWIOFish 1 (Current – WIO countries focus is Tanzania 5) LVEMP 2 (Lake Victoria)
- Environmental Impact Assessment of the Aquaculture Development Zone in Mossel Bay (South Africa)
- Scoping assessment and EIA of the potential for and Aquaculture Development Zone in Saldanha Bay, South Africa (pending)
- Lake Victoria – field trip and overview of the 'Source of the Nile' tilapia cage culture including provision of juvenile grow out and adult cage culture (conducted through LVEMP2 and the World Bank with the Lake Victoria Fisheries Organization and NAFIRI)

Date	Location	Company& reference person	Position	Description
Regional and International Experience				
1987 to 1996	South Africa	Sea Fisheries Research Institute and Marine and Coastal Management (Ref. Dr Augustyn)	Head of Offshore Research	Fisheries Research head – Management of Offshore resources including Demersal, Large Pelagic and Small Pelagic resources. Ref. is Dr J. Augustyn (Dept Agriculture, Forestry and Fisheries. Cape Town. (johann@seafstile.co.za)
1996 to 2016	Cape Town South Africa	Capricorn Fisheries Monitoring and Fisheries & Oceanographic Support Services	Consultant and Director	Many consulting projects with the FAO, World Bank, Benguela Current LME. Also developed the Regional Observers Programme. Specialization : Fisheries Management and Research ref. Xavier Vincent : xvincent@worldbank.org
2008 - 2009	Namibia	Benguela Current Commission	Consultant	State of Stock review – Benguela Current Commission. Hashali Hamukuaya hashali@benguelacc.org)
2009 to 2016 (ongoing)	Mombasa - Kenya)	Development of the Kenya Coastal Development Project (KCDP) – World Bank and FAO	Fisheries Expert	Thus was an ongoing consultancy (5 years) developing the KCDP with the World Bank Team – project participation was on near continuous basis until project effectiveness in June 2011. Portfolio : Fisheries Management, Research and Development : Ref is AG. Glauber - World Bank Office, Dar Es Salaam aglauber@worldbank.org
2007 to 2012	Tanzania and Zanzibar	Appraisal of the Tanzania *Marine and Coastal Environment Project* (MACEMP) - World Bank / FAO	Fisheries Expert	Ongoing consultancy every six months to Tanzania – Project appraisal and Mid-Term review. Presently project is winding down and new MACEMP two phase being developed. Portfolio : Fisheries Management, Research and Development : Ref is AG. Glauber - World Bank Office, Dar Es Salaam aglauber@worldbank.org
2006 to 2016	Kenya, Tanzania, Mozambique and IOC countries	World Bank and FAO – Fisheries Expert. Project development and implementation (South West Indian Ocean Fisheries Shared Growth and Governance Project (SWIOFish 1)	Fisheries Expert	Consultancy up to 2015 – fisheries components – development and implementation. Specialization : Fisheries Management and Development. Ref ; AJ Glauber aglauber@worldbank.org
2004 to 2007	IOTC	IOTC	Fisheries Experts	Provision of trained tuna tagging technicians and Cruise leaders for the IOTC Tuna Tagging programme (Note: this was done through CapFish under contract to MEP). Ref : Gerard Dominique (IOTC) . gerard.dominique@iotc.org
2009 to ongoing	IOTC	IOTC	Fisheries Observers	Provision of Observers for Transhipment vessels (ongoing) Gerard Dominique (IOTC) gerard.dominique@iotc.org

2004 to 2014	FAO	FAO – Jessica Sanders / Ross Shotton	Fisheries Expert	Consultancy undertaken for technical works relating to 1. South West Indian Ocean Fisheries 2. Regional (Indian Ocean) fisheries reporting (catches) 3. Observer training (Madagascar) 4. Development of High Sea Guidelines (FAO)
2009 to 2016	FAO and WWF	FAO - and WWF USA	Fisheries Expert	Fishery Improvement Process – fishery pre-assessments for MSC and follow-up. Contract is current. Portfolio : Fisheries Management and Development. Domingos Gove (dgove@wwfesampo.org
2013	Angola Namibia (BCC)	ACP Fish 2	Fisheries Expert	Development of horse mackerel national plans and transboundary management (BCC)
2004-current	International	MSC Assessments – RSA Hake, Tristan da Cunha lobster, Russian Pollock and numerous pre-assessments and peer rev.	Fisheries expert : P2 and P3	Full assessments through CABs (Moody, Intertek, MRAG, Tavel, FCI, BV, Acroura)

ADDITIONAL INFORMATION

Major Projects - Summary

- Resource Assessment
- Submission of management advice on hake (TAC assessments from 1989 to 1997);
- Biological assessment of hake species in South African waters and determination of ageing and stock structure,
- Design of hake-directed biomass surveys and cruise leader on up to four demersal surveys a year from 1989 to 1997;
- Demersal Working Group co-ordinator from 1991 to 1997 responsible for the management advice on hake and other demersal species;
- Project management (Scientist responsible) of hake-directed longline experiment in SA from 1992-1996

Aquaculture-Specific

- Post graduate degrees in Fisheries science included bot fresh water and marine aquaculture
- East African project undertaken with the World Bank include major fisheries components which incorporate development of aquaculture (fresh and marine)
- Scoping studies and impact assessments of Aquaculture Development Zones in Mossel Bay (South Africa)
- Scoping studies and EIA of ADZ in Saldanha Bay (this project is not yet activated and is pending subject to tender and financing)
- World Bank Project (LVEMP2) – consultant has been providing specialist fisheries advice to the LVFO including aquaculture field work in the Jinga / Lake Victoria including the use of Mukene as both feed and for human consumption
- Assessment of the Saldanha Bay Aquaculture Development Zone (ADZ – current)

Fishery Economics and Governance :

- Preparation of sector economic reports for RSA fisheries to assist with rights allocation procedures: Hake Longline, Inshore Trawl (Hake and Sole), Shark longline, South Coast Rock Lobster, Patagonian Toothfish, Deepwater Fishery, Midwater Trawl & Hake Handline

- Economic Assessment of the Westfish and Freezer Trawl apportionment of Hake in Namibia
- BCLME – Ecosystem Approach to Fisheries – Cost Benefit Analysis (March 2006)
- Review of the West Indian Ocean Tuna Fishery and Potential Opportunities and Options for the Development of the Port of Victoria (Seychelles) – Completed March 2008
- Assessment of economic loss due to hydrocarbon development – numerous ongoing projects, PetroSA, Forrest Oil west coast gas, CNR well drilling and many others.
- Value-Adding of Anchovy *Engraulis encrasicolus* in South Africa and potential for poverty relief.
- Governance of Kenya Fisheries – Consultancy and report prepared for IOC Smartfish programme (2011)

Other Projects Completed :

- Comparative assessment (socio-economic) of trawl and Longline fisheries in Benguela Region (BCLME).
- Evaluation of deepwater groundfish fishery in South West Indian Ocean 2004/2005 – FAO.
- Review of Ecosystem Approach to Fisheries Management for South African Fisheries (BCLME – MCM project).
- Review of South Africa's Indian Ocean fisheries – management and policy.
- Development of the South West Indian Ocean Fisheries Programme Implementation Plan – World Bank / FAO – Completed March 2007 (preparation of Project Documents for World Bank and GEF).
- Ecosystem Approach to Fisheries – BCLME project LMR/EAF/03/01 – Contracted consultant including Risk Assessments and Benefit Cost estimators for EAF – Ongoing as of 5 November 2006.
- Indian Ocean Tuna Tagging Programme – 2004-2007 collaborative programme with McAllister Elliot and Partners (UK) and Capricorn Fisheries Monitoring cc (RSA)
- Indian Ocean Tuna Commission – 2009 Collaborative programme between MRAG (UK) and Capricorn Fisheries Monitoring cc for the provision of Observers and monitors on Indian Ocean tuna transhipment vessels.
- International Commission for the Conservation of Atlantic Tunas – 2007 Collaborative programme between MRAG (UK) and Capricorn Fisheries Monitoring cc for the provision of Observers and monitors on Atlantic tuna transhipment vessels.
- Domestic contract awarded (Sept. 2007) for the monitoring of national and high seas tuna longline fisheries, all trawl and small pelagic sectors and deep water rock lobster trap fisheries
- FAO / World Bank – review of Tanzania MACEMP programme with WB surveillance team (2008, 2009, 2010, 2011, 2012)
- FAO / World Bank – initiation of the South West Indian Ocean Fisheries Project – development of Project Implementation Manual and Observer programme (Mombasa – 2007- 2009)
- FAO / World Bank – Project development – Kenya Coastal Development Project (KCDP) – Ongoing 2010-2015
- FAO – EAF-Nansen Programme – Mozambique Sofala Bank Shrimp fishery management plan – development of effort management recommendations.
- FAO World Bank – Lake Victoria LVEMP project. Project management and support to Lake Victoria Fisheries Organisation.
- FAO World Bank – South West Indian Ocean Fisheries Shared Growth and Governance Project (Tanzania effective from June 2015)
- ICCAT Tuna Transhipment Programme Observers – CapFish project executant (2009 to 2012) – ongoing
- IOTC Tuna Transhipment Programme Observers – CapFish project executant (2010-2012) – ongoing
- Tuna Longline – RSA Observer deployments – 100% coverage on Deep Water Fishing Nations (RSA) – Project executant (2007-2012) – on-going
- IOTC Tuna – review of economic reports undertaken by WWF (10 country reports and summaries) – May 2012

Marine Stewardship Council :

- Numerous fisheries assessed including Russian Pollock, Tristan da Cunha Lobster, RSA Hake and many others including many pre-assessments
- Fishery improvement projects ongoing : Kenya Lobster, Mozambique shallow and deepwater shrimp and Namibian Hake assessment
- Assessment of the PNA Western Pacific tuna Fishery (current September 2016)

- Review of the Mozambique linefish fishery (MSC preassessment) and SASSI assessment (WWF - South Africa) (Current September 2016)

Lecturing and Document Preparation:

- Extensive lecturing and seminar presentations (30 years) as well as detailed project and document preparation experience.
- Presentation of 5 x International courses in Namibia on International Agreements, UNCLOS, RFO's etc to Inspectors, Observers and Fisheries Managers.

PUBLICATIONS

JAPP, D.W. 1988 - The status of the South African experimental longline fishery for kingklip *Genypterus capensis* in Divisions 1.6, 2.1 and 2.2 *Colln. Scient. Pap. Int. Comm. SE Atl. Fish.* 15(2). 35-39

JAPP, D.W. 1989 - An assessment of the South African longline fishery with emphasis on stock integrity of kingklip *Genypterus capensis* (Pisces: Ophidiidae). M.Sc. Thesis, Rhodes University: [iii] + 136pp

JAPP, D.W. and A.E. PUNT 1989 - A preliminary assessment of the status of kingklip *Genypterus capensis* stocks in ICSEAF Division 1.6 and Subarea 2. *ICSEAF Document SAC/89/S.P.*: 15 pp (mimeo).

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JAPP, D.W. 1990 - A new study on the age and growth of kingklip *Genypterus capensis* off the south and west coasts of South Africa, with comments on its use for stock identification. *S. Afr. J. mar. Sci* 9: 223-237.

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JAPP, D.W. 1997 - Discarding practices and bycatches for fisheries in the Southeast Atlantic Region (Area 47). In L.J. Cluces & D.G. James, eds 1997. *Papers presented at the Technical Consultation on Reduction of Wastage in Fisheries.* Tokyo FAO Fisheries Report No. 547 (Suppl.), Rome, FAO.

JAPP, D.W. 1999 - Management of elasmobranch fisheries in South Africa. In. *Case studies of the management of elasmobranch fisheries* Edited by R. Shotton. *FAO Fisheries Technical Paper 378/1* : 199-217.

JAPP, D.W. 1999 - Allocation of fishing rights in the South African hake fishery. In: *Case studies of Rights allocations. FAO Fisheries Technical Paper 411.*

JAPP, D.W. 2006 - Country Review : South Africa (Indian Ocean). *Review of the state of world marine capture fisheries management : Indian Ocean. FAO Fisheries Technical Paper 488.*

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JAPP, D.W. P. SIMS and M.J. SMALE 1994 - A Review of the fish resources of the Agulhas Bank. *S. Afr. J. Sci.* 70: 123-134.

JAPP, D.W. 2010. Discussion Paper Prepared for Workshop on the Implementation of the FAO Guidelines for the Management of Deep-sea Fisheries in the High Seas. Pusan, South Korea (May 2009)

JAPP, D.W. 2010. Pre Assessment Report for the South African Longline Fishery for Hake Client: WWF (RSA) and Ocean Fresh. Capricorn Fisheries Monitoring cc. 3 February 2010 (final)

JAPP, D.W. 2012. Rapid Fishery Pre-Assessment for Marine Stewardship Council (MSC) Namibian Hake : *Merluccius paradoxus* and *M. capensis* undertaken for MRAG Americas

JAPP, D.W. 2012 .South African large pelagic (tuna) assessment. MRAG Americas: WWF ABNJ Tuna Project Baseline Analysis

JAPP, D.W. 2014. Development of a Training and Capacity Building Programme for Developing Country Fisheries Pursuing MSC certification: Principle 2 - Ecosystems Working towards Marine Stewardship Council Certification in a Developing Country – Identifying the gaps, needs and means to achieving certification

JAPP, D.W and A. JAMES 2005 - Potential exploitable deepwater resources and exploratory fishing off the South African coast and the development of the deepwater fishery on the south Madagascar Ridge. *FAO Fisheries Proceedings* 3/2. Deep Sea 2003 : Conference on the Governance and Management of Deep-sea Fisheries. R. Shotton ed.

JAPP, D.W., M. PURVES and S. WILKINSON. 2007. Benguela Current Large Marine Ecosystem State of Stocks Review 2007. Report No. 1 (2007) BCLME.

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JAPP, D.W. and H. CURRIE-POTGIETER. 2009. FAO case studies : Marine Protected Areas. *The development and status of Marine Protected Areas in South Africa and Namibia*. (In press, FAO)

JAPP, D.W AND M. SMITH 2012. Fisheries, Mammals and Seabirds specialist study Environmental Impact AssesementL Namibian Marine Phosphate (Pty) Ltd.: Dredging of marine phosphates from ML 170 Report (Revised 8 March 2012)

JAPP, D.W., KELLEHER, K, D. BOYER. 2013. Preparation of the Horse Mackerel (*Trachurus trecae*) Management Plan for Angola. ACP - Support for the devising of the management plan for the Horse Mackerel fishery Angola and Namibia Project ref. N° SA-1.2-B5 REL Region: Southern Africa Country: Namibia, Angola 27 October 2013

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COCHRANE, K, C.J. AUGUSTYN, T. FAIRWEATHER, D.W. JAPP, K. KILONGO, J IITEMBU, N. MOROFF, J.P. ROUX, L.SHANNON, B. VAN ZYL and F. VAZ VELHO. 2009. Benguela Current Large Marine Ecosystem – Governance and management for an Ecosystem Approach to Fisheries in the region. *Coastal management*. 37:235-254.

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DECLARATION OF THE ENVIRONMENTAL SPECIALIST

I, SARAH JANE WILKINSON (Full Name and Surname) declare that –

General declaration:

- I act as an independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting undertaking the specialist work as required, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I have not, and will not engage in, conflicting interest in the undertaking of the activity.
- I understand to disclose to the applicant and competent authority all material information in my possession that reasonably has or may have the potential of influencing- any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- I have taken into account, to the extent possible, the matters referred to in Regulation 18 when preparing the report, plan or document.
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not.
- All the particulars furnished by me this form are true and correct.
- I will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations.
- I am aware of what constitutes an offence in terms of Regulation 48 and that a person convicted of an offence in terms of Regulation 48(1) is liable to the penalties as contemplated in Section 49B of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remunerative for work performed in terms of the Regulations.

5428

Signature of the Specialist: SARAH JANE WILKINSON 7906200119080

Name of Company: CAPRICORN MARINE ENVIRONMENTAL PTY LTD

Date: 26/11/2022

UNDERTAKING UNDER OATH/AFFIRMATION

I, SARAH JANE WILKINSON swear under oath/affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Name of Company: CAPRICORN MARINE ENVIRONMENTAL PTY LTD

Date: 26/11/2022

Signature of the Commissioner of Oaths:

Date: 2022-11-26

Official Stamp below

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which was examined by me and that, from my observations, the

waarnemings, die oorspronklike nie op enige wyse gewysig is nie
original has not been altered in any manner.

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Community Service Centre

26 NOV 2022

SOUTH AFRICAN POLICE SERVICE

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Proposed TGS Seismic Survey

Located approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay, off the West Coast, South Africa.

Heritage Impact Assessment

Template Number	Document Number	Revision	Date
PGS PJ REP 007 01	634HIA-001	0.1	28 September 2022

Head Office
904 Rosmead Avenue
Wynberg, 7800
South Africa

REVISION HISTORY

Version	Issue Date	Description of Changes
001	28 September 2022	First draft

Declaration of Independence

- I, Wouter Fourie, declare that –
- General declaration:
- I act as the independent heritage practitioner in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting heritage impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected from a heritage practitioner in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

HERITAGE CONSULTANT: PGS Heritage (Pty) Ltd

CONTACT PERSON: Wouter Fourie – Senior Heritage Specialist

Tel: +27 (0) 12 332 5305

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SIGNATURE:

ACKNOWLEDGEMENT OF RECEIPT

Report Title	The proposed TGS Seismic Survey Project		
Control	Name	Signature	Designation
Author	W Fourie		Project Manager – Senior Heritage Practitioner
Co-Author	N Mann		Archaeologist
Reviewed			Client

CLIENT: Environmental Impact Management Services Consulting (Pty) Ltd

CONTACT PERSON: GP Kriel

Email: gp@eims.co.za

SIGNATURE: _____

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd was appointed by Environmental Impact Management Services Consulting (Pty) Ltd (EIMS) on behalf of TGS Geophysical Company (UK) (TGS) to undertake a Heritage Impact Assessment (HIA) that forms part of the Basic Environmental Assessment (BA) for their proposed 3D seismic survey off the West Coast of South Africa. The application area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay, Off the West Coast, South Africa.

Site Name

TGS West Coast 3D Reconnaissance Project

Site Location

The proposed project is located offshore between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay.

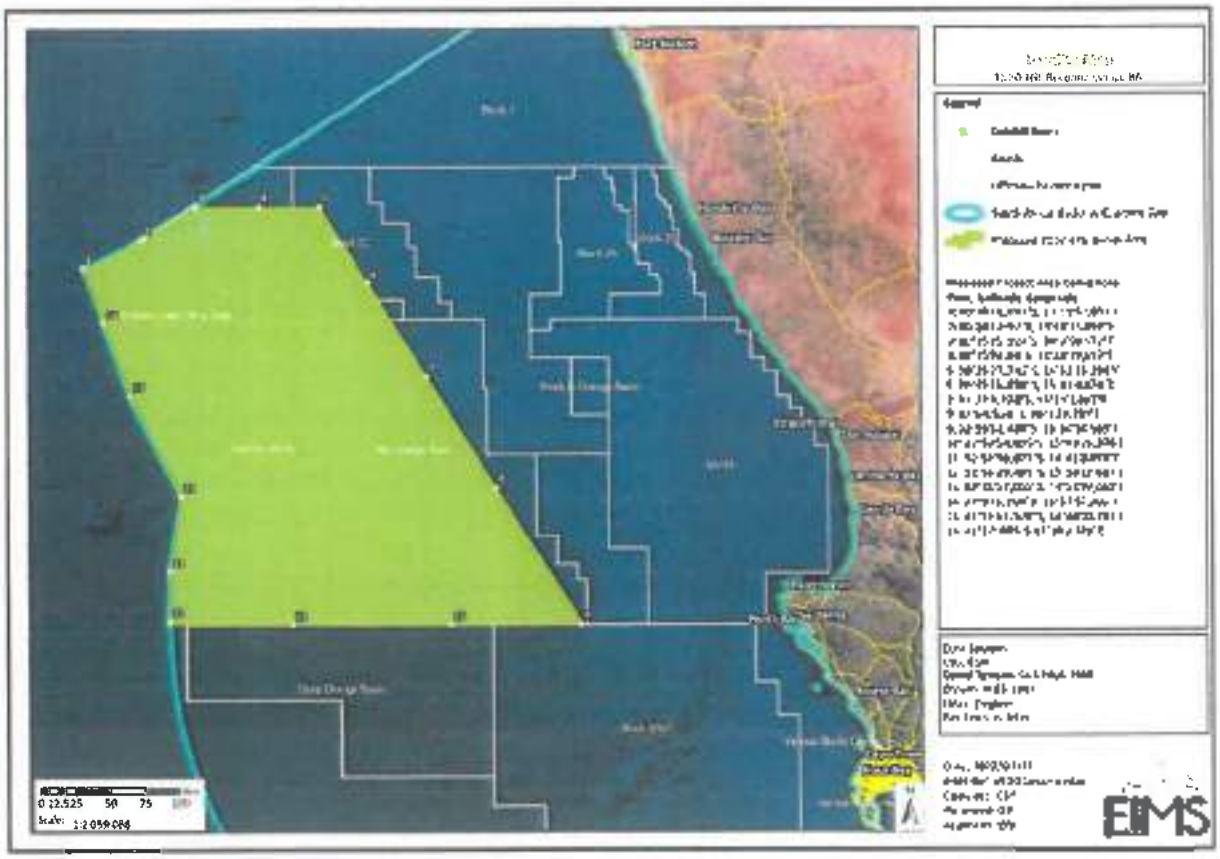

Figure 1 – Map indicating the location of the proposed survey project (green polygon) (source: EIMS).

Heritage Statement

It must be noted that, first and foremost, a large section of the affected communities not only view them as small-scale fishers but also as indigenous people and, as such, are intrinsically linked to the ocean and the land they have lived on for centuries. The resurgence movement through which Khoi and San descendants are reclaiming their identity has in recent decades afforded these communities the ability to re-establish their cultural roots and grounding in an ancient landscape. This sentiment is echoed in the founding affidavit submitted (5 Feb 2022) during the appeal submitted to the first Searcher application by CJ Adams. It notes that the ocean is not only important for fishing but also has spiritual meaning and is a place of healing and holds healing powers for the indigenous communities. It further expanded that the ocean and its resources play an important part in their community's history and heritage.

Community identity and culture are thus strongly linked to the ocean and what it can provide, physically and spiritually. Communities have coexisted with the ocean for generations. This existence has created a culture and heritage that defines their way of living, community, and kinship unique to the West Coast of South Africa. Cook (2001) describes this as maritimity, a process whereby the sum of cultural adaptations made by coastal populations becomes imbued with meaning and culture. This is evident in community structures, cultural events, and seasonal activities.

The public meetings and focused discussions with interlocutors have shown that these communities and groupings are struggling economically due to decades of turmoil in the fishing industry. An industry plagued by the closing of fish processing plants, fishing licence and quota issues, and diminishing catches due to environmental and industrial impacts, to name a few. This economic downturn leads to social issues within the communities. Foremost are poverty, loss of social fabric, substance abuse, teenage pregnancies, and violence. In all the interviews, the above issues were raised as central to their social existence and community experience.

As with Smith (2015), Loulanki (2006), and Ndoro (2105) emphasised that culture is more than just the tangible but is also shared beliefs, values, language, traditions, functionality, meaning and community connections. Considering the various values and heritage significance as listed in section 3(3) of the NHRA, the cultural and living heritage associated with the communities and indigenous people along the southwestern and west coast of South Africa holds heritage significance. It is part of the national estate and holds importance as a way of life for small-scale fishers and Khoisan descendants alike. The physical and spiritual interaction with the ocean and the shorelines through millennia resulted in a maritimity that developed into the cultural fabric as they experience it today.

The significance of such intangible and living cultural heritage features can potentially have a combined heritage grading of Grade II or even Grade I through further research. However, grading inevitably implies the investigation into and consideration of a Provincial or Heritage declaration of significance for a largely intangible cultural heritage. This is problematic as the NHRA provides for the proclamation/declaration of place, objects, or structures as Provincial or National Heritage Sites and only refers to intangible/living heritage relating to such place, objects, or structures.

Impact Statement

The scientific studies conducted for this project identified impacts on the fishing stock as low for all types of species.

By inference, a potential impact on fishing yield could be expected and thus potential economic impact on communities due to reduced caught fish volumes.

We considered that the recommended mitigation measures, as listed in the specialist reports for the project, focus on the reduction of impacts on fish species and the projected reduction of the impact on the commercial and small-scale fishery catch yield. These mitigation measures should then indirectly positively impact the potential negative impacts on the cultural heritage of the communities to be impacted.

By using the impact assessment methodology as provided by EIMS, we can project a pre-mitigation negative impact on a regional scale over the long term with a moderate intensity due to the potential indirect impact on the communities and, ultimately, their heritage, with a high probability of this impact occurring. The pre-mitigation impact on heritage resources is rated as MEDIUM. The potential residual impact on heritage resources, with mitigation measures from the scientific studies is projected as LOW with a medium confidence factor.

PGS is aware of the current Searcher application and the potential of another application soon occurring in the Orange Basin. Communities have expressed a definite concern about the multiple application occurring in their fishing waters and the potential long-term effect of these surveys resulting in Oil and Gas companies starting applications for production rights based on the findings of these reconnaissance surveys. ***It is, however, the understanding that only one 3D survey will be done in the overlapping areas even if the various applications are successful over the same area.***

At this stage, cumulative impacts are purely speculative. Still, the potential for the future increase in cumulative impacts due to current and future seismic surveys and the potential for future Oil and Gas production cannot be excluded but is not quantifiable at this stage for cultural heritage.

Recommendations

The following recommendations are based on the UNESCO ICH guidelines. They are aimed at safeguarding the cultural heritage of the small-scale fishers and cultural groupings in the influence of this project:

- Re-assess post-project the potential effects on the identified communities and their intangible cultural heritage. This will require consideration of the socio-economic baseline developed during this environmental impact process against quantified economic damage and losses and human development impacts in a follow-up socio-economic. It will enable the heritage specialist to evaluate the link between the socio-economic changes induced by the proposed project as it relates to changes in the intangible cultural heritage practices of the communities.

- Based on the outcomes, **provide resources and support for communities** to develop and undertake safeguarding measures or plans to enhance the **mitigation capacity of their intangible cultural heritage** by **fostering dialogue, mutual understanding and reconciliation** between and within communities. It is anticipated that this can be achieved through the implementation of the mitigation measures in the Social Impact Assessment.

We know that 3D seismic surveys can locate wrecks on the surface and sometimes below sediments. Any shipwrecks or pieces noted during the survey must be shared with the SAHRA MUCH Unit for inclusion in the national database. These could then be identified and incorporated into the EMP.

Considering the assessment based on the fieldwork findings and the scientific studies relating to the impact on fisheries, I am of the opinion that the impact of the proposed project on the intangible cultural heritage resources and practices can be mitigated through the implementation of the recommendations in this report.

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TERMINOLOGY AND ABBREVIATIONS

Archaeological resources

This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- features, structures, and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic, or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age between 700 000 and 2 500 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants, and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

Holocene

The most recent geological period which commenced 10 000 years ago.

Late Stone Age

The archaeology of the last 30 000 years associated with fully modern people.

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's, associated with iron-working and farming activities such as herding and agriculture.

Middle Stone Age

The archaeology of the Stone Age between 30 000-300 000 years ago, associated with early modern humans.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Abbreviations	Description

AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
ECO	Environmental Control Officer
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services Consulting (Pty) Ltd
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
HWC	Heritage Western Cape
I&AP	Interested & Affected Party
LSA	Late Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHS	Provincial Heritage Site
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency
Searcher	Searcher Geodata UK Ltd

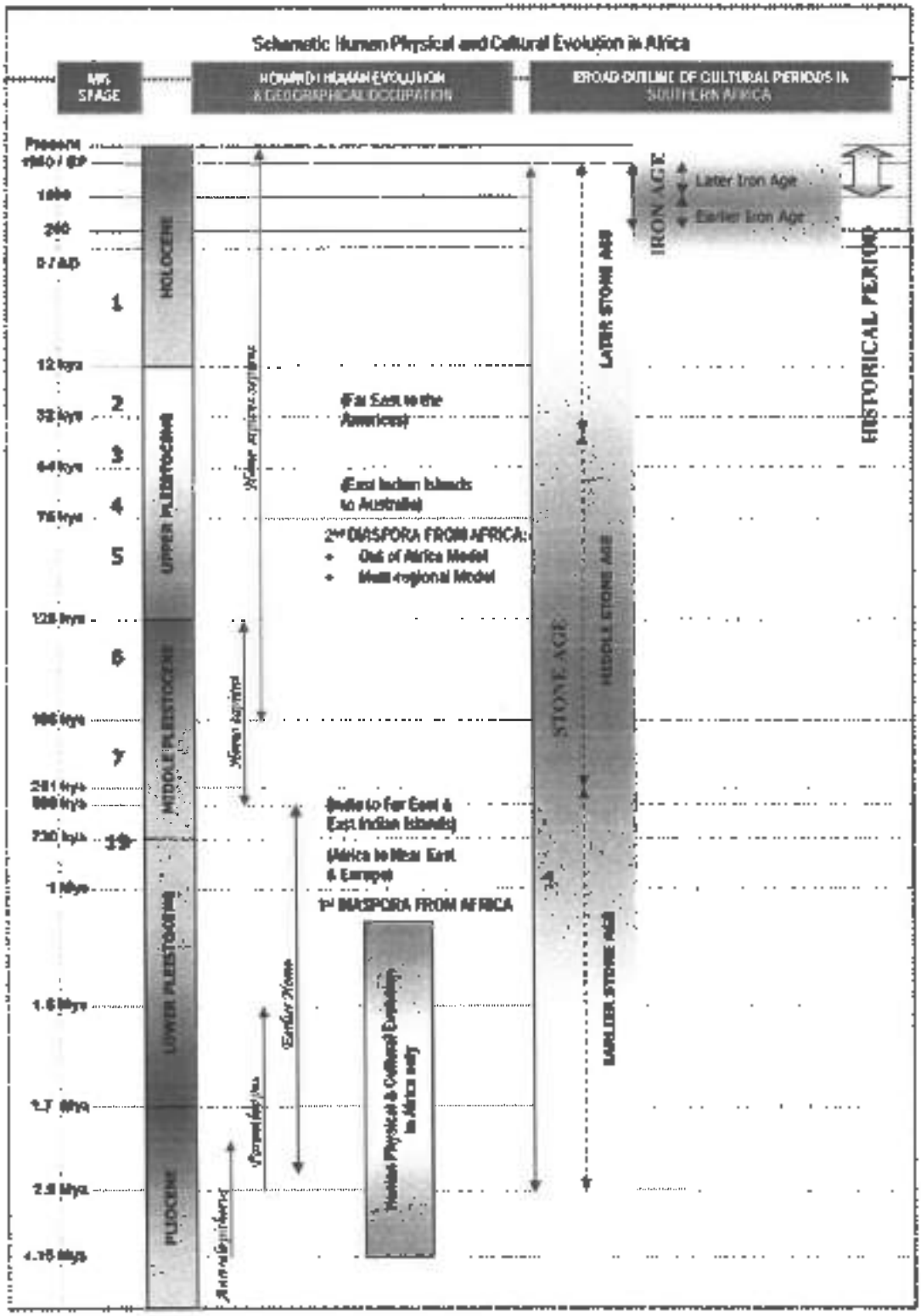

Figure 2 – Human and Cultural Timeline in Africa

1 INTRODUCTION

PGS Heritage (Pty) Ltd was appointed by Environmental Impact Management Services Consulting (Pty) Ltd (EIMS) on behalf of S TGS Geophysical Company (UK) (TGS) to undertake a Heritage Impact Assessment (HIA) that forms part of the Basic Environmental Assessment (BA) for their proposed 3D seismic survey off the West Coast of South Africa. The application area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay, Off the West Coast, South Africa.

1.1 SCOPE OF THE STUDY

The aim of the study is to identify the heritage resources that may be impacted upon by the proposed project. The HIA aims to inform the BA to assist the developer in managing the discovered heritage resources in a responsible manner, to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 SPECIALIST QUALIFICATIONS

This HIA Report was compiled by PGS Heritage (PGS).

The staff at PGS has a combined experience of nearly 90 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

The following individuals were involved with this study:

- Wouter Fourie, the Project Coordinator and Principal Heritage Practitioner, is registered with the ASAPA as a Professional Archaeologist and is accredited as a Principal Investigator, he is further an Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners (APHP).

- Nikki Mann, the author of this report, is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA). She has 4 years of experience in the heritage assessment field and holds a Master's degree (MSc) in Archaeology from the University of Cape Town.

1.3 ASSUMPTIONS AND LIMITATIONS

Not detracting from the stakeholder engagement completed, it is necessary to realise that the intangible heritage elements identified during engagements do not necessarily represent all

possible intangible cultural heritage elements present in this region. Various factors account for this, including the layered histories (e.g., memory of conflict, dispossession, and disempowerment through time) associated with the West Coast region, specifically in terms of intangible and living heritage resources associated with the ocean landscape. The values attributed to the ocean by the communities do not necessarily align to provide one definitive single significance to the ocean. Instead, the depth and complexity of values assigned to intangible heritage in this landscape depends on peoples' relationship to the ocean and their feelings about the proposed project.

1.4 LEGISLATIVE CONTEXT

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation:

- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified
- National Environmental Management Act (NEMA), Act 107 of 1998 – Appendix 6
- National Heritage Resources Act (NHRA), Act 25 of 1999

1.4.1 NEMA – APPENDIX 6 REQUIREMENTS

The HIA report has been compiled considering the NEMA Appendix 6 requirements for specialist reports, as indicated in the table below. For ease of reference, the table below provides cross-references to the report sections where these requirements have been addressed.

1.4.2 THE NATIONAL HERITAGE RESOURCES ACT

- National Heritage Resources Act (NHRA) Act 25 of 1999
    - Protection of Heritage Resources – Sections 34 to 36; and
    - Heritage Resources Management – Section 38

The NHRA is utilised as the basis for the identification, evaluation, and management of heritage resources and in the case of Cultural Resource Management (CRM), those resources are specifically impacted by development as stipulated in Section 38 of NHRA. This study falls under s38(8) and requires comment from the relevant heritage resources authority.

2 TECHNICAL DETAILS OF THE PROJECT

The following background information is provided by EIMS.

2.1 LOCALITY

TGS proposes to undertake a 3D seismic survey off the West Coast of South Africa. The proposed project area approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay over several petroleum licence blocks

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(Figure 3). The area of interest for the proposed 3D seismic survey is approximately 57 400 km2 in extent.

The survey area corner coordinate points are as follows:

Table 1 - Coordinates of the proposed survey area.

Point	Latitude	Longitude	Point	Latitude	Longitude
1	32°59'53.46"S	16°35'02.75"E	6	30°40'16.36"S	13°20'38.26"E
2	32°59'57.95"S	13°53'17.25"E	7	30°32'53.92"S	13°35'15.39"E
3	32°39'06.43"S	13°53'26.20"E	8	30°15'21.82"S	14°04'05.31"E
4	32°09'29.22"S	13°56'04.38"E	9	30°15'27.76"S	14°52'29.65"E
5	31°31'44.64"S	13°39'01.12"E			

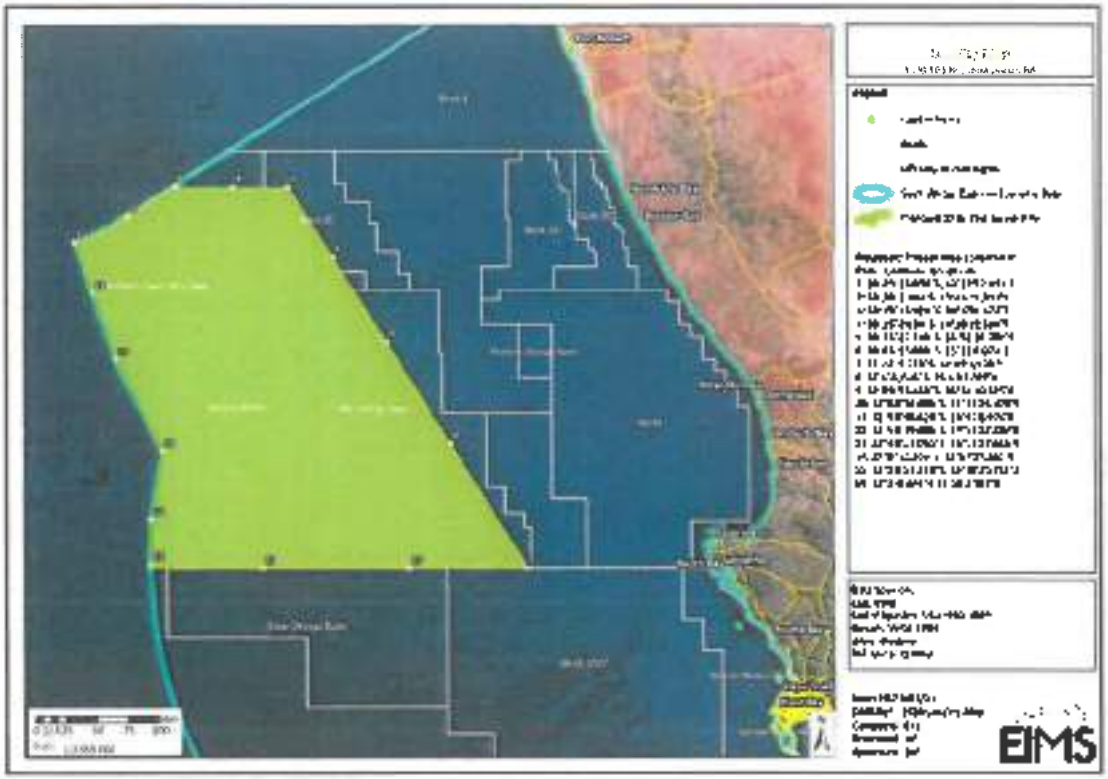

Figure 3 – Map indicating the location of the proposed survey project (green polygon) (source: EIMS).

2.2 TECHNICAL PROJECT DESCRIPTION

TGS is planning to conduct a seismic campaign over in the Orange Basin during the best available window of opportunity in either 2023 or 2024, subject to granting of the Reconnaissance Permit and vessel availability. The Reconnaissance Permit Area is approximately 57 400 km2 in extent. Water depths in the Reconnaissance Permit Area range from ~500 m to nearly 4 000 m. The area is situated roughly between the Orange River mouth and Cape Columbine, approximately 120 km offshore at its closest points. The total 3D survey duration would be in the order of up to four months.

The anticipated acoustic source (airgun) and hydrophone array would consist of 24 active guns with operating pressures of 2 000 pound-force per square inch (psi), situated some 50 m behind the vessel at a depth of 7 - 8 m below the surface. The 3D survey will involve multiple streamers (up to 12 streamers spaced 100 m apart) up to 12 000 m long, towed at a depth of approximately 8 m.

The seismic vessel would steam a series of predefined transects describing the survey grid, the headings of which would be fixed and reciprocal. During surveying the seismic vessel would travel at a speed of between four and six knots and the sound sources would be "fired" by the airgun array. As the seismic vessel would be restricted in manoeuvrability (a turn radius of approximately 5 km is expected), other vessels should remain clear of it. A support vessel usually assists in the operation of keeping other vessels at a safe distance.

Each triggering of a sound pulse is termed a seismic shot, and these are fired at intervals of 6 - 20 seconds (depending on water depth and other environmental characteristics) (Barger & Hamblen 1980). Each seismic shot is usually only between 5 and 30 milliseconds in duration, and despite peak levels within each shot being high, the total energy delivered into the water is low. Airguns have most of their energy in the 5-300 Hz frequency range, with the optimal frequency required for deep penetration seismic work being 50-80 Hz.

Sound levels from individual airguns use today in the seismic industry range from 200 to 232 dB re 1 µPa at 1 m, for small to large individual guns, respectively. For airgun arrays, sound levels range from 235 dB re 1 µPa at 1 m for a small array (500 cubic inches) to 260 dB re 1 µPa at 1 m for large arrays (7 900 cubic inches) (Bröcker 2019). The majority of the produced energy is below 250 Hz, with 90% of the energy between 70 to 140 Hz, although pulses do contain some higher frequencies up to 16 kHz (Bröcker 2019). It must be noted, however, that the sound level specifications for airgun arrays refer to sound levels in the vertical direction directly beneath the airgun array, generally near its centre, with nominal sound levels in the horizontal direction being ~10-20 dB lower (Caldwell & Dragoset 2000; Dragoset 2000).

3 ASSESSMENT METHODOLOGY

The section below outlines the assessment methodologies utilised in the study.

3.1 METHODOLOGY FOR ASSESSING HERITAGE SITE SIGNIFICANCE

This HIA report was compiled by PGS for the proposed project. The applicable maps, tables and figures are included, as stipulated in the NHRA (no 25 of 1999) and the National Environmental Management Act (NEMA) (No. 107 of 1998). The HIA process consists of three steps:

Step I – Literature Review and initial analysis: The background information to the field survey relies greatly on the Heritage Background Research undertaken for the study area.

Step II – The first phase of stakeholder engagement was part of the Public Participation process conducted by EIMS for the project. These public meetings were attended by a specialist from PGS to identify heritage themes highlighted by attendees to the meetings. Individuals and grouping were then identified to engage with in focussed meetings and interviews.

Step III – Focussed interviews with identified individuals and cultural group representatives. The aim was to build a database of tangible and intangible heritage that could potentially be impacted by the proposed project.

3.2 HERITAGE SIGNIFICANCE

Heritage significance classification standards use is based on the heritage classification of s3 in the NHRA and developed for implementation keeping in mind the grading system approved by SAHRA for archaeological impact assessments. The update classification and rating system as developed by Heritage Western Cape (2021) is implemented in this report

Site significance classification standards prescribed by the Heritage Western Cape Guideline (2016), were used for the purpose of this report (**Table 2** and **Table 3**).

Table 2 - Rating system for archaeological resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Langebaanweg (West Coast Fossil Park) Cradle of Humankind	May be declared as a National Heritage Site managed by SAHRA. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Highest Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
II	Heritage resources with special qualities which make them significant, but do not fulfil the criteria for Grade I status. Current examples: Blombos, Paternoster Midden.	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Exceptionally High Significance
III	Heritage resources that contribute to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. Current examples: Varschedrift; Peers Cave; Brobartia Road Midden at Betty's Bay	Resource must be retained. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree.	Resource must be retained where possible where not possible it must be fully investigated and/or mitigated.	Medium Significance
IIIC	Such a resource is of contributing significance.	Resource must be satisfactorily studied before impact. If the recording already done (such as in an HIA or permit application) is not sufficient, further recording or even mitigation may be required.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant or the consultant and approved by the authority.	No research potential or other cultural significance

Table 3 - Rating system for built environment resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Robben Island	May be declared as a National Heritage Site managed by SAHRA.	Highest Significance
II	Heritage resources with special qualities which make them significant in the context of a province or region, but do not fulfil the criteria for Grade I status. Current examples: St George's Cathedral, Community House	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority.	Exceptionally High Significance
II	Such a resource contributes to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. These are heritage resources which are significant in the context of an area.	This grading is applied to buildings and sites that have sufficient intrinsic significance to be regarded as local heritage resources; and are significant enough to warrant that any alteration, both internal and external, is regulated. Such buildings and sites may be representative, being excellent examples of their kind, or may be rare. In either case, they should receive maximum protection at local level.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree. These are heritage resources which are significant in the context of a townscape, neighbourhood, settlement, or community.	Like Grade IIIA buildings and sites, such buildings and sites may be representative, being excellent examples of their kind, or may be rare, but less so than Grade IIIA examples. They would receive less stringent protection than Grade IIIA buildings and sites at local level.	Medium Significance
IIIC	Such a resource is of contributing significance to the environs These are heritage resources which are significant in the context of a streetscape or direct neighbourhood.	This grading is applied to buildings and/or sites whose significance is contextual, i.e. in large part due to its contribution to the character or significance of the environs. These buildings and sites should, consequently, only be regulated if the significance of the environs is sufficient to warrant protective measures, regardless of whether the site falls within a Conservation or Heritage Area. Internal alterations should not necessarily be regulated.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHFA are required. This must be motivated by the applicant and approved by the authority. Section 34 can even be lifted by HWC for structures in this category if they are older than 60 years.	No research potential or other cultural significance

3.2.1 Methodology used in Determining the Significance of Environmental Impacts

The methodology used to determine the environmental impact significance was provided by EIMS and is explained in **Appendix B**.

4 DESKTOP STUDY

4.1 OVERVIEW OF THE STUDY AREA AND SURROUNDING LANDSCAPE

For the last 200 000 years, the West Coast has been an attractive region for hunter-gatherers, pastoralist groups and modern-day fisher people, due to its wealth of marine and terrestrial resources. The ocean is an integral part of West Coast's natural and cultural heritage. West Coast residents are proud of their unique 'Weskus' culture. According to Schultz (2010), 'a family's association with the West Coast is their claim to Khoisan heritage as constituting a historical bond with the cape West Coast".

4.1.1 PRE-COLONIAL ARCHAEOLOGICAL CONTEXT

Marine resources have a long history of human exploitation. Evidence from archaeological sites suggest that the West Coast region was occupied from the Early Stone Age (ESA) through to the Middle Stone Age (MSA) and Later Stone Age (LSA), up until the arrival of early European settlers from the 18th century onwards. There are numerous sites (including shell middens, stratified cave deposits, rock art, stone tools, and fish traps) recorded along the coast that demonstrate that the rocky shorelines were attractive to hunter-gatherers through time (e.g., Halkett, 2003; Halkett and Dewar, 2007; Sadr *et al.*, 1992; Kaplan, 1993, 1996, 1998, 2008, 2011a, 2014; Morris, 2006; Webley, 2009; Jerardino *et al.*, 2013). Much of what we know about settlement, subsistence strategies and diet along the coast is linked to these shorelines (Parkington 1976; Hart & Miller, 1994). Whilst gorges and stone sinkers are probably the best evidence for technical fishing equipment in the LSA, marine shell middens also demonstrate that the coastal zone was particularly favoured by LSA people (Deacon, 1995).

4.1.2 SHELL MIDDENS

Marine shell middens have been identified within 1km of the coastline, near estuaries and in dune fields which lie adjacent to rock shores. While pre-historic people likely favoured the rocky shorelines for ease of access to marine resources, middens have also been found further inland, where people would have been able to exploit additional resources such as game life and fresh water.

In some instances, these shell middens are associated with domestic artefactual debris which suggests that they in fact represent occupation sites of long duration. Whilst the opposite can be said for midden sites that do not contain a formal stone artefact component, and instead may represent visits of short duration. These pre-historic people were the ancestors of the San and Khoikhoi.

According to archaeologists, several shell middens in the Vredenburg Peninsula are associated with both San and Khoikhoi groups who were harvesting the shorelines and estuaries of the West Coast in a sustainable and patterned manner (Parkington et al. 1988).

4.1.3 STONE FISH TRAPS

The remains of fish traps (*visvywers; stone-walled tidal fish traps*) have been recorded along the South African coastline from St Helena Bay to Mossel Bay (Goodwin, 1946; Avery 1975; Phillip et al , 2010). Along the south-western coastline, these traps, which use "the tidal range to allow fish to enter pre-built enclosures and be trapped at low tide", provide evidence of early fishing techniques. The preserved fish traps vary in shape, size, and spatial complexity. Identifying the architects of these traps is, however a contentious issue.

Initially, researchers believed that the fish traps on the south coast were ancient maritime resource systems that originated among LSA people after 2000 years ago with the arrival of Khoikhoi herders (Avery, 1975; Gribble, 2006). More recent research suggests that the development of fish traps along the southern and western coasts dates to the 19th century. Furthermore, these structures may have been introduced by European farmers as part of the farming-fishing system when intensive exploitation of inshore fish by local farmers occurred (Hine, 2006, 2009; Hine et al. 2010).

In 1987, Graham Avery recorded a tidal fish trap in Mauritzbaai, south of Jacobsbaai (Kaplan 2004). Hart and Halkett (1992) have also identified the remains of at least six traps in the intertidal zone at Wilde Varkens Valley, St Helena Bay.

4.1.4 INDIGENOUS PEOPLES

4.1.5 INTRODUCTION

Before the colonial era, there were several diverse ancient tribes who traversed the valleys and plains of the present-day West Coast region of South Africa. The origins of the West Coast fishing communities can be traced back to the San and Khoikhoi peoples who lived within this region. Together, the Khoi and the San are the First Peoples of South Africa.

In 1928, a German physical anthropologist Leonard Schultze, created the term 'Khoisan', to stress the similarities between the Khoikhoi and the San (Le Fleur and Jansen, 2013; Secorun, 2018). The settlers used the term 'Bushmen' when referring to the San, and many of whom the colonists' called 'Bushmen' were, in fact, Khoikhoi or former Hottentot. Today, this term is considered derogatory, and instead, scholars would rather refer to hunters and herders together as 'Khoisan'.[1]

[1] https://www.sahistory.org.za/article/khoisan

It should be noted that although Khoi and San Peoples may share some experiences, culturally, they remain two distinct groups, and the general preference amongst both Khoi and San people is to be called by their clan names.

4.1.6 THE SAN[2]

During almost the entire Holocene period, small groups of San hunter-gatherers were present in southern Africa. The San are the direct descendants of the first peoples of southern Africa.[3] It should be noted that the term "San" is used to cover over a dozen distinct hunter-gatherer groups who speak distinctive "click" languages (incl. the Khwe, !Xun, Juhoansi, Naro, Ju|'hoansi and other groups). These groups lived across Namibia, South Africa, Botswana, and Zimbabwe. The San were small groups of nomadic people who lived by the ethos of "all people are equal". They hunted and gathered resources and did not keep livestock.

It is generally agreed amongst academics that the San were the first inhabitants of the Cape region. During the latter part of the Holocene, there were hunter-gatherers living on the West Coast who made seasonal use of the coastal resources (Parkington and Hall, 1987). Several archaeological sites, including Duyker Eiland, which is in Britannia Bay, confirmed the importance of shellfish, seals, marine birds, crayfish, and beached whales as a food source for the local inhabitants during this time (Robertshaw, 1979).

4.1.7 THE INTRODUCTION OF KHOIKHOI

For thousands of years, the Khoikhoi[4] people have occupied and moved around Southern Africa as nomadic herders. The Khoikhoi were large groups of nomadic herders who owned substantial herds (incl. cattle and sheep) and migrated for pasture, water, and food resources. It is understood that Khoikhoi peoples have a spiritual connection to land, where land is perceived as a gift from nature to be cared for

Note that the Khoikhoi term is an umbrella term which refers to different tribes. The Khoikhoi people comprise four historical groupings: the Griqua, Nama, Koranna and Cape Khoi (incl further subgroupings). Today, the Nama people are primarily located in the Northern Cape. The Griqua are in the Western Cape, Eastern Cape, KwaZulu Natal and Gauteng, and various other parts of the country. The Korana people, live primarily in Kimberly and the Free State. The Cape Khoi are in the Western and Eastern Cape.

Evidence suggests that around 2000 years ago, the pastoralist Khoikhoi entered South Africa along the West Coast into the Cape region (Smith, 1987, Sealy and Yates 1994; Henshilwood, 1996;

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[2] *The Khoikhoi and the early Dutch settlers called these groups Soaqua (literally 'San').*
[3] *https://www.hr-dp.org/files/2015/07/06/30516746.pdf*
[4] *Note that the use of the terminology of Khoikhoi or Khoekhoe is used by various scholars and writers. This report will be using Khoikhoi as the standard*

Avery, 1975; Schweitzer, 1979; Deacon et al., 1978;). They brought a new way of life, from its northern origins, to South Africa. The Khoikhoi introduced domesticated livestock and new material culture (incl. pottery) into the region. They relied more on sheep as a meat resource and hunted and gathered (Schapera, 1933). Groups living close to the coast would also exploit shellfish, seals, and other marine resources. The St Helena Bay (Slipper Bay) region appears to have provided the Khoikhoi with invaluable resources, including whale meat obtained via 'cetacean traps[5].

One of the most important West Coast pastoralist sites, Kasteelberg, is an open-air archaeological site located 4km from the coast. It provides evidence of occupation by herders between 1800 and 1600 years ago (Klein, 1986). The occupants of the site focused on harvesting seals and the presence of sheep bones also indicated that the inhabitants were most likely herding domestic stock (Klein, 1986; Smith, 2006).

It is thought that the indigenous people in the Cape populated a region from Northern Namibia to the Cape of Good Hope and from the Atlantic Ocean to the Fish River in the East (Figure 4). The area between Saldanha and Vredenburg was occupied by the CochoQua and the CheriGuriQua (GuriQua) group occupied the lower Berg River area which included St Helena Bay and regions around Pickelberg.

Some researchers choose to use the term Peninsular Khoikhoi" when referring to the *Gorachoquas, Goringhaiquas* and the *Goringhaiconas* ("strandlopers") and "Surrounding Khoikhoi" for the *Cochoqua, Chainouqua* and *Hessequa* (see Brink, 2000; Nienaber, 1989; Wilson, 1990).

[5] "Places where whales often strand themselves along the shore are known as 'cetacean traps'. These are areas where anomalies in the earth's magnetic field cross the shoreline, and where there are offshore reefs." (http://www.saveabeach.com/history.html)

Figure 4 – Map illustrating the approximate locations of Khoikhoi before contact with the Europeans (in the southwest Cape ca. 1650) (Source: Elphick and Giliomee, 1979).

In the pre-colonial era, the relations between the Khoikhoi and the San were relatively stable due to a mutual acknowledgement of territories. Although the San and Khoikhoi seemed to have co-existed for a period, it appears that, to some degree, the San groups were displaced (Elphick, 1977; Parkington *et al.* 1986). It's assumed that the Khoikhoi moved into areas that had previously been utilised by the San, thus forcing the San to move into more isolated coastal regions (Manhire, 1987). The San's "settlement and subsistence strategy changed from one based on the large-band occupation of open areas and the hunting of large game towards the more intensive utilisation of rock shelters, in small groups and a foraging-based economy" (Barnard, 1992). Unfortunately, indigenous groups who lived on the coast were the first people to be severely impacted by colonial oppression (Boezak, 2017).

4.1.8 COLONIAL DISPOSSESSION

First contact between indigenous pastoralist groups and Europeans occurred during the 15th and 16th centuries when Portuguese mariners would sail down the coast. Before the Dutch East India Company's ("VOC") governance over the southernmost tip of Africa, European merchants, and travellers en route to or from Asia would call in at the natural harbour of Saldanha Bay for refreshment. Encampments were also set up along the coast by survivors of shipwrecks, and in their journals, they would recall how they met and traded with indigenous groups (Smith, 1985; Raven-Hart, 1967). Written records reveal that in 1497, the GuriQua and the San (SonQua) witnessed the arrival and departure of Vasco da Gama in St Helena Bay (Raven-Hart, 1967; Axelson,1996). Although the Saldanha Bay harbour was more sheltered than Table Bay and

allowed for the crews to trade livestock from the Khoikhoi in the area (Raven-Hart, 1967; Smith, 1965), there was not enough fresh water available to allow for the establishment of large permanent settlements.

It was only in 1652 that the VOC decided to occupy the Cape and establish the first permanent European settlement in South Africa. The VOC established a station at Table Bay to supply Company fleets travelling between Europe and the Indies with refreshments (i.e., meat, wheat, vegetables, and freshwater) (Ward, 2009). When the Dutch colonists arrived, they encountered several Khoikhoi groups. The largest concentration of Khoikhoi lived in the lush pasture lands of the south-western Cape region.

Initially, the relationship between the Dutch and the Khoikhoi was one of cooperation, and the VOC established trading agreements with local chiefs to get regular supplies of fresh meat (Elphick, 1977). As the colony grew, the VOC decided to decrease their dependency on local trade with the Khoikhoi. Their alternative plan was to give land to free burghers to supply meat and grain to the Company.

Khoikhoi and San lives were impacted upon by both internal strife and direct conflict with the Europeans over the disregard of traditional customs, the privatisation of land, and exhausting indigenous resources (i.e., overfishing and farming). As the Dutch took over more of the Khoikhoi's grazing land for farms, much of the Khoikhoi and San peoples' traditional lands were dispossessed (Elphick, 1977; Bredekamp, 1986; Elphick and Malherbe 1989; SAHistory, 2012). In 1657, the Goringhaiqua tribe were ordered to move to the east of the Liesbeeck boundary and this 'eviction' event would be instrumental for the first war against colonial intrusion (Bredekamp and Newton-King, 1984). The First Khoikhoi-Dutch War lasted the whole of 1659 (Elphick, 1977).

According to Sleigh (1993: 148), "In 1672, two sons of the weakened Peninsular Khoisan chiefs signed a contract, which they probably did not fully understand, and sold huge tracts of land from Table Bay to Saldanha Bay in the North and to the Hottentots Hollands mountains in the East to the VOC for an incredible low price (which they did not even fully receive)".

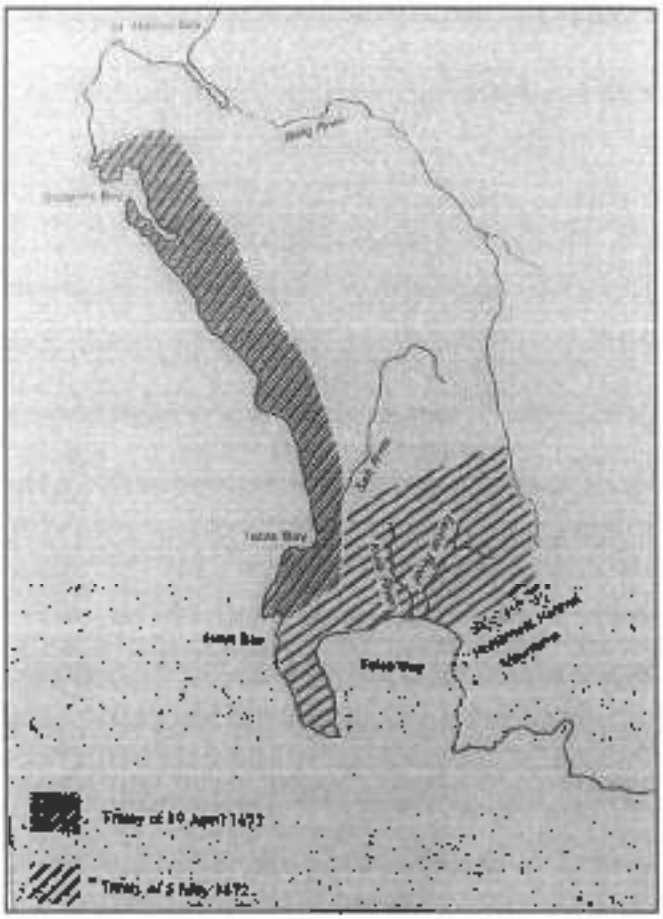

Figure 5 – Map illustrating the 1672 land 'sale' (Source: Boonzaier et al., 1996: 79).

After a few more instances of territories being ignored and further land appropriation, another war of resistance was initiated by the Cochoqua, and the Second Khoikhoi-Dutch War commenced (1673-1677). This led to more Khoikhoi groups being forced to relocate to areas further up the coast.

According to writings of early settlers, it appears that some San groups, who pursued a hunting and foraging lifestyle, may have still resided in the mountainous regions of the Cape where they were less likely to clash with the Khoi or Dutch settlers (Parkington et al. 1988). Regions that were less desirable for the colonists, such as Namequaland, became places of refuge for the San and Khoikhoi who were able to continue many aspects of their traditional ways of life in this area for some time (Raper and Boucher, 1988).

In 1713, the small-pox epidemic led to the death of many Khoikhoi people living in the south-western Cape. The surviving Khoisan became assimilated as domestic/farm workers due to the high demand for labour by the Dutch. In rural areas, the Khoisan were forced into what was referred to as semi-bonded labour (Ward, 2009).

By the late 18th century, the Cape settler colony's territories incorporated the Berg (c. 1790), Olifants (1750), and Buffels (1798) rivers.

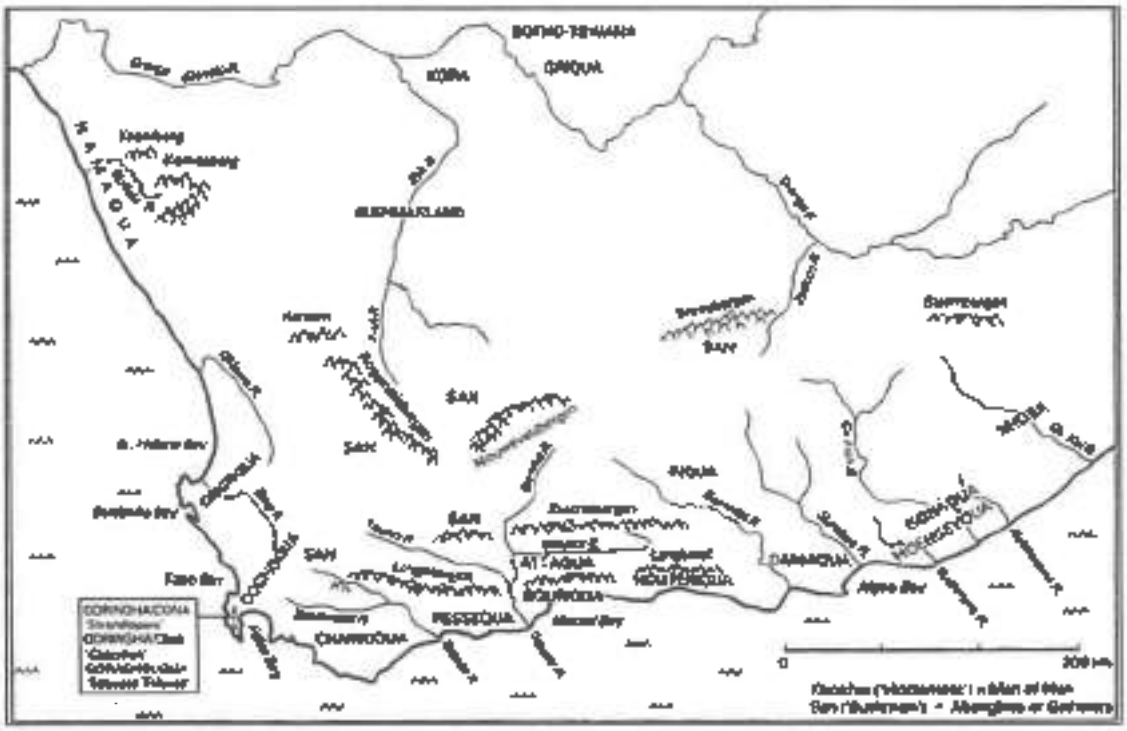

Figure 6 – Map illustrating the Khoikhoi and San groupings in South Africa during the 17th and 18th centuries (Source: Boeseken and van den Berg, 1955).

4.1.9 THE HISTORY OF FISHING ON THE WEST COAST

4.1.10 17TH CENTURY

During the 17th century, the VOC established an outpost at St Helena Bay (Saldanha Bay Municipality, 2020). From 1670, free burgers started to fish regularly in St Helena Bay (Sleigh, 1993). They introduced methods to the region that were not previously available to indigenous fishermen, such as metal hooks, boats, nets and bulk processing and storage.

4.1.11 18TH CENTURY

During the 18th century, the Cape settler's economy was primarily based on slave labour which was imported from Asia and East Africa. The agricultural sector which was maintained by free burghers (freed from Company service) was not stable and due to the trade of the Khoikhoi's livestock being intermittent, the settlers had to make alternative arrangements for food resources. This led to Robben Island being exploited for seals, penguins, and seabirds (Penn, 1996; Ward, 2009). Large rural landowners established private coastal fishing posts to supply marine resources to the Company, the local region, passing ships and for export (Muller 1942; De Kock 1966). Soon, Dassen Island, Saldanha Bay and St Helena Bay developed as significant centres to supply the

VOC with additional resources to sustain the growing number of people in the Cape colony, including the substantial number of slaves kept by the Company. According to Sleigh (1993), the slaves were given salted fish, seal meat, penguin, and bird eggs whilst the rest of the colony preferred to consume meat.

According to Marincowitz (1985: 40–46) *"With exclusive land grants closing the north-western frontier, from the 1740s growing numbers of ex-slaves, dispossessed Khoekhoe, failed farmers, evicted tenants and bywoners (tenant farmers), new immigrants and fugitives from colonial and military justice moved onto the beaches of the west coast".*

Early fishing, sealing and whaling activities, by European and American whalers, around Saldanha Bay, especially near Marcus Island/Outer Bay and at Salamander Point, have been extensively documented in the archival/historical record (*Griffiths et al. 2004;* David & van Sittert, 2008). Although the inshore whale population declined after 1830, processing continued at Donkergat in Saldanha Bay (Halkett 1998).

4.1.12 19TH CENTURY

By the mid 19th century, scattered subsistence communities had emerged along the West Coast. Before the arrival of industrial fisheries, residents in St Helena Bay employed basic fishing technology (small-scale line fishing, beach seine nets and rowing boats) and fishing activities were informally organized by boat and net owners.

Malay slaves and other residents moved into the region to work as farm labourers. Over time, the unique fishing skills of enslaved Malay people interminglied with the fishing skills of the indigenous people. This led to the establishment of small fishing villages along the West Coast (incl. Saldanha, Langebaan and St Helena Bay).

After the emancipation of slaves, new laws were introduced to control both the freedom of movement and independent livelihoods of people who did not own land. This forced fishermen on the West Coast "to either develop artisanal skills, become wage labourers or squat on coastal government land to eke out a living from small scale production and seasonal work" (Van Sittert 1992: 12-14).

Using business capital in both the local and international markets, entrepreneurs were able to lease Crown land and establish coastal industries along the West Coast (Van Sittert 1992).

By the 1880s, a Cape Town-based trading company, Stephan Brothers, was able to monopolise the West Coast trade. The company bought the main grain shipping points along the West Coast,

including the southern shore of St Helena Bay, where they established Laaiplek (translates to 'loading place') at the mouth of the Berg River (Van Sittert 2001: 197).

4.1.13 20TH CENTURY

Although the local fishing industry on the West Coast employed a substantial number of locals at the start of the 20th century, the industry is associated with a history of hardship. The industry's collapse in the mid-20th century left numerous West Coast communities impoverished (Van Sittert, 2001). Despite all the obstacles thrown at them, the West Coast fishing communities were resilient and continued their fishing tradition throughout the 20th century.

Historically, small-scale fishers have constantly had to compete against big scale fisheries. For example, Piketberg coastal fisheries used a method of fishing called beach seining to supply inland farmers with cheap ration fish. When there was a decline in snoek sources further south, Italian immigrant fishermen from Cape Town travelled up the West Coast on boats with set nets. Ultimately, their method of fishing impacted the supply of fish for the sedentary fishermen.

By 1900, the Stephan Brothers company were in control of nearly every suitable bay from Saldanha Bay to Lamberts Bay. They also owned numerous farms which were often acquired in exchange for debt. In 1909, the company negotiated an agreement with the State to establish an Exclusive Trek Seine Fishing Zone along the Malmesbury coast (Van Sittert 1992: xxxii). This move meant that the company was able to dominate a new manufacturing industry which further exacerbated resource owners and local fishermen.

During World War One, there was a crayfish canning boom in the Cape. The sourcing of crayfish moved rapidly up the West Coast during this period (Griffiths et al. 2004). By the early 1920s, the overexploitation of crayfish resulted in an exhaustion of crayfish stocks and West Coast factories were forced to close. This meant that the small-scale seine fishermen, and fishermen who netted in the backwaters, were left even more vulnerable to the financial depression of the 1930s.

Then, in 1934, in an act of retaliation, "Saldanha Bay fishermen invaded the Piketberg area on motorboats carrying Italian lampara nets and, with the support of Government, wiped out the non-motorised Berg River inshore fisheries run by consortiums of farmers, fishery owners and canners" (Van Sittert 1992: 211–237).

In 1951, increasing catches along the West Coast, meant that both skippers and fishermen yielded good financial returns. By 1955, South Africa had the largest fishing industry in the southern hemisphere (Griffiths et al. 2004).

With the Apartheid system arriving, the indigenous identity of the Khoisan was further disrupted through the Race Classification Act and the Populations Registration Act. The Khoisan were forcibly categorised as "Coloured" (Boswell and Thornton, 2021). This label further dispossessed the

people from their heritage. Under the Group Areas Act (1950) the towns of the West Coast were divided into segregated residential and business areas. The forced removals marked yet another era of forced removals from areas that indigenous people occupied. Despite the discrimination, the communities continued their tradition of fishing that had been passed on through the generations of fisher families.

4.1.14 MARITIME HERITAGE RESOURCES

The following section was developed by maritime archaeologist Vanessa Maitland.

The first recorded European voyages down the west coast of Africa were by the Portuguese. When the first Portuguese explorers travelled down the west African coast, they stuck close to the coastline, to map the land. However, occasionally they were swept towards the Americas, as is evident by the fate of the fleet of Pedro Alvares Cabral, in 1500. This was first Portuguese fleet which was to sail annually to the Indies. Twenty days after the fleet left Brazil, which they had "discovered", it was struck by storms and four ships, including the one under command of Bartolomeu Dias, foundered somewhere in the southern Atlantic. Different researchers put them anywhere between Tristan da Cunha and the Cape.

Bartolomeu Dias and his fleet passed the Orange River Mouth in 1487/1488 (Axelson, 1973). Thereafter, the rate of exploration and trade increased exponentially, as is evidenced by the increase in shipwrecks over the centuries. These early voyages were not well documented, and the archives often merely report that a fleet of a certain number of vessels left and only a certain amount returned, with only vague references to their place and manner of loss. Therefore, there are many undocumented wrecks, along the coastline and even more offshore.

There is some anecdotal evidence that the Phoenicians circumnavigated Africa (Herodotus, 1954). If this is true, these ships had to stick right to the coastline and therefore are likely to be inshore. There's increasing evidence that the Chinese voyages of the 1400s explored parts, if not all, of the African coast (Paine, 2013). However, once again the archival evidence to date, and availability to Western researchers, limits this knowledge.

There are many ships that are only recorded as having disappeared between Europe and the Far East and Americas. As well as between local ports. The mechanics of sailing vessels and winds meant that for a ship to get from Europe to the Cape, they often sailed via South America. There are also numerous missing U-boats and other war vessels from WW1 and WW2 that may be found.

Thousands of ships have disappeared in the southern Atlantic Ocean, a portion of these can be seen in **Figure 7**. There are numerous historical reports of abandoned vessels being seen by other ships (**Figure 8**).

Figure 7 - A portion of the ships wrecked off South Africa and in the southern Atlantic

on the Wednesday returned for my North.

Captain Worsnop, of the ship Waimate, which arrived at Port Chalmers from London yesterday, reported that on May 22nd, in latitude 17·39 S., longitude 33·45 W., he encountered the hull of the British ship Kakanui which caught fire when bound from London to Melbourne and was abandoned by the crew on April 28. The vessel was completely burnt out, nothing but the shell being left, with a mass of metal and burning in the bottom of the hold. As the hull was lying right in the track of vessels, and was a dangerous obstruction, Captain Worsnop had a steps knocked out of the bottom, and it was expected that it would sink in a couple of days.

Figure 8 - Report in The Auckland Star 26-07-1895, by the Waimate on the drifting hulk of the Salsette

4.1.15 ARCHIVAL AND HISTORICAL MAPS

Relevant historical maps were studied to identify the tribes that historically occupied the West Coast region. Historical maps for various years (1747 and 1850) were available for utilisation in the background study.

4.1.15.1 MAP OF CAPE OF GOOD HOPE, 1747

(Publisher: Pierre d'Hondt)

The map depicted in **Figure 9** is titled Kaart van de Kaap de Goede Hoop ("Map of Cape of Good Hope"). The map dates from 1747. The land surveyor/mapmaker was Jacques Nicolas Bellin (Publisher: Pierre d'Hondt).

4.1.15.2 SECTION OF CAPE COLONY, 1812

(David Rumsey Historical Map Collection: Image No. 0028063).

The map depicted in **Figure 10** is titled "Cape Colony". The full title of the map is "Colony of the Cape of Good Hope. ". The map dates from 1812. The map was drawn from Mr. Barrow's survey by A Arrowsmith and S. Lewis (Publisher: Thomas & Andrews). "Relief shown by hachures".

4.1.15.3 SECTION OF SOUTH AFRICA (CAPE COLONY), 1832

(David Rumsey Historical Map Collection: Image No. 0247106).

The map depicted in **Figure 11** is titled "South Africa (Cape Colony)". The map dates from 1832. The authors of the map were W.M. Higgins and D. John (Publisher: W.S. Orr & Co.).

4.1.15.4 CAPE COLONY, 1850

(Publisher: J. & F. Tallis)

The map depicted in **Figure 13** is titled "Cape Colony". The map dates from 1850. The map was drawn and engraved by John Rapkin, and illustrations were by H. Warren (Publisher: J. & F. Tallis).

4.1.15.5 SECTION OF CAPE PROVINCE, TRANSVAAL, &C. – WESTERN SECTION, 1922

(David Rumsey Historical Map Collection: Image No. 2113082)

The map depicted in **Figure 12** is titled "Cape Province, Transvaal, &c. – western section". The map dates from 1922. The author of the map was John Bartholomew and Son (Publisher: The Times).

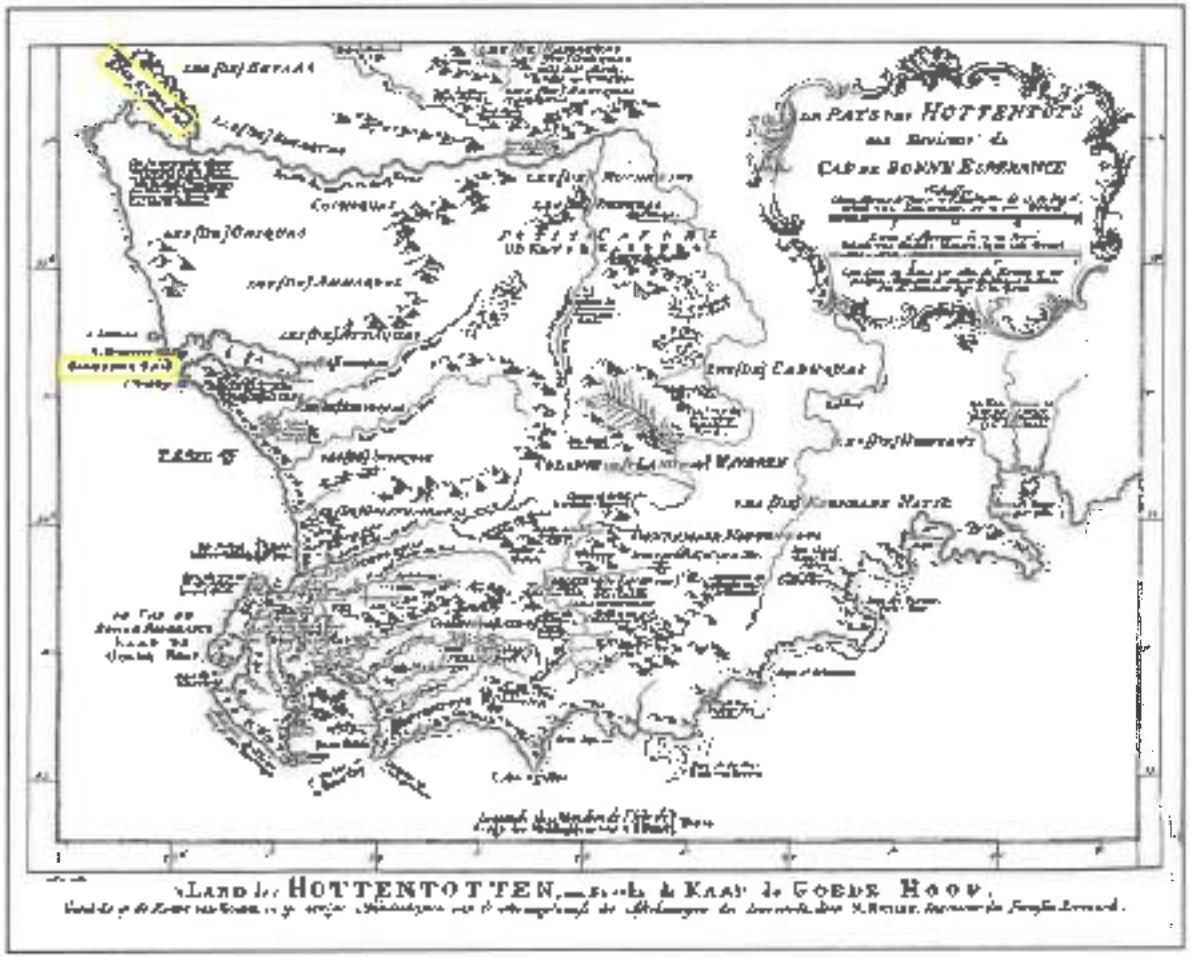

Figure 6 – 1747 historical map titled "Map of Cape of Good Hope"[6] (yellow polygons: West Coast towns).

[6] Source: https://commons.wikimedia.org/wiki/File:AMH-7958-KB_Map_of_the_Cape_of_Good_Hope.jpg

Figure 10 - Section of the 1812 Cape Colony map (yellow polygons: West Coast towns).

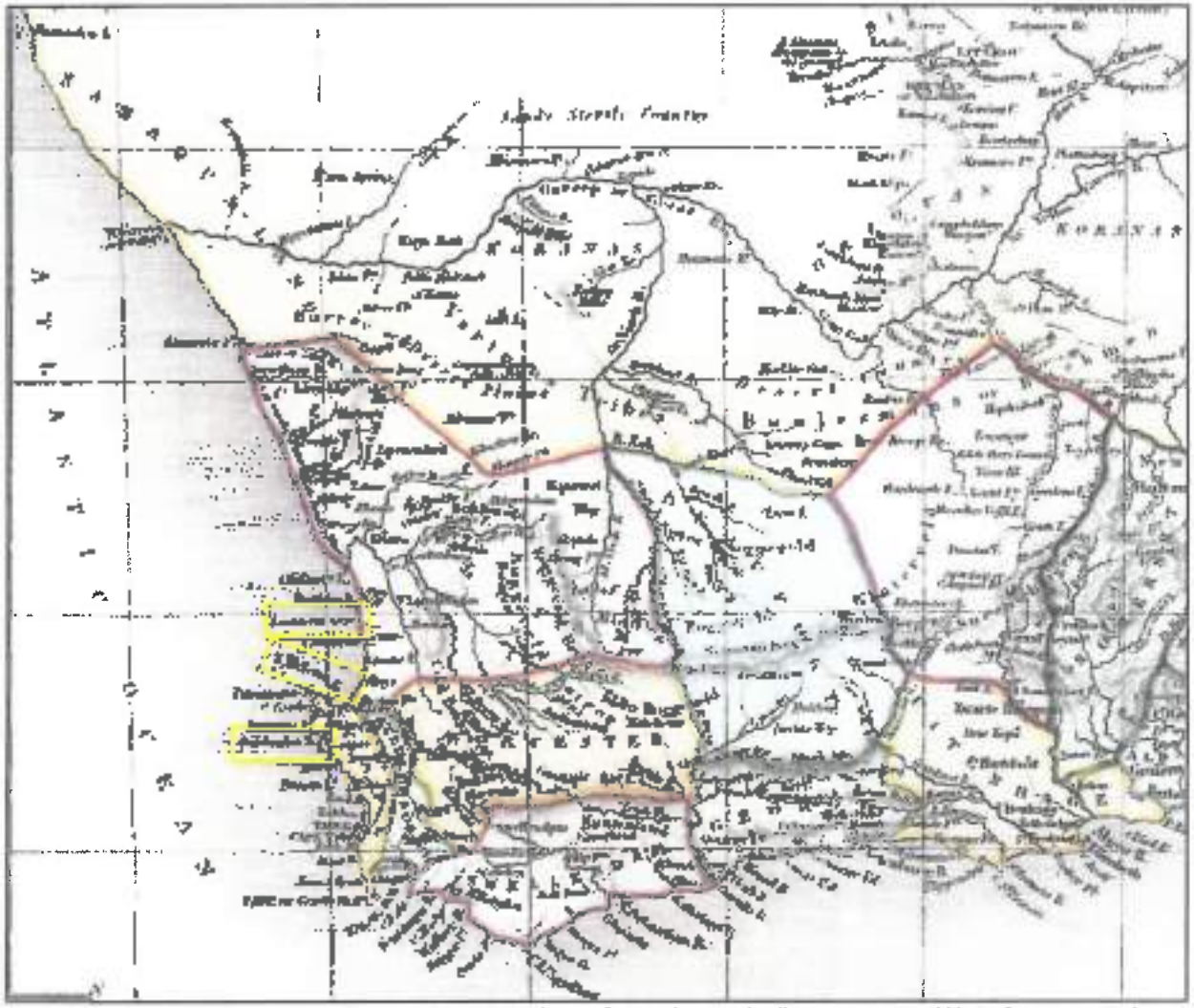

Figure 11 - Section of the 1832 South Africa (Cape Colony) map (yellow polygons: West Coast towns).

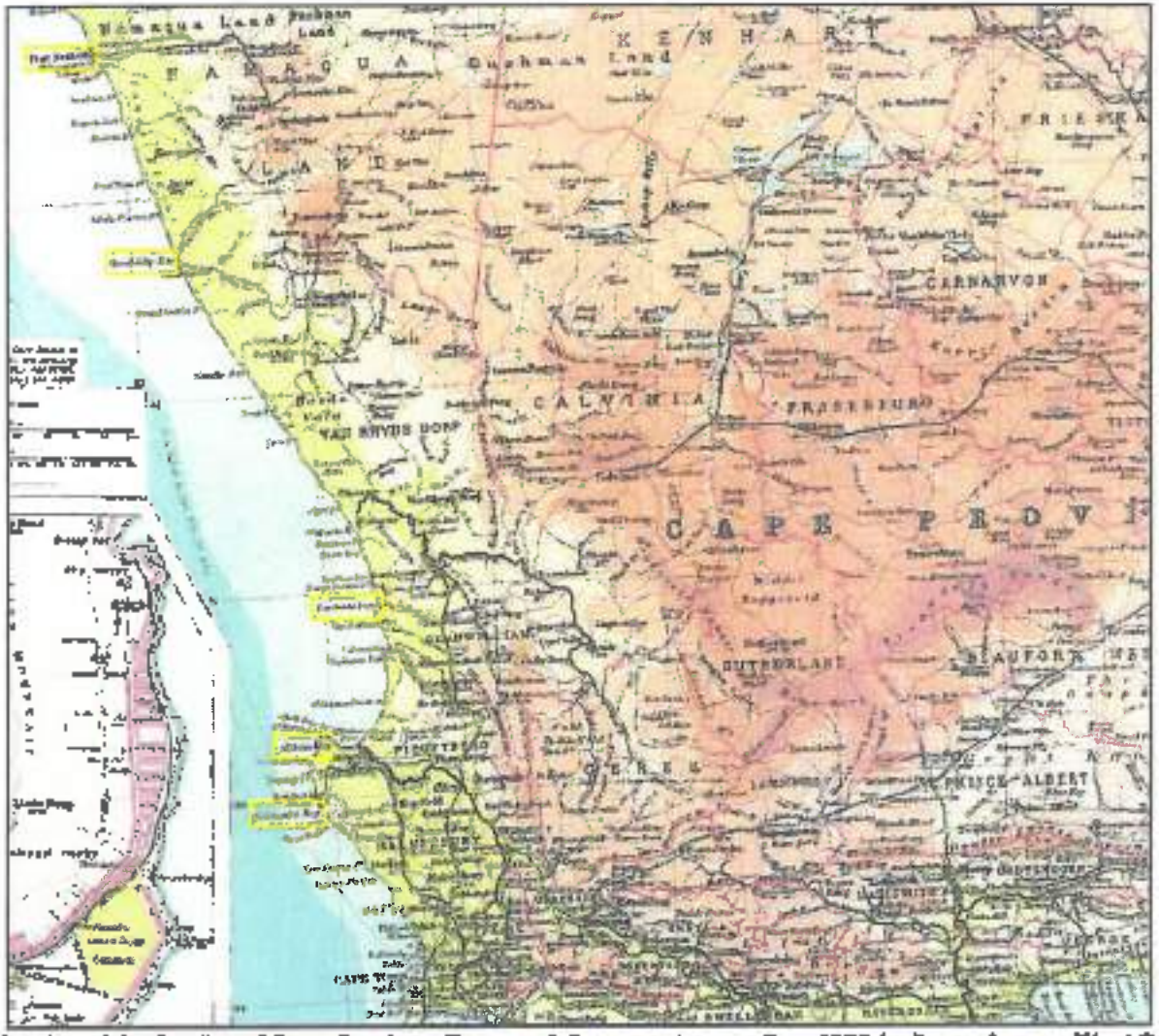

Figure 12 - Section of the Section of Cape Province, Transvaal, &c. – western section, 1922 (yellow polygons: West Coast towns).

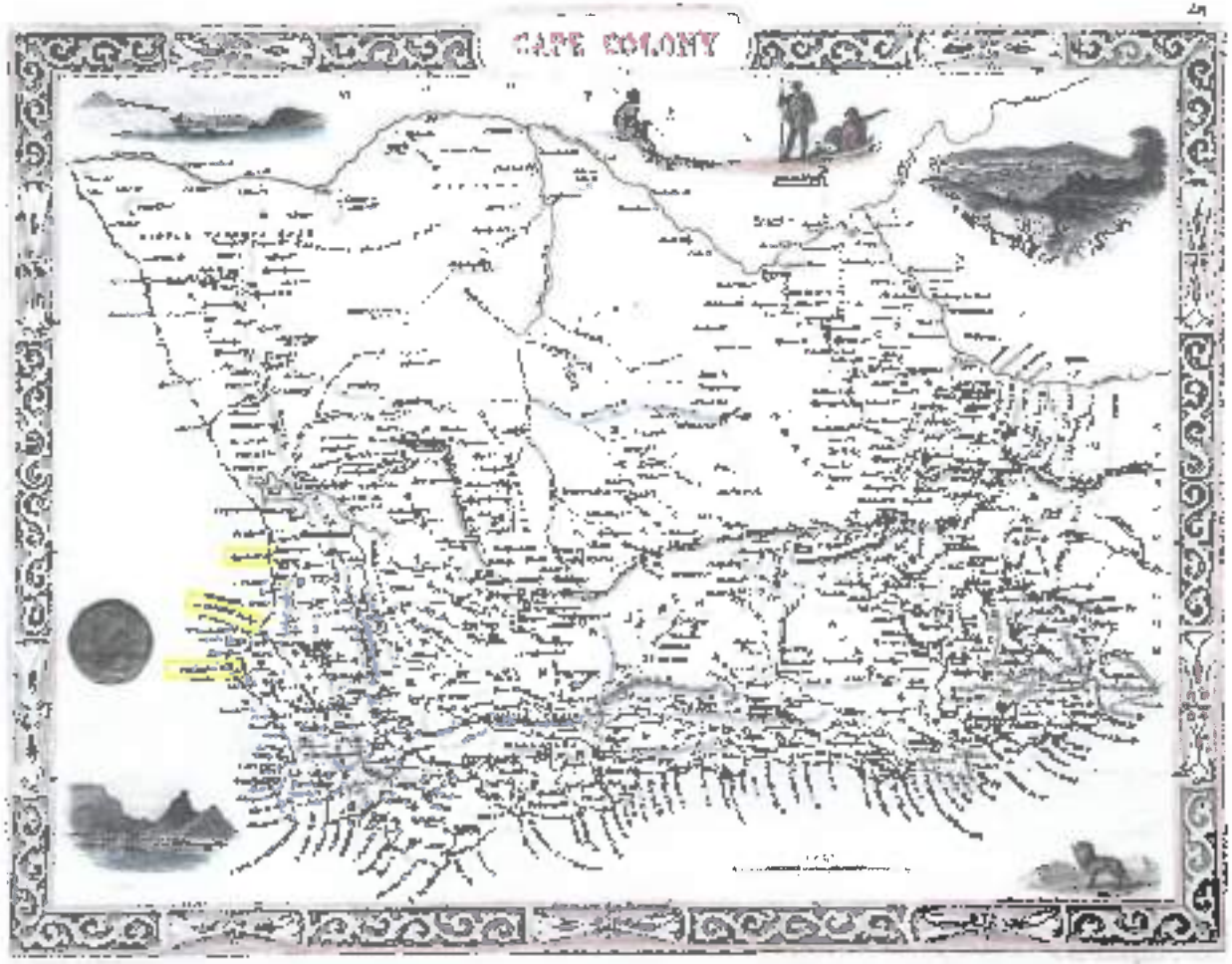

Figure 13 – 1850 historical map titled "Cape Colony"[7] (yellow polygon: West Coast towns).

[7] Source: https://commons.wikimedia.org/wiki/File:1850_Tallis_Map_of_the_Cape_Colony.jpg

4.2 PREVIOUS HERITAGE IMPACT ASSESSMENT REPORTS FROM THE STUDY AREA AND SURROUNDINGS

A search of the South African Heritage Resources Information System (SAHRIS) database revealed that numerous archaeological and heritage impact assessments had been undertaken within the surroundings of the West Coast. These reports solely focused on tangible heritage and do not fully address the intangible heritage of the West Coast region. Therefore, this report will not reference these impact assessments.

5 INTANGIBLE HERITAGE

'Intangible heritage' (also referred to as "Living Heritage") is a term which is used to describe "aesthetic, spiritual, symbolic or other social values people may associate with a site, as well as rituals, music, language, know-how, oral traditions and the cultural spaces in which these 'living heritage' traditions are played out."[8] Through its efforts to safeguard intangible heritage UNESCO and its member states developed the Convention for the Safeguarding of the Intangible Cultural Heritage (ICHC).[9]

The following section is extracted from a UNESCO webpage that explains the importance of Intangible Heritage:

"While fragile, intangible cultural heritage is an important factor in maintaining cultural diversity in the face of growing globalization. An understanding of the intangible cultural heritage of different communities helps with intercultural dialogue and encourages mutual respect for other ways of life.

The importance of intangible cultural heritage is not the cultural manifestation itself but rather the wealth of knowledge and skills that is transmitted through it from one generation to the next. The social and economic value of this transmission of knowledge is relevant for minority groups and for mainstream social groups within a State, and is as important for developing States as for developed ones.

Intangible heritage is:

- *Traditional, contemporary, and living at the same time: intangible cultural heritage does not only represent inherited traditions from the past but also contemporary rural and urban practices in which diverse cultural groups take part.*
- *Inclusive: we may share expressions of intangible cultural heritage that are similar to those practised by others. Whether they are from the neighbouring village, from a city on the opposite side of the world, or have been adopted by peoples who have migrated and settled in a different region, they all are intangible cultural heritage: they have been passed from one generation to another, have evolved in response to their environments and they constitute to giving us a sense of identity and continuity, providing a link from our past, through the present, and into our future. Intangible cultural heritage does not give rise to questions of whether or not certain practices are specific to a culture. It constitutes to social cohesion, encouraging a sense of identity and responsibility which helps individuals to feel part of one or different communities and to feel part of society at large.*
- *Representative: intangible cultural heritage is not merely valued as a cultural good, on a comparative basis, for its exclusivity or its exceptional value. It thrives on its basis in*

[8] Report from meeting to define Intangible Cultural Heritage, Piedmont (Italy) March 2001 (https://ich.unesco.org/doc/src/00077-EN.pdf. accessed 22 July 2022).
[9] UNESCO. 2003. Convention for the Safeguarding of the Intangible Cultural Heritage

communities and depends on those whose knowledge of traditions, skills and customs are passed on to the rest of the community, from generation to generation, or to other communities.

- ***Community-based: Intangible cultural heritage can only be heritage when it is recognized as such by the communities, groups or individuals that create, maintain, and transmit it – without their recognition, nobody else can decide for them that a given expression or practice is their heritage."***

In this assessment, marine-related intangible cultural heritage and people's connection to the ocean is relevant. This type of heritage incorporates the unique ethos and identity of specific places linked with fishing villages; oral history; popular memory; cultural traditions; indigenous knowledge systems, rituals, beliefs, and practices (e.g., fishing techniques) associated with the ocean.

In some cultures, the ocean is regarded as a spiritual realm filled with healing powers and a means to connect to one's ancestors. Gabie (2014) explains how water is the Khoisan's "...'source of life, a sense of belonging and their permanence to nature". Water is vital for various rituals and cleansing ceremonies.

According to Boswell and Thornton (2021), the Khoisan "advocate for deep connections and complementarity between humans and nature, recognising the agency and 'direction' provided by nature to humanity"

Considering that the ICHC emphasises the declaration and listing of forms of Intangible Heritage, it can lead to a diminished recognition of intangible heritage not listed or formally recognised (Gimblett, 2004). The ICHC requires a State Party to develop an inventory of intangible heritage within their country or territory and then take measures to safeguard community participation (Article 11(a)) (Deacon and Smeets, 20013). As Smith (2015) argues, the European Authorised Heritage Discourse within UNESCO emphasises the declaration and the importance of heritage and things as defined by experts or those entities and nation states promoting their discourse. The ICHC, however, did provide the opportunity for communities on a sub-national level to promote and give legitimacy to their intangible heritage. Unfortunately, the ICHC and its operational standards place the responsibility of assessment, nomination, and listing on the State Parties. This leads to a gatekeeper process in which these Parties can decide and control what is listed and nominated through their national discourse to the detriment of the community or grouping.

The Khoisan has historical experienced marginalisation and stigmatisation since the onset of colonialisation in Southern Africa. Section 4 of this report provides a narrative of the general history of the Khoisan on the West Coast and Western Cape, indicating a gradual disbanding of communities and cultural fabric of these indigenous groupings due to colonialism and economic

influences. The last decade has however shown a renewed interest and growth in claiming their roots and history through the resurgence movement.

Natural Justice (2016) submitted that strides were made in the recognition and legitimising of the Khoisan. However, entrenched continuing historic race classifications and the lack of leadership recognition through such issues as the dragging finalisation of the Traditional and Khoi-San Leadership Bill, before its promulgation in 2019, is robbing these communities of a voice and standing within the larger South African landscape. This speaks to the recognition of their culture that is inclusive of tangible and intangible heritage.

6 STAKEHOLDER ENGAGEMENT

6.1 INTRODUCTION

Public meetings were conducted by EIMS from 29 August to 3 September 2022 (Table 4) to inform Interested and Affected Parties (IAPs) of the proposed project and associated application process and allow them to raise comments/concerns.

Table 4 – Information relating to the public participation meetings

Town	Venue	Date	Time
Hout Bay	Hout Bay Public Library	Monday 29 August 2022	16:00 – 18:00
Cape Town	Life Conference Centre (Three Anchor Bay)	Tuesday 30 August 2022	16:00 – 18:00
Saldanha	Hoedjies Bay Hotel	Wednesday 31 August 2022	16:00 – 18:00
Lamberts Bay	Community Hall	Thursday 1 September 2022	16:00 – 18:00
Vredenburg	Eric Baker Hall	Friday 2 September 2022	16:00 – 18:00
Port Nolloth	Port Nolloth Country Club	Saturday 3 September 2022	10:00 – 12:00

6.1.1 Issues Raised

The Public Participation process did raise some comments on heritage-related issues. Several individuals who attended the public meetings raised concerns about how their heritage will be impacted by the proposed project.

The people regard the ocean as an inseperable part of their identity. "The sea is in our blood" is a common expression community members use. The ocean and its marine resources symbolise an important part of their history and heritage. They have relied on the ocean for survival as their skill sets are catered toward fishing.

6.1.2 Hout Bay

During the public meeting at the Hout Bay Public Library no pertinent mention was made to heritage issues.

6.1.3 Saldanha

6.1.3.1 A MS MOSTERT RAISED THE FOLLOWING CONCERNS:

- Explained their close association with the ocean as small scale fishers and that an impact by the project will impact on their way of life and social cohesion.

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6.1.3.2 A WEST COAST CHIEF KHAESEN MAART RAISED SEVERAL POINTS:

- Mr Maart explained that the ocean is a precious and spiritual way of life. They have always lived in harmony with the ocean, and through generations, they have conserved and managed their own interaction with the ocean and its bounty.

6.1.4 Lambertsbay

6.1.4.1 MR NIKOLAAS BOOYSEN

- Objected that the San communities are still being ignored and not considered to interact with first to obtain free and informed consent.

6.1.5 Focus Discussions

During and after the consultation process for the Searcher Seismic application held in July 2022, focused meetings were held with selected representatives and grouping identified during the public engagements. These meetings were conducted by members of PGS. During the meeting, it was indicated that the TGS application will be forthcoming and that PGS will be the heritage consultant for this application as well.

Table 5 - Summary of discussion with groups

Area	Date	Interlocutors	Association	Themes and issues identified and discussed
Lambertsbaai	18/08/2022	Rosey Shoshola Giovanni Cloete	Small scale fishers	• Activities in small-scale fisheries keep youth away from social issues such as substance abuse. • The waning of small-scale fisheries and their economic decline are linked to social issues such as gangsterism, substance abuse, and teenage pregnancies. • Their heritage is closely linked to their life as a fishing community. Their interaction between families and various groupings within the community. • Activities such as bartering, food dishes linked to specific days, and local and community festivals are intrinsically linked to their life as fishers. • If they would not be able to continue their fishing activities will lead to a further decline in their community cohesion and cultural character. • There is a definite link between declining fish yield and industrial impacts • They feel there is already evidence of previous seismic activity's impact at the end of 2021 on snoek catches in this year, 2022.
Lambertsbaai	18/08/2022	Anthony Andrews Nicolaas Booysen	West Coast Gurigua Council	• Focus and emphasis was placed on the need for Free, Prior and Informed Consent (FPIC) required from the Girqua Council and group as stipulated United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). • They are not heard and engage with. • The interlocutors further stressed their position as representatives and part of the Gurigua as first people of the West Coast • They explained that their way of live is linked with the ocean as well as the land as some of the Guriqua had to move towards ocean subsistence after displacement from farms • They are indelibly linked as to the ocean as economic fishers but due to the historic and current economic climate needs to make ends meet with other activities.
Saldanha	19/08/2022	Kevin Maart Magdalena Vertyb Magrieta Petro	Aikonese Cochoqua Khoi Tribal Council	• Mr Maart explained the regional extent of the Cochoqua and linkages with the various sub-clans • The historic impact on the decline of fisheries on the community and way of live was discussed • The fear of the impact on the ocean and fish stock by current seismic projects was expressed • They further expanded on the potential impact of the project on their social discourse and how it will further erode their social and cultural way of live.
Houtbaai	20/08/2022	Bradley van Sitters	=Girokamilaas	• The discussion with the interlocuters started off with Mr van Sitters giving a short background of the cultural and economic position of their group in Houtbaai.

		Basil van der Boss Chief Regan James Natahsa James Elston Gillan	Katz Korana Royal House	• It was explained that their people and Korana/Kora House are historically linked to the Cape and West Coast area and the various tribal and cultural groupings can be linked to the original tribes found at the start of colonial power visiting the Cape region and see them as one of the first nations of South Africa • Mr van Sitter explained that they as tribal grouping has a very close spiritual and cultural relation with the ocean and seashores. He further explained that they are reclaiming this historical and ancient linkage. • Although Government is slow in recognising the first people formally, however historically the proof of their existence is there. • They as first and indigenous people have a responsibility as custodians of the environment to speak out against development and activities that will impact on the environment. • They further expanded that their main concerns are the economic impact due to the seismic projects that will just compound the historic economic decline experience by their community. • Chief James explained that they have already seen the impact of seismic activities on fishing stock. • They have also not previously been engaged by government on such projects. They further feel the Government has already sold out on communities where resources are found with no real positive impact back to the communities. • Social decline and cultural loss due to economic decline in the last twenty years will be indicative of the next twenty years.

7 HERITAGE STATEMENT

One of the main issues raised by the communities interacted with during the Public Meetings is the lack of consultation within the communities to hear their concerns. This interaction needs to be at a level that is understood by the local community. This is further strengthened by the indigenous groupings emphasising the need for FPIC. One of the main tasks of this report is to address this lack of consultation through interacting with key groups and individuals and recognising their concerns.

It must be noted that, first and foremost, a large section of the affected communities not only view them as small-scale fishers but also as indigenous people and, as such, are intrinsically linked to the ocean and the land they have lived on centuries. The resurgence movement through which Khoi and San descendants are reclaiming their identity has in recent decades afforded these communities the ability to re-establish their cultural roots and grounding in an ancient landscape. This sentiment is echoed in the founding affidavit submitted (5 Feb 2022) during the appeal submitted to the first Searcher application by CJ Adams. It notes that the ocean is not only important for fishing but also has spiritual meaning and is a place of healing and holds healing powers for the indigenous communities. It further expanded that the ocean and its resources play an important part in their community's history and heritage.

Community identity and culture are thus strongly linked to the ocean and what it can provide, physically and spiritually. Communities have coexisted with the ocean for generations. This existence has created a culture and heritage that defines their way of living, community, and kinship unique to the West Coast of South Africa. Cook (2001) describes this as maritimity, a process whereby the sum of cultural adaptations made by coastal populations becomes imbued with meaning and culture. This is evident in community structures, cultural events, and seasonal activities. Their culture and heritage historically had a physical manifestation in village layouts, boat building and the unique west coast architectural vernacular. This vernacular was appropriated by the rich to develop quasi-cultural village expressions in the modern expansions of West Coast towns such as Paternoster

This uptake of the cultural heritage manifestations or elements of the indigenous communities by the public at large, provides a manner of legitimacy to their culture that is deeply entwined with the ocean and coastal landscape. It, unfortunately, does not translate into economic providence and brings no relief to their plight as subsistence communities. The changes in the fishing economies around the South African coast in the past four decades have resulted in a loss in income and livelihoods. It has inevitably impacted their community structures and activities which are a large part of their cultural heritage.

The public meetings and focused discussions with interlocutors have shown that these communities and groupings are struggling economically due to decades of turmoil in the fishing

industry. An industry plagued by the closing of fish processing plants, fishing licence and quota issues, and diminishing catches due to environmental and industrial impacts, to name a few. This economic downturn led to social issues within the communities. Foremost are poverty, loss of social fabric, substance abuse, teenage pregnancies, and violence. In all the interviews, the above issues were raised as central to their social existence and community experience.

Considering the Article 8(j) and 10(c) Convention on Biological Diversity (29 December 1993), of which South Africa has been a signatory since 1995, the need to "*...respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices*" must be considered within the available South African legislation. As such, the NHRA (section 3) (2)) considers heritage resources that are part of the national estate to include:

- "places to which oral traditions are attached or which are associated with living heritage;
- Or as per subsection 3, has cultural significance or other special values because of –
    a) its importance in the community or pattern of South Africa's history;
    b) its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
    c) its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
    d) its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
    e) its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
    f) its importance in demonstrating a high degree of creative or technical achievement at a particular period;
    g) its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
    h) its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa;

As with Smith (2015), Loulanksi (2006), and Ndoro (2105) emphasised that culture is more than just the tangible but is also shared beliefs, values, language, traditions, functionality, meaning and community connections. Considering the various values and heritage significance as listed in section 3(3) of the NHRA, the cultural and living heritage associated with the communities and indigenous people along the southwestern and west coast of South Africa holds heritage significance. It is part of the national estate and holds importance as a way of life for small-scale fishers and Khoisan descendants alike. The physical and spiritual interaction with the ocean and

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the shorelines through millennia resulted in a maritimity that developed into the cultural fabric as they experience it today.

The significance of such intangible and living cultural heritage features can potentially have a combined heritage grading of Grade II or even Grade I through further research. However, grading inevitably implies the investigation into and consideration of a Provincial or Heritage declaration of significance for a largely intangible cultural heritage. This is problematic as the NHRA provides for the proclamation/declaration of place, objects, or structures as Provincial or National Heritage Sites and only refers to intangible/living heritage relating to such place, objects, or structures.

8 IMPACT STATEMENT

The impact assessment rating is based on the rating scale in **Appendix B**

The cultural heritage and living heritage related to the communities linked to fisheries and ocean subsistence and further identifying as indigenous communities can potentially be impacted by the proposed project. This impact is indirect and is in the community perceived to be primarily linked to their economic existence as a result in the loss of fishing yield. Investigation and discussion have shown that the historic economic decline of fisheries has resulted in the loss of social cohesion, activities, and traditions.

To deliberate the potential impact, we evaluated the Commercial and Small-scale Fisheries report completed by Capricorn Marine Environmental (2022) for the Searcher application as well as the Biodiversity and Ecosystem Services Assessment repon (2022) completed for this application completed by Pisces Environmental Services (Pty) Ltd.

The Capricorn report summarises that "***With the implementation of the project controls and mitigation measures, the residual impact due to seismic noise is considered to be of LOW negative significance for the large pelagic longline sector. Due to the remote location of the proposed survey area, noise would be expected to attenuate to below threshold levels before reaching fishing grounds of all other sectors viz. the demersal trawl, midwater trawl, demersal longline, tuna pole-line, small pelagic purse-seine, traditional linefish, west coast rock lobster and small-scale fisheries sectors.***"

The Pisces (2002) survey notes, "***The proposed exploration activities to be undertaken by TGS are expected to result in impacts on marine invertebrate fauna in the Orange Basin, ranging from negligible to very low significance. Only in the case of potential impacts to turtles and marine mammals are impacts of low significance expected.***"

The scientific studies conducted for this project thus identified impacts on fishing stock as low for all types species.

By inference, a potential impact on fishing yield could be expected and thus potential economic impact on communities due to reduced caught fish volumes.

We considered that the recommended mitigation measures, as listed in the specialist reports for the project, focus on the reduction of impacts on fish species and the projected reduction of the impact on the commercial and small-scale fishery catch yield. These mitigation measures should then indirectly positively impact the potential negative impacts on the cultural heritage of the communities to be impacted.

By using the impact assessment methodology as provided by EIMS, we can project a pre-mitigation negative impact on a regional scale over the long term with a moderate intensity due to the potential indirect impact on the communities and, ultimately, their heritage, with a high probability of this impact occurring. The pre-mitigation impact on heritage resources is rated as MEDIUM. The potential residual impact on heritage resources, with mitigation measures from the scientific studies is projected as LOW with a medium confidence factor.

8.1 CUMULATIVE IMPACTS

This section evaluates the possible cumulative impacts (IC) on heritage resources concerning the current application and other proposed applications that are ongoing in the Orange Basin.

The following must be considered in the analysis of the cumulative effect of development on heritage resources:

- **Fixed datum or dataset:** There is no comprehensive heritage data set for the Offshore and onshore impact region and thus we cannot quantify how much of a specific cultural heritage element is present in the region. The region has never been covered by a heritage resources study that can account for all heritage resources. Further to this, none of the heritage studies conducted can with certainty state that all heritage resources within the study area has been identified and evaluated;
- **Defined thresholds:** The value judgement on the significance of a heritage site will vary from individual to individual and between interest groups. Thus, implicating that heritage resources' significance can and does change over time. And so, will the tipping threshold for impacts on a certain type of heritage resource;
- **Threshold crossing:** In the absence of a comprehensive dataset or heritage inventory of the entire region we will never be able to quantify or set a threshold to determine at what

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stage the impact from developments on heritage resources has reached or is reaching the danger level or excludes the new development on this basis. (Godwin, 2011)

PGS is, however, aware of the current Searcher application and the potential of another application soon occurring in the Orange Basin. Communities have expressed a definite concern about the multiple application occuring in their fishing waters and the potential long-term effect of these surveys resulting in Oil and Gas companies starting applications for production rights based on the findings of these reconnaissance surveys. ***It is, however, the understanding that only one 3D survey will be done in the overlapping areas even if the various applications are successful over the same area.***

The scientific studies conducted for seismic projects in the same are make the following comments relating to cumulative impacts:

- **Capricorn Marine – Commercial and Small-Scale Fisheries report (2022)**
  Concurrent activities such as other planned speculative or proprietary seismic surveys in the Orange Basin could add to the cumulative impact on fisheries, especially if the activities are concurrent. The cumulative impact on any one fishery is expected to be of VERY LOW to LOW significance. Once completed there is not expected to be any residual impact. This would thus further mitigate any cumulative impact across fishery sectors. The potential that cumulative impacts of other hydrocarbon exploration activities on the fishing industry arise is considered to be possible to likely.
- **Fiona Environmental Services – Biodiversity and Ecosystem Services Assessment for the Searcher and TGS applications (2022)**
  While it is foreseeable that further exploration and future production activities could arise if the current Environmental Clearance Certificate is granted, there is not currently sufficient information available to make reasonable assertions as to nature of such future activities. This is primarily due to the current lack of relevant geological information, which the proposed exploration process aims to address. While there are many other rights holders in the South African offshore environment, most of these are not undertaking any exploration activities at present or would be concurrently with the proposed 3D survey, particularly not in the far offshore environment. Thus, the possible range of the future prospecting, mining, exploration, and production activities that could arise will vary significantly in scope, location, extent, and duration depending on whether a resource(s) is discovered, its size, properties, and location, etc. As these cannot at this stage be reasonably defined, it is not possible to undertake a reliable assessment of the potential cumulative environmental impacts. It is also possible that the proposed, or future, exploration fails to identify an economic petroleum resource, in which case the potential impacts associated with the production phase would not be realised.

The report further notes that..."*Similarly, potential cumulative impacts on individuals and populations as a result of other seismic surveys undertaken either previously, concurrently or subsequently are difficult to assess.*'

- **Pisces Environmental Services – Biodiversity and Ecosystem Services Assessment for the TGS applications (2022)**
  While it is foreseeable that further exploration and future production activities could arise if the current Environmental Authorisation is granted, there is not currently sufficient information available to make reasonable assertions as to nature of such future activities. This is primarily due to the current lack of relevant geological information, which the proposed exploration process aims to address. There are many other rights holders in the South African and adjacent Namibian offshore environment, but most of these are not undertaking any exploration activities at present or would be concurrently with the proposed 3D survey, particularly not in the far offshore environment. Thus, the possible range of the future prospecting, mining, exploration and production activities that could arise will vary significantly in scope, location, extent, and duration depending on whether a resource(s) is discovered, its size, properties and location, etc. As these cannot at this stage be reasonably defined, it is not possible to undertake a reliable assessment of the potential cumulative environmental impacts. It is also possible that the proposed, or future, exploration fails to identify an economic petroleum resource, in which case the potential impacts associated with the production phase would not be realised...

  ...Other than this project, there are currently three other applications for 3D surveying being prepared over much the same area of the Deep Water Orange Basin. Should these all be approved, it is, however, highly unlikely that the operators will undertake these surveys either concurrently or sequentially. This again emphasises that the number of applications submitted to PASA cannot be assumed to relate to a realistic assessment of cumulative impacts.

At this stage, cumulative impacts are purely speculative. Still, the potential for the future increase in cumulative impacts due to current and future seismic surveys and the potential for future Oil and Gas production cannot be excluded but is not quantifiable at this stage for cultural heritage.

Table 6 - Impact table

IMPACT (HAZARD/RISK)		Pre-Mitigation							Post Mitigation										
Impact	Phase	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Pre-mitigation SR	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Post-mitigation SR	Confidence	Significance Impact	Implementation Cost	Priority Factor	Final score
Impact on cultural heritage	Overall	-1	4	4	3	3	4	-14	-1	4	3	1	3	1	4.25	Medium	1	1	1.13	-8.25

9 CONCLUSIONS AND RECOMMENDATIONS

The background research and initial public participation in the available consultation days given to PGS have shown that the affected communities are largely linked to subsistence and small-scale fisheries along the west coast of the Western and Northern Cape Provinces of South Africa.

These communities have expressed their concerns about the effect that the proposed 3D reconnaissance project will have on the fishing stock that will ultimately impact their livelihoods. It is also evident that they do not place much faith in the findings of the scientific fishing stock studies for this and other similar projects.

9.1 HERITAGE STATEMENT SUMMARY

It must be noted that, first and foremost, a large section of the affected communities not only view them as small-scale fishers but also as indigenous people and, as such, are intrinsically linked to the ocean and the land they have lived on centuries. The resurgence movement through which Khoi and San descendants are reclaiming their identity has in recent decades afforded these communities the ability to re-establish their cultural roots and grounding in an ancient landscape. This sentiment is echoed in the founding affidavit submitted (5 Feb 2022) during the appeal submitted to the first Searcher application by CJ Adams. It notes that the ocean is not only important for fishing but also has spiritual meaning and is a place of healing and holds healing powers for the indigenous communities. It further expanded that the ocean and its resources play an important part in their community's history and heritage.

Community identity and culture are thus strongly linked to the ocean and what it can provide, physically and spiritually. Communities have coexisted with the ocean for generations. This existence has created a culture and heritage that defines their way of living, community, and kinship unique to the West Coast of South Africa. Cook (2001) describes this as maritimity, a process whereby the sum of cultural adaptations made by coastal populations becomes imbued with meaning and culture. This is evident in community structures, cultural events, and seasonal activities.

The public meetings and focused discussions with interlocutors have shown that these communities and groupings are struggling economically due to decades of turmoil in the fishing industry. An industry plagued by the closing of fish processing plants, fishing licence and quota issues, and diminishing catches due to environmental and industrial impacts, to name a few. This economic downturn led to social issues within the communities. Foremost are poverty, loss of social fabric, substance abuse, teenage pregnancies, and violence. In all the interviews, the above issues were raised as central to their social existence and community experience.

As with Smith (2015), Loulanksi (2006), and Ndoro (2105) emphasised that culture is more than just the tangible but is also shared beliefs, values, language, traditions, functionality, meaning and community connections. Considering the various values and heritage significance as listed in section 3(3) of the NHRA, the cultural and living heritage associated with the communities and indigenous people along the southwestern and west coast of South Africa holds heritage significance. It is part of the national estate and holds importance as a way of life for small-scale fishers and Khoisan descendants alike. The physical and spiritual interaction with the ocean and the shorelines through millennia resulted in a maritimity that developed into the cultural fabric as they experience it today.

The significance of such intangible and living cultural heritage features can potentially have a combined heritage grading of Grade II or even Grade I through further research. However, grading inevitably implies the investigation into and consideration of a Provincial or Heritage declaration of significance for a largely intangible cultural heritage. This is problematic as the NHRA provides for the proclamation/declaration of place, objects, or structures as Provincial or National Heritage Sites and only refers to intangible/living heritage relating to such place, objects, or structures.

9.2 IMPACT STATEMENT SUMMARY

The scientific studies conducted for this project identified impacts on fishing stock as low for all species.

By inference, a potential impact on fishing yield could be expected and thus potential economic impact on communities due to reduced caught fish volumes.

We considered that the recommended mitigation measures, as listed in the specialist reports for the project, focus on the reduction of impacts on fish species and the projected reduction of the impact on the commercial and small-scale fishery catch yield. These mitigation measures should then indirectly positively impact the potential negative impacts on the cultural heritage of the communities to be impacted.

By using the impact assessment methodology as provided by EIMS, we can project a pre-mitigation negative impact on a regional scale over the long term with a moderate intensity due to the potential indirect impact on the communities and, ultimately, their heritage, with a high probability of this impact occurring. The pre-mitigation impact on heritage resources is rated as MEDIUM. The potential residual impact on heritage resources, with mitigation measures from the scientific studies, is projected as LOW with a medium confidence factor.

aware of the current Searcher application and the potential of another application soon occurring in the Orange Basin. Communities have expressed a definite concern about the multiple application occuring in their fishing waters and the potential long-term effect of these surveys resulting in Oil and Gas companies starting applications for production rights based on the findings of these reconnaissance surveys. It is, however, the understanding that only one 3D survey will be done in the overlapping areas even if the various applications are successful over the same area.

At this stage, cumulative impacts are purely speculative. Still, the potential for the future increase in cumulative impacts due to current and future seismic surveys and the potential for future Oil and Gas production cannot be excluded but is not quantifiable at this stage for cultural heritage.

9.3 RECOMMENDATIONS

The following recommendations are based on the UNESCO ICH guidelines. They are aimed at safeguarding the cultural heritage of the small-scale fishers and cultural groupings in the influence of this project:

- Re-assess post-project the potential effects on the identified communities and their intangible cultural heritage. This will require consideration of the socio-economic baseline developed during this environmental impact process against quantified economic damage and losses and human development impacts in a follow-up socio-economic. It will enable the heritage specialist to evaluate the link between the socio-economic changes induced by the proposed project as it relates to changes in the intangible cultural heritage practices of the communities.
- Based on the outcomes, **provide resources and support for communities** to develop and undertake safeguarding measures or plans to enhance the **mitigation capacity of their intangible cultural heritage by fostering dialogue, mutual understanding and reconciliation** between and within communities.
- It is anticipated that this can be achieved through the implementation of the mitigation measures in the Social Impact Assessment.

We know that 3D seismic surveys can locate wrecks on the surface, and sometimes below sediments. Any shipwrecks or pieces thereof noted during the survey must be shared with the SAHRA MUCH Unit for inclusion into the national database. These could then be identified and be incorporated into the EMP.

Considering the assessment based on the findings of the fieldwork as well as the scientific studies relating to the impact on fisheries, I am of the opinion that the impact of the proposed project on

the intangible cultural heritage resources and practices can be mitigated through the implementation of the recommendations in this report.

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APPENDIX A

ENVIRONMENTAL IMPACT METHODOLOGY

The impact significance rating methodology, as provided by EIMS, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). The impact assessment will be applied to all identified alternatives. Where possible, mitigation measures will be recommended for the impacts identified.

10.4 DETERMINATION OF ENVIRONMENTAL RISK

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the impact and the probability (P) of the impact occurring. The consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

To this methodology, the consequence of the impact is represented by:

$$C = \frac{(E+D+M+R) \times N}{4}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in **Table 7** below.

Table 7 – Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	-1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary).
	3	Local (i.e. the area within 5 km of the site).
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years).
	3	Medium term (6-15 years).
	4	Long term (the impact will cease after the operational life span of the project).

Aspect	Score	Definition
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected).
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected).
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way).
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease). or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible impact

Once the C has been determined, the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per Table 8.

Table 8 - Probability Scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%).
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%).
	3	Medium probability (the impact may occur; >50% and <75%).
	4	High probability (it is most likely that the impact will occur- > 75% probability). or
	5	Definite (the impact will occur)

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

ER= C x P

Table 9 - Determination of Environmental Risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
	0	1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 10.

Table 10 - Significance Classes

Environmental Risk Score	
Value	**Description**
<9	Low (i.e., where this impact is unlikely to be a significant environmental risk).
≥9 - <17	Medium (i.e., where the impact could have a significant environmental risk).
≥17	High (i.e., where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post-implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

10.5 IMPACT PRIORITISATION

Further to the assessment criteria presented in the section above, it is necessary to assess each potentially significant impact in terms of:

1. Cumulative impacts; and
2. The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 11 - Criteria for Determining Prioritisation

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.

	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 12. The impact priority is therefore determined as follows:

Priority = CI + LR

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (Refer to Table 12).

Table 12 - Determination of Prioritisation Factor

Priority	Ranking	Prioritisation Factor
2	Low	1
3	Medium	1.125
4	Medium	1.25
5	Medium	1.375
6	High	1.5

To determine the final impact significance, the PF is multiplied by the ER of the post-mitigation scoring. The ultimate aim of the PF is an attempt to increase the post-mitigation environmental risk rating by a full ranking class if all the priority attributes are high (i.e., if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be too upscale the impact to a high significance).

Table 13 - Final Environmental Significance Rating

Environmental Significance Rating	
Value	**Description**
< -17	High negative (i.e., where the impact must have an influence on the decision process to develop in the area).
≥ -17 ≤ -9	Medium negative (i.e., where the impact could influence the decision to develop in the area).
> -9, <0	Low negative (i.e., where this impact would not have a direct influence on the decision to develop in the area).
0	No impact
<0, <9	Low positive (i.e., where this impact would not have a direct influence on the decision to develop in the area).
≥ 10 ≤ 17	Medium positive (i.e., where the impact could influence the decision to develop in the area).
≥ 217	High positive (i.e., where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

APPENDIX B

PGS TEAM CVS

WOUTER FOURIE

Professional Heritage Specialist and Professional Archaeologist and Director PGS Heritage

Summary of Experience

Specialised expertise in Archaeological Mitigation and excavations, Cultural Resource Management and Heritage Impact Assessment Management, Archaeology, Anthropology, Applicable survey methods, Fieldwork and project management, Geographic Information Systems, including *inter alia* -

Involvement in various grave relocation projects (some of which relocated up to 1000 graves) and grave "rescue" excavations in the various provinces of South Africa

Involvement with various Heritage Impact Assessments, within South Africa, including -

- Archaeological Walkdowns for various projects
- Phase 2 Heritage Impact Assessments and EMPs for various projects
- Heritage Impact Assessments for various projects
- Iron Age Mitigation Work for various projects, including archaeological excavations and monitoring
- Involvement with various Heritage Impact Assessments, outside South Africa, including -
- Archaeological Studies in Democratic Republic of Congo
- Heritage Impact Assesements in Mozambique, Botswana, and DRC
- Grave Relocation project in DRC

Key Qualifications

BA [Hons] (Cum laude) - Archaeology and Geography - 1997

BA - Archaeology, Geography and Anthropology - 1996

Professional Archaeologist - Association of Southern African Professional Archaeologists (ASAPA) - Professional Member

Accredited Professional Heritage Specialist – Association of Professional Heritage Practitioners (APHP)

CRM Accreditation (ASAPA) -

- Principal Investigator - Grave Relocations
- Field Director – Iron Age
- Field Supervisor – Colonial Period and Stone Age
- Accredited with Amafa KZN

Key Work Experience

2009- current - Director – Professional Grave Solutions (Pty) Ltd

2007 – 2009 - Project Manager – Marakoma-ARM, Heritage Contracts Unit, University of the Witwatersrand

JGS

2005-2007 - Director – Matakoma Heritage Consultants (Pty) Ltd

2000-2004 - CEO– Matakoma Consultants

1998-2000 - Environmental Coordinator – Randfontein Estates Limited, Randfontein, Gauteng

1997-1998 - Environmental Officer – Department of Minerals and Energy, Johannesburg, Gauteng

Worked on various heritage projects in the SADC region including, Botswana, Mauritius, Malawi, Zambia, Mozambique, and the Democratic Republic of the Congo

PROFESSIONAL CURRICULUM VITAE FOR NIKKI MANN

Key Qualifications:

MSc Archaeology (phytolith analysis) - University of Cape Town - 2017
BSc Honours Archaeology - University of Cape Town – 2014
Bachelor of Science (BSc) - University of Cape Town - Majors in Archaeology, and Environmental and Geographical Science -2013

Professional Archaeologist – Association of Southern African Professional Archaeologists **(ASAPA)**

Archaeological Experience

- 2021- Current – Archaeologist – PGS Heritage (Pty) Ltd
- Kathu Tyre Management Plant HIA. Kathu. EXM. Position: Heritage Specialist.
- Kathu Borrow Pit Screening. Kathu. EXM. Position: Heritage Specialist.
- Harmony Karee:and Pipelines Project. Between Klerkdorp and Potchefstroom, North West Province. EIMS. Position: Heritage Specialist
- Black Mountain PV, Northern Cape. Uvuna. Position: Heritage Specialist
- Proposed amendment of existing mining activities for Kolomela Mine. South-west of Postmasburg, Northern Cape. EXM. Position: Heritage Specialist.
- Proposed amendment of existing mining activities for Kudumane Mine. Hotazel, Northern Cape. SRK. Position: Heritage Specialist.
- Victoria West Pipeline project. Victoria West. IXEng. Position: Heritage Specialist.
- Koup 1 and Koup 2 WEF. Beaufort West, Western Cape. SIVEST. Position: Heritage Specialist.
- Victoria West Pipelines. Victoria West, Northern Cape. IXEng. – Position: Heritage Specialist.
- East Orchards Poultry Farm Project. Delmas, Mpumalanga. EcoSphere. – Position: Heritage Specialist.
- Phase 1 Archaeological Impact Assessment (Phase 1 AIA): Gunstfontein Wind Energy Facility (WEF) and overhead powerline, near Sutherland, Northern Cape, South Africa. – Position: Archaeological Specialist (November 2020).
- Phase 1 Archaeological Impact Assessment (Phase 1 AIA): Proposed development of an overhead powerline for the approved Oya PV Facility, between Sutherland and Matjiesfontein, Northern and Western Cape, South Africa. – Position: Archaeological Specialist (October 2020).
- Phase 1 Archaeological Impact Assessment (Phase 1 AIA): Proposed development of infrastructure for the approved Kudusberg Wind Energy Facility (WEF), between Sutherland and Matjiesfontein, Northern and Western Cape, South Africa. – Position: Archaeological Specialist (October 2020).
- Phase 1 Archaeological Impact Assessment (Phase 1 AIA): Proposed Square Kilometre Array (SKA) fibre optic cable, between Beaufort West and Carnarvon, Northern and Western Cape, South Africa. (September 2020).
- Phase 1 Archaeological Impact Assessment (**Phase 1 AIA**): Kolkies PV (Photovoltaics) Project, north of Touws River, Western Cape, South Africa. – Position: Archaeological Specialist (September 2020).
- Phase 1 Archaeological Impact Assessment (**Phase 1 AIA**): Plenaarspoort Wind Energy Facility (WEF) Project 1 and 2, north-west of Matjiesfontein, Western Cape, South Africa. – Position: Archaeological Specialist (September 2020).
- Phase 1 Archaeological Impact Assessment (**Phase 1 AIA**): Swellendam Wind Energy Facility (WEF), Swellendam, Western Cape, South Africa. – Position: Archaeological Specialist (August 2020).

- **Phase 2 Archaeological Mitigation**: Proposed development of infrastructure in the Port of Ngqura within the Coega Industrial Development Zone (IDZ), Nelson Mandela Bay Municipality, Eastern Cape, South Africa: Contract Archaeologist, excavation of Later Stone Age (LSA) shell middens (July 2020). Contracted to work with PGS Heritage.
- Polihali Dam Heritage Management Project, Lesotho: Junior field archaeologist, excavation of Later Stone Age (LSA) sites (May 2019- May 2020) as part of PGS Heritage.
  - Duties included excavation of rock shelters, site supervision, site recording, photography, lab work, section drawing and digital illustration (Inkscape and Photoshop), assisting in report writing and implementation of HSE practices.
- Ledi-Geraru Research Project, Ethiopia: excavation of Early Stone Age (ESA) sites (February-March 2020; Directed by Dr David R. Braun)
- Gorras Farm, Northern Cape, South Africa: excavation of middens next to a corbelled building; Historical site (October 2018; supervised by Simon Lee Hall and UCT PhD student Ms Vuyiswa Thembelihle Lupuwana)
  - Duties included excavation of middens and surface collection.
- **Phase 2 Archaeological Mitigation**: Proposed development of boreholes and associated pipelines for the Langebaan Aquifer within the Hopefield Private Nature Reserve, Hopefield, Western Cape. - Position: Archaeological specialist (August 2018).
- Koobi Fora Field School, Kenya: Intern, excavation of Early Stone Age (ESA) and Middle Stone Age (MSA) sites (June-July 2018; Directed by Dr David R. Braun, Kathryn Ranhorn (Postdoctoral Research Fellow at Harvard University) and Jonathan Reeves (PhD student at The George Washington University))
- Data extraction to SAHRIS (South African Heritage Resource Agency) for CTS Heritage (April 2018)
- Phase 1 Archaeological Impact Assessment (**Phase 1 AIA**). Matjiesfontein Road Extension Project, Matjiesfontein, Western Cape. – Position: Archaeological Specialist (April 2018).
- Ledi-Geraru Research Project, Ethiopia: excavation of Early Stone Age (ESA) sites (February-March 2018; Directed by Dr David R. Braun)
- Ferrycarrig, Irish National Heritage Park, Wexford, southeast Ireland: Excavation of ringwork castle site associated with the Anglo-Norman invasion of Ireland (January 2018; Directed by Dr Denis Shine and Dr Stephen Mandal)

DECLARATION OF THE ENVIRONMENTAL SPECIALIST

I, Wouter Fourie declare that –

General declaration:

- I act as an independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting undertaking the specialist work as required, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I have not, and will not engage in, conflicting interest in the undertaking of the activity.
- I understand to disclose to the applicant and competent authority all material information in my possession that reasonably has or may have the potential of influencing- any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- I have taken into account, to the extent possible, the matters referred to in Regulation 18 when preparing the report, plan or document.
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.
- All the particulars furnished by me this form are true and correct.
- I will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations.
- I am aware of what constitutes an offence in terms of Regulation 48 and that a person convicted of an offence in terms of Regulation 48(1) is liable to the penalties as contemplated in Section 49B of the Act.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remunerative for work performed in terms of the Regulations.

Signature of the Specialist:

Name of Company: PGS Heritage Pty Ltd

Date: 5/12/2022

UNDERTAKING UNDER OATH/AFFIRMATION

E-25

I, Wouter Fourie swear under oath/affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Name of Company: PGS Heritage Pty Ltd

Date: 2/12/2022

Signature of the Commissioner of Oaths:

Date: 2022.12.05

Official Stamp below

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2022 -12- 05
WESTONARIA
SOUTH AFRICAN POLICE SERVICE

IN THE HIGH COURT OF SOUTH AFRICA

(WESTERN CAPE DIVISION, CAPE TOWN)

Case No 24492/2024

In the matter between:

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	First Applicant
THE GREEN CONNECTION NPC	Second Applicant
NATURAL JUSTICE	Third Applicant

and

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	First Respondent
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	Second Respondent
TGS GEOPHYSICAL COMPANY (UK) LIMITED	Third Respondent
MINISTER OF MINERAL AND PETROLEUM RESOURCES	Fourth Respondent

OFFICE OF THE CHIEF JUSTICE
PRIVATE BAG X9020
CAPE TOWN 8000
2024 -11- 14
GENERAL OFFICE
WESTERN CAPE HIGH COURT

Bundle 2

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CHENNELLS ALBERTYN
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Email: fiona@chennellsalbertyn.co.za and
carol@chennellsalbertyn.co.za

1348
"A7.4"

TGS Orange Basin Reconnaissance Project

Social Impact Assessment

Prepared by:

Equispectives Research & Consulting Services

Contact person: Ms San-Marié Aucamp

Dr Ilse Aucamp

Prepared for:
EIMS

September 2022

Executive Summary

TGS Geophysical Company (UK) Ltd proposes to undertake a 3D seismic survey off the West Coast of South Africa. The proposed project area is located approximately 256 km offshore of St Helena Bay, extending north along the western coastline to approximately 220 km offshore of Hondeklip Bay over a number of petroleum license blocks. At the closest point the proposed survey area is approximately 218 km offshore of the coast of the Western and Northern Cape provinces. The area of interest for the proposed 3D seismic survey is approximately 30 000 km^2 in extent.

TGS's activities for this application would be of short duration if approved, and if viewed in isolation considering only technical risks as discussed in various specialist reports conducted as part of the EIA process, the impacts will be negligible. However, communities feel that there are significant gaps in the available data and from a social perspective the non-technical or social risks can potentially cause significant impacts. The following potential social impacts have been identified:

- Uncertainty
- Further marginalisation of vulnerable groups
- Concerns about cumulative impacts
- Perceived impact on livelihoods
- Impacts on sense and spirit of place
- Impacts on the social licence to operate
- Stakeholder fatigue and disillusionment
- Community expectations
- Social unrest

JRDS

Seismic reconnaissance projects are controversial in South Africa and has been in the news frequently in the last year. For many stakeholders it is an emotional matter, for others the potential of impacting their livelihoods is the biggest fear. There are also stakeholders that feel that the exploration for fossil fuels is not in line with sustainable development and the fight against climate change. Other stakeholders feel that it is imperative for the growth and development of the South African economy to engage in these investigations. It is a complex and wicked[1] problem.

Based on the findings, the following recommendations are made:

- TGS should develop a community engagement protocol, communication strategy and grievance mechanism that is based on the San Code of Research Ethics.
- TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. Collaboration across seismic operators with holders of hydrocarbon exploration and the industry as a whole to collectively fund pro-active research would provide opportunity for the development and implementation of a structured and experimentally sound acoustic study. This would quantitatively inform the authorities and stakeholders of acoustic impacts to the various faunal groups in South African Waters.
- Consult with communities on potential ways in which to make a positive contribution to the communities.
- Engage in meaningful consultation.
- The seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign.

[1] a wicked problem is a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize.

From a social perspective it is clear that the communities and majority of local people are opposed to the project. If the project is considered in isolation, the impacts are negligible. However, the project does not happen in a vacuum, and the social environment is much wider than the footprint of the project. If the social risks and potential damage to cultural and indigenous rights are considered the impact on the social fabric of already vulnerable communities may be significant. At this stage communities feel that they cannot make informed decisions. Communities does not distinguish between the different role players in the seismic survey industry. Although all legal processes have been followed by TGS, the seismic survey industry is not moving at the pace of the community, and in the long run this will be detrimental to the industry. Potential future benefits and the economic development of the country should the surveys find any significant resources are not disputed. From a social perspective it is recommended that the project proceed subject to the mitigation measures (i.e. meaningful consultation, local research, education, and awareness raising in the project-affected communities) forming part of the conditions for authorisation and being implemented prior to the commencement of the actual survey.

Opsomming

TGS Geophysical Company (UK) Ltd beoog om 'n 3D seismiese opname te doen aan die Weskus van Suid-Afrika. Die voorgenome projek area is ongeveer 256 km van St Helena Baai in die diepsee geleë, en strek dan Noord teen die westelike kuslyn af tot ongeveer 220 km in die diepsee in vanaf Hondeklipbaai oor 'n aantal petroleum lisensie blokke. Die punt wat die naaste aan die land is, is ongeveer 218 km in die diepsee aan die kus van die Wes Kaap en die Noord Kaap Provinsies. Die gebied wat die voorgenome 3D seismiese opname beplan om te dek beslaan ongeveer 30 000 km^2.

TGS se aktiwiteite vir hierdie aansoek sal van korte duur wees indien dit goedgekeur word, en wanneer dit in isolasie beskou word en slegs die tegniese risiko's oorweeg word soos wat bepreek is in die onderskeie spesialis studies wat gedoen is as deel van die omgewingsimpak assessering proses is die impakte gering. Die betrokke gemeenskappe voel egter dat daar betekenisvolle gapings in die beskikbare data is en van 'n sosiale perspektief kan die nie-tegnies of sosiale risiko's potensieel betekenisvolle impakte veroorsaak. Die volgende sosiale impakte is geïdentifiseer:

- Onsekerheid
- Verdere uitskuiwing van weerbare groepe
- Bekommernisse oor kumulatiewe impakte
- Perceived impak op vermoë om 'n lewensbestaan te maak
- Impakte op sin en gees van plek
- Impakte op die sosiale bedryfslisensie
- Uitputting en ontmugtering van geaffekteerde gemeenskappe (agv volume van konsultasie)
- Verwagtinge van die gemeenskappe

- Maatskaplike onrus

Seismiese verkenningsprojekte is kontroversieel in Suid Afrika en was dikwels in die nuus die afgelope jaar. Vir baie belanghebbendes is dit 'n emosionele saak, vir ander is die moontlikheid dat hulle lewensbestaan geaffekteer gaan word die grootste vrees. Daar is ook belanghebbendes wat voel dat die eksplorasie vir fossielbrandstowwe nie in lyn is met volhoubare ontwikkeling en die stryd teen klimaatsverandering is nie. Ander belanghebbendes voel dat dit noodsaaklik is vir die groei en ontwikkeling van die Suid Afrikaanse ekonomie om betrokke te raak by hierdie ondersoeke. Dit is 'n komplekse probleem, en 'n probleem wat moeilik of onmoontlik is om op te los.

Gebaseer op die bevindinge word die volgende aanbevelings gemaak:

- TGS moet 'n gemeenskapsbetrokkenheid protokol, kommunikasie strategie en grief meganisme ontwikkel wat gebaseer is op die San Kode van Navorsingsetiek.

- TGS moet behulpsaam wees met samewerking tot onafhanklike navorsing oor hoe visspesies aan die Weskus soos snoek reageer op seismiese opnames. Samewerking tussen seismiese operateurs en houers van koolwaterstof eksplorasie regte en die industrie as 'n geheel om kollektief pro-aktiewe navorsing te befonds sal die geleentheid bied vir die ontwikkeling en implementering van 'n gestruktureerd en eksperimenteel solide akoestiese studie. Dit sal die owerhede en belanghebbendes kwantitatief inlig omtrent die akoestiese impakte op die verskeie fauna groepe in die Suid Afrikaanse waters.

- Konsulteer met die gemeenskap op maniere waarop 'n positiewe bydrae tot die gemeenskappe gelewer kan word.

- Raak betrokke by betekenisvolle konsultasie.

- Die seismiese opname bedryf moet hulle posisie en sosiale bedryfslisensie as 'n industrie in die Suid-Afrikaanse konteks heroorweeg en 'n strategiese omgewingsassessering van die impak van die bedryf uitvoer en 'n bewusmakings- en opvoedkundige veldtog van stapel stuur.

Vanuit 'n sosiale perspektief is dit duidelik dat die gemeenskappe en die meerderheid van die plaaslike mense gekant is teen die projek. As die projek in isolasie beskou word, is die impakte gering. Die projek vind egter nie in 'n vakuum plaas nie, en die sosiale omgewing is heelwat breër as die voetspoor van die projek. Indien die sosiale risiko's en potensiële skade aan die kulturele en inheemse regte oorweeg word, kan die impak op die sosiale weefsel van die reeds weerlose gemeenskappe betekenisvol wees. Vanuit 'n sosiale perspektief kan die projek slegs aanbeveel word na betekenisvolle konsultasie, plaaslike navorsing, opvoeding, en bewusmaking gedoen is in die gemeenskappe wat deur die projek geraak is. Tans voel die gemeenskappe dat hulle nie ingeligte besluite kan neem nie. Gemeenskappe onderskei nie tussen die verskillende rolspelers in die seismiese opname industrie nie. Alhoewel al die wetlike prosesse deur TGS gevolg is, beweeg die seismiese opname bedryf nie teen die pas van die gemeenskap nie, en op die lange duur sal dit tot nadeel van die industrie wees. Moontlike toekomstige voordele en ekonomiese ontwikkeling van die land indien die opnames betekenisvolle hulpbronne vind, word nie betwyfel nie. Die aanbeveling is gevolglik dat die projek slegs kan voortgaan sodra die mitigasie maatreëls geïmplementeer is en die gemeenskappe genoegsaam ingelig en toegerus is om op 'n betekenisvolle manier betrokke te raak.

Declaration of Independence

Equispectives Research and Consulting Services declare that:

- All work undertaken relating to the proposed project was done as independent consultants;
- They have the necessary required expertise to conduct social impact assessments, including the required knowledge and understanding of any guidelines or policies that are relevant to the proposed activity;
- They have undertaken all the work and associated studies in an objective manner, even if the findings of these studies were not favourable to the project proponent;
- They have no vested interest, financial or otherwise, in the proposed project or the outcome thereof, apart from remuneration for the work undertaken under the auspices of the above-mentioned regulations;
- They have no vested interest, including any conflicts of interest, in either the proposed project or the studies conducted in respect of the proposed project, other than complying with the relevant required regulations; and
- They have disclosed any material factors that may have the potential to influence the competent authority's decision and/or objectivity in terms of any reports, plans or documents related to the proposed project as required by the regulations.

Record of Experience

Ilse Aucamp and San-Marié Aucamp compiled this report.

Ilse Aucamp holds a D Phil degree in Social Work obtained from the University of Pretoria in 2015. She also has master's degree in environmental management (Cum Laude) from the Potchefstroom University for Christian Higher Education, which she obtained in 2004. Prior to that she completed a BA degree in Social Work at the University of Pretoria. She is frequently a guest lecturer in pre- as well as post-graduate programmes at various tertiary institutions. Her expertise includes social impact assessments, social management plans, social and labour plans, social auditing, training as well as public participation. She is a co-author of the newly published *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects* document published by the International Association for Impact Assessment.

San-Marié Aucamp is a registered Research Psychologist with extensive experience in both the practical and theoretical aspects of social research. She has more than 20 years' experience in social research and she occasionally presents guest lectures on social impact assessment. Her experience includes social impact assessments, social and labour plans, training, group facilitation as well as social and marketing research in a range of sectors such as mining, manufacturing, utilities, government, automotive, financial services, telecoms and IT as well as FMCG. She occasionally presents guest lectures at tertiary institutions. San-Marié is a contributor to the international guidance document on assessing and managing social impacts for projects that was published by IAIA International in 2015. She is currently busy with her PhD in Consulting Psychology.

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1 Introduction

TGS Geodata UK Ltd proposes to undertake a 3D seismic survey off the West Coast of South Africa. The proposed project area is located approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay over a number of petroleum license blocks. At the closest point the proposed survey area is approximately 218 km offshore of the coast of the Western and Northern Cape provinces. The area of interest for the proposed 3D seismic survey is approximately 57 400 km^2 in extent.

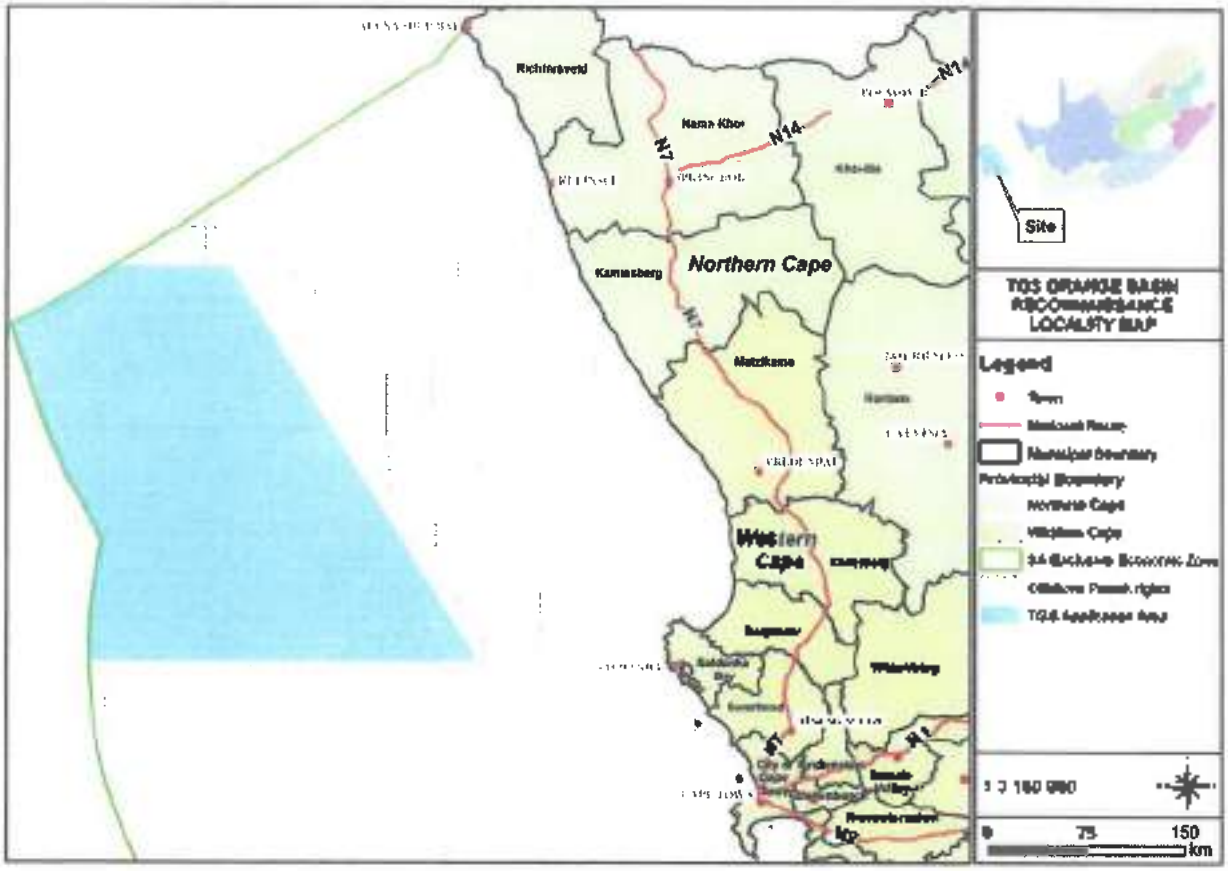
Marine seismic surveys are the primary tool for locating hydrocarbon deposits and are thus a key component of offshore oil and gas exploration. Hydrocarbon deposits occur in reservoirs in sedimentary rock layers. Being lighter than water they accumulate in traps where the sedimentary layers are arched or tilted by folding or faulting of the geological layers. It is currently envisaged that the survey lines would have a NE-SW or a SE-NW orientation. The 3D survey will take in the order of 70 days including downtime.

A single survey vessel equipped with seismic sources and streamers will be used which will be supported by up to two escort vessels. The escort vessel will assist in monitoring for and alerting of other vessels (e.g. fishing, transport, etc) about the survey and the lack of manoeuvrability of the survey vessel. At a minimum one Fisheries Liaison Officer (FLO) that speaks English and Afrikaans will be on board either the survey or escort vessel to facilitate communication in a local language with the fishing or other vessels that are in the area. In addition, there will be Marine Mammal Observers (MMO's) and Passive Acoustic Monitoring on board the survey vessel to monitor for marine mammals and fauna visually and ensure that the survey is conducted in compliance with the specified guidelines as stated in the Environmental Management Programme.

Crew changes will occur by the support or survey vessel calling to port. The onshore logistics base will be either in the Port of Cape Town or the Port of Saldanha Bay.

Figure 1 shows the location of the proposed project area.

Figure 1: Locality of proposed TGS Orange Basin Reconnaissance Project.



The purpose of this report is to provide baseline information regarding the socio-economic environment, to identify possible social and economic impacts and to suggest ways in which these impacts can be mitigated. This will assist decision-makers on the project in making informed decisions by providing information on the potential or actual consequences of their proposed activities. The process entailed the following:

- A baseline socio-economic description of the affected environment;
- Identification of potential social and economic change processes that may occur as a result of the project; and
- Identification of potential social and economic impacts.

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One of the ways in which social risk can be managed is by conducting a social impact assessment (SIA). Such an assessment can assist with identifying possible social impacts and risks. Disregarding social impacts can alter the cost-benefit equation of development and in some cases even undermine the overall viability of a project. A proper social impact assessment can have many benefits for a proposed development (UNEP, 2002) such as:

- Reduced impacts on communities of individuals;
- Enhanced benefits to those affected;
- Avoiding delays and obstruction – helps to gain development approval (social license);
- Lowered costs;
- Better community and stakeholder relations; and
- Improved proposals.

More detail on the scope of each of these phases is included in the section below.

2 Scope of Work

The purpose of the SIA is to provide input in the Environmental Impact Assessment (EIA)/ Environmental Management Programme (EMPr) Report for the proposed seismic reconnaissance study.

3 Methodology

Scientific social research methods were used for this assessment. To clarify the process to the reader, this section will start with a brief explanation of the processes that have been used in this study.

3.1 Information base

The information used in this report was based on the following:

- A literature review (see list provided in the References);
- Data from Statistics South Africa;
- The public participation records provided by EIMS;
- Professional judgement based on experience gained with similar projects; and
- Consultation with affected stakeholders in August and September 2022. It must be noted that not every individual in each community could be consulted. Consultations took place in Hout Bay, Steenberg's Cove, Lamberts Bay and Port Nolloth. Due to other commitments the meeting with the Gurlqua leadership could not take place. The meeting in Hondeklip Bay got cancelled at the last minute by the stakeholders.

3.2 Assumptions and limitations

The following assumptions and limitations were relevant:

1. Not every individual in the community could be interviewed therefore only key people in the community were approached for discussion. Additional information was obtained using existing data.
2. The social environment constantly changes and adapts to change, and external factors outside the scope of the project can offset social changes, for example changes in local political leadership, droughts or economic conditions. It is therefore difficult to predict all impacts to a high level of accuracy, although

care has been taken to identify and address the most likely impacts in the most appropriate way for the current local context within the limitations.

3. Given that the survey will be conducted over a short period of time, the the impacts will be short term and from an outsiders perspective may appear as inconsequential. However, the outcomes of the survey will introduce new social impacts, and the potential of these impacts occuring is already causing fear and uncertainty amongst coastal communities. Communities view the survey as the beginning of potentially significant changes in their socio-economic environment.

4. Social impacts can be felt on an actual or perceptual level, and therefore it is not always straightforward to measure the impacts in a quantitative manner.

5. Social impacts commence when the project enters the public domain. Some of these impacts will occur irrespective of whether the project continues or not, and other impacts have already started. These impacts are difficult to mitigate and some would require immediate action to minimise the risk.

6. There are different groups with different interests in the community, and what one group may experience as a positive social impact, another group may experience as a negative impact. This duality will be pointed out in the impact assessment phase of the report.

7. Social impacts are not site-specific, but take place in the communities surrounding the proposed development.

8. Limited time was available for conducting the assessment.

3.3 Social Impact Assessment Model

The theoretical model used for this impact assessment was developed by Slootweg, Vanclay and Van Schooten and presented in the *International Handbook of Social Impact Assessment* (Vanclay & Becker, 2003). This model identifies pathways by which social impacts may result from proposed projects. The model differentiates between social change processes and social impacts, where the social change process is the

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pathway leading to the social impact. Detail of how the model works is not relevant to this study, but it is important to understand the key concepts, which will be explained in the following paragraphs.

Social change processes are set in motion by project activities or policies. A social change process is a discreet, observable, and describable process that changes the characteristics of a society, taking place regardless of the societal context (that is, independent of specific groups, religions etc.) These processes may, in certain circumstances and depending on the context, lead to the experience of social impacts (Vanclay, 2003). If managed properly, however, these changes may not create impacts. Whether impacts are caused will depend on the characteristics and history of the host community, and the extent of mitigation measures that are put in place (Vanclay, 2003). Social change processes can be measured objectively, independent of the local context. Examples of social change processes are an increase in the population, relocation, or the presence of temporary workers.

For the purpose of this report, the following social change process categories were considered:

- Demographic processes;
- Economic processes;
- Geographic processes;
- Institutional and legal processes;
- Emancipatory and empowerment processes;
- Socio-cultural processes; and
- Other relevant processes.

The *International Association for Impact Assessment* (2003) states that Social Impact Assessment includes the processes of analysing, monitoring, and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes

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Invoked by these interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment.

A social impact is something that is experienced or felt by humans. It can be positive or negative. Social impacts can be experienced in a physical or perceptual sense. Therefore, two types of social impacts can be distinguished:

- **Objective social impacts** – i.e. impacts that can be quantified and verified by independent observers in the local context, such as changes in employment patterns, in standard of living or in health and safety.
- **Subjective social impacts** – i.e. impacts that occur "in the heads" or emotions of people, such as negative public attitudes, psychological stress or reduced quality of life.

It is important to include subjective social impacts, as these can have far-reaching consequences in the form of opposition to, and social mobilisation against the project (Du Preez & Perold, 2005).

For the purpose of this SIA, the following Social Impact Assessment categories were investigated:

- Health and social well-being;
- Quality of the living environment;
- Economic impacts and material well-being;
- Cultural impacts;
- Family and community impacts;
- Institutional, legal, political and equity impacts; and
- Gender impacts.

Relevant criteria for selecting significant social impacts included the following:

- Probability of the event occurring;
- Number of people that will be affected;

- Duration of the impact;
- Value of the benefits or costs to the impacted group;
- Extent to which identified social impacts are reversible or can be mitigated;
- Likelihood that an identified impact will lead to secondary or cumulative impacts;
- Relevance for present and future policy decisions;
- Uncertainty over possible effects; and
- Presence or absence of controversy over the issue.

The model was adapted to suit the South African context, and where processes and impacts were not relevant to the study, it was omitted. Each category has a number of sub-categories, which also have been investigated. The Equator Principles, International Finance Corporation Performance Standards and World Bank Environmental, Health and Safety guidelines were consulted in the writing of this report and the mitigation suggested adheres to these requirements.

3.4 Literature study

A literature search was undertaken to obtain secondary data for the baseline description of the socio-economic environment. The information in this report was acquired via statistical data obtained from Statistics South Africa, SIA literature (see References), previous studies conducted in the area, EIMS's public consultation process and information from reputable sources on the World Wide Web.

3.5 Research approach

Traditionally there are two approaches to SIA, a technical approach, and a participatory approach. A technical approach entails that a scientist remains a neutral observer of social phenomena. The role of the scientist is to identify indicators, obtain objective measures relevant to the situation and provide an expert assessment on how the system will change (Becker, Harris, Nielsen & McLaughlin, 2004). A participatory approach uses the knowledge and experiences of individuals most affected by the proposed changes as the basis for projecting impacts. In this case the

role of the scientist is facilitator of knowledge sharing, interpretation, and reporting of impacts (Becker et al, 2004). A combination of these approaches was used for this study.

The findings presented in this report are based on primary and secondary (desk) research. A qualitative approach was followed for the primary research, while qualitative and quantitative data were used for the secondary research.

The layperson sometimes criticises qualitative research as "subjective" or "not really that scientific". For this reason, it is vital to understand the distinction between qualitative and quantitative research and their respective areas of application.

Qualitative research as a research strategy is usually characterised by the inference of general laws from particular instances, forms theory from various conceptual elements, and explains meaning (David & Sutton, 2004). It emphasises words rather than quantification in the collection and analysis of data. Data collection takes place by using methods such as unstructured or semi-structured interviews, focus groups, observations, etc. Data is not recorded in any standardised coding format but is usually reported according to themes. Qualitative data express information about feelings, values, and attitudes. This approach is used where insight and understanding of a situation is required (Malhotra, 1996). Participants are selected based on their exposure to the experience or situation under review. The aim of qualitative research is to understand, not to quantify and as such it is extremely suitable for assessing social impacts. A potential impact must be understood before it can be assessed appropriately.

Quantitative research as a research strategy usually makes inferences of particular instances by reference to general laws and principles and tends to emphasize what is external to or independent of the mind (objective) and incorporates a natural science model of the research process (David & Sutton, 2004). This makes it easier for a person with a natural or physical sciences background to relate to. This approach emphasises quantification in the collection and analysis of data. Data collection take place by using methods such as structured questionnaires and data is recorded in a numeric or some

other standardised coding format. Data is expressed in numerical format and statistical techniques are usually used to assist with data interpretation. This approach is used when information needs to be generalised to a specific population and participants are usually selected using probability sampling techniques (although non-probability methods can be used depending on the characteristics of the target population).

Although in theory the qualitative phase of this project could be followed by a quantitative phase, for a number of reasons it was not done. A quantitative phase would be more resource intensive in terms of labour, time and cost and the incremental precision obtained in terms of generalisability would not warrant the additional investment. Due to the strong emotional component relating to the perceived impacts, respondents may intentionally magnify the intensity of the impacts or indicate all impacts are equally severe in an attempt to bias the results in their favour, which will reduce the utility of quantitative results as part of the primary research process.

3.6 Ethical issues

The most basic principle of research is that participants should not be harmed by participation in the research project. It is important that research not only does no harm, but also potentially contributes to the wellbeing of others. At times this might place a researcher in a difficult position – what is beneficial to one group may not be beneficial to another (Bless, Higson-Smith & Kagee, 2006). Furthermore, an individual has the autonomy to decide whether to participate in research or not. No person should be forced, either overtly or covertly, to participate in research. Other important principles include justice (based on the assumption that all people are equals), fidelity (keeping promises or agreements, specifically between the researcher and the participant) and respect for participants' rights and dignity. In addition to these overarching ethical principles, important ethical principles that should be met are informed consent, confidentiality, anonymity, and discontinuance. This is in line with international as well as national research practice such as the World Association for Market, Social and Opinion Researchers (ESOMAR) and Southern African

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Marketing Research Association (SAMRA) codes of conduct. The researcher has an ethical obligation to develop well-designed projects and execute them with care. Researchers are not allowed to change their data or observations and should report on technical shortcomings, failures, limits of the study, negative findings, and methodological constraints. The honest and accurate reporting of data is also an essential component of scientifically accurate and ethically legitimate research and conclusions should be supported by data.

4 Legislative and Policy Framework

Although there are no explicit acts referring directly to SIA, there are many acts and policies that require specific social outcomes that can be related to this project, and these are discussed in the section below.

4.1 The Constitution of the Republic of South Africa 1996

The current Constitution of the Republic of South Africa 1996 can be regarded as one of the most progressive constitutions in the world. Human rights are enshrined in the South African Constitution, which forms the basis of all the country's legislation. Chapter 2 consists of a Bill of Rights, which explicitly spells out the rights of every South African citizen. Human rights and dignity are fundamental to SIA and it recognises fundamental human rights and the prerogative to protect those rights as core values (Vanclay, 2003). The human rights relevant to the environmental management field that are safeguarded by the Constitution of the Republic of South Africa 1996 in the Bill of Rights, include:

- Right to a healthy environment;
- Right of access to land and to security of tenure; and
- Right to adequate housing and protection against evictions and demolitions.

The right to a protected biophysical environment, the promotion of social development and trans-generational equity is explicitly included in the Constitution of the Republic of South Africa 1996, which states:

"Everyone has the right -

1. To an environment that is not harmful to their health and wellbeing, and
2. To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:
    1. *Prevent pollution*
    2. *Promote conservation, and*

3. *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*

When considering an environment that is not harmful to peoples' health and wellbeing, it is important to reflect on the interconnectedness of biophysical, economic, and social aspects. The impact of development on people, and the true cost of development, as well as the consideration of "who pays the price?" versus "who reaps the benefits?" cannot be ignored in a discussion about human rights and the environment.

The right to a generally satisfactory environment is increasingly seen as a human right in Africa (Du Plessis, 2011), and South Africa's environmental legislation supports this.

4.1.1 The National Environmental Management Act 107 of 1998

The National Environmental Management Act (NEMA) 107 of 1998 states that the State must respect, protect, promote and fulfil the social, economic and environmental rights of everyone and strive to meet the needs of previously disadvantaged communities. It states further that sustainable development requires the integration of social, economic and environmental factors in the planning, evaluation and implementation of decisions to ensure that development serves present and future generations.

Chapter 1 of NEMA contains a list of principles and states clearly that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests (NEMA, 1998). It states further that negative impacts on the environment and on peoples' environmental rights must be anticipated and prevented, and if they cannot be prevented, they should be minimised and remedied. It elaborates further on the equity of impacts, and the fact that vulnerable communities should be protected from negative environmental impacts. It refers to the principle that everyone should have equal access to environmental resources, benefits and services to meet their basic

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human needs (NEMA, 1998). Therefore there is a clear mandate for environmental and restorative justice in the act, something that must be considered in this project.

Another important aspect of NEMA is the principle of public participation. It states that people should be empowered to participate in the environmental governance processes, and that their capacity to do so should be developed if it does not exist. All decisions regarding the environment should take the needs, interest and values of the public into account, including traditional and ordinary knowledge (NEMA, 1998). There are also specific environmental management acts that fall under NEMA, such as the National Environmental Management, Air Quality Act 39 of 2004 (NEM: AQA), and the National Environmental Management, Waste Act 59 of 2008 (NEM: WA). These acts require similar public participation processes to NEMA and the principles of NEMA also apply to them (Department of Environmental Affairs & Development Planning [DEA&DP], Provincial Government of the Western Cape, 2010).

Chapter 6 of NEMA elaborates on the public participation requirements. This is supplemented by the EIA regulations published in GN 982 of 4 December 2014, which contained requirements for public participation (GN 982 in GG 38282 of 4 December 2014). It provides requirements for the public participation, the minimum legal requirements for public participation processes, the generic steps of a public participation process, requirements for planning a public participation process and a description of the roles and responsibilities of the various role players. A compulsory Public Participation Guideline that was published in 2012 (GN 807 of 10 October 2012) in terms of section J of NEMA (NEMA, 1998) complements these requirements. According to the guidelines, public participation can be seen as one of the most important aspects of the environmental authorisation process. Public participation is the only requirement of the environmental impact assessment process for which exemption cannot be given unless no rights are affected by an application. This stems from the requirement in NEMA that people have a right to be informed about potential decisions that may affect them and that they must be given an opportunity to influence those decisions.

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The principles of the National Environmental Management Act 107 of 1998 declare further that community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, sharing of environmental knowledge and experience and any other appropriate means. It states that the social, environmental and economic impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions taken must be appropriate given the assessment and evaluation. NEMA 107 of 1998 recognises that the environment is held in public trust for the people, and therefore the beneficial use of environmental resources must serve the peoples' interest and protect the environment as the peoples' common heritage.

NEMA takes a holistic view of the environment, and promotes the consideration of social, economic, and biophysical factors to obtain sustainable development and achieve effective management of the biophysical environment.

4.1.2 The Mineral and Petroleum Resources Development Act 28 of 2002

The Mineral and Petroleum Resources Development Act (MPRDA) 28 of 2002 is the only environmental act that explicitly requires a social development output, in addition to a public participation process, in the form of a Social and Labour Plan (SLP). In the preamble to the Act it recognises the need to promote local and rural development and the social upliftment of communities affected by resource development. In Section 2 it states that some of the objectives of the act are:

- To substantially and meaningfully expand opportunities for historically disadvantaged persons, including women, to enter the mineral and petroleum industries and to benefit from the exploitation of the nations' mineral and petroleum resources;
- To promote economic growth and mineral and petroleum resources development in the Republic;
- To promote employment and advance the social and economic welfare of all South Africans, and

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- To ensure that holders of mining and production rights contribute towards the socio-economic development of the areas in which they are operating.

The MPRDA acknowledges that mineral and petroleum resources are the common heritage of all the people of South Africa and that the State is the custodian thereof for the benefit of all. It states that the Minister of Mineral Resources must ensure the sustainable development of South Africa's mineral and petroleum resources within a framework of national environmental policy, norms and standards while promoting economic and social development (MPRDA, 2002).

In Section 37 of the Mineral and Petroleum Resources Development Act 28 of 2002 it endorses the principles set out in Chapter 1 of the National Environmental Management Act 107 of 1998. In Section 39 of the MPRDA the act explicitly requires a social impact assessment as well as an environmental impact assessment when it states that applicants must:

"...investigate, assess and evaluate the impact of his or her proposed prospecting or mining operations on:

(i) The environment;

(ii) The socio-economic conditions of any person who might be directly affected by the prospecting or mining operation..."

Section 3, Chapter 2, Part I, of the regulations (Government Notice 527, 23 April 2004) published under the MPRDA refers to the public participation process, which must be followed according to the Act. It includes advertising and an invitation to comment on the process.

Sections 40 to 46, Chapter 2, Part II, of the regulations published under the MPRDA deal with the Social and Labour Plan (SLP) requirements (Government Notice 527, 23 April 2004). The Department of Mineral Resources provided guidelines for the development of the SLP (Department of Mineral Resources, 2010). The guidelines specify the objectives of the SLP as:

- Promote economic growth and mineral and petroleum resources development in the Republic;
- Promoting employment and advancing the social and economic welfare of all South Africans;
- Ensuring that holders of mining or production rights contribute towards the socio-economic development of the areas in which they are operating as well as the areas from which the majority of the workforce is sourced, and
- To utilise and expand the existing skills base for the empowerment of Historically Disadvantaged South Africans and to serve the community (Department of Mineral Resources, 2010).

The crux of this section is that the SLP requires applicants for mining and production rights to develop and implement comprehensive Human Resources Development Programmes including Employment Equity Plans, Local Economic Development Programmes and processes to save jobs and manage downscaling and/or closure (MPRDA 28 of 2002). According to the regulations, the above programmes are aimed at promoting employment and advancement of the social and economic welfare of all South Africans whilst ensuring economic growth and socio-economic development. The management of downscaling and/or closure is aimed at minimising the impact of commodity cyclical volatility, economic turbulence and physical depletion of the mineral or production resources on individuals, regions, or local economies. All mines in South Africa are required to compile an SLP, and they must report compliance on a yearly basis (MPRDA, 2002). Compiling an SLP must be done in a participatory manner, and local economic development initiatives must be aligned with the municipal integrated development planning processes. An SLP is not a social impact management plan per se, although it does aim to manage some negative social impacts. The guideline is very clear about the fact that measures put in place for the mitigation of impacts cannot be seen as mine community development projects (Department of Mineral Resources, 2010).

4.1.3 The National Heritage Resources Act 25 of 1999

Although the National Heritage Resources Act (NHRA) 25 of 1999 is not an environmental act per se, it is relevant in the field of environmental management. The

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NHRA affirms that every generation has a moral responsibility to act as trustee of the national heritage for later generations and that the State is obliged to manage heritage resources in the interest of all South Africans. The general principles for heritage management in Chapter 5 of the Act state that in order to ensure that heritage resources are effectively managed, the skills and capacities of persons and communities involved in heritage resources management must be developed. The Act further elaborates on the fact that heritage resources form an important part of the history and beliefs of communities and must be managed in a way that acknowledges the right of affected communities to be consulted and to participate in their management.

The general principles (Chapter 5) state that the identification, assessment and management of the heritage resources of South Africa must:

- Take account of all relevant cultural values and indigenous knowledge systems;
- Take account of material or cultural heritage value and involve the least possible alteration or loss of it;
- Promote the use and enjoyment of and access to heritage resources, in a way consistent with their cultural significance and conservation needs;
- Contribute to social and economic development, and
- Safeguard the options of present and future generations.

The National Heritage Resources Act 25 of 1999 therefore protects the cultural rights and heritage of the people of South Africa. It does not require explicit public participation, or give any guidelines on how the public should participate. It does refer, like the National Environmental Management Act 107 of 1998 and the National Water Act 36 of 1998, to social and economic development. Public participation processes may be requested by the South African Heritage Resources Agency if it deems it necessary for a specific project.

4.1.4 Promotion of Administrative Justice Act 3 of 2000

The Bill of Rights in the Constitution of the Republic of South Africa 1996 states that everyone has the right to administrative action that is legally recognised, reasonable, and procedurally just. The Promotion of Administrative Justice Act (PAJA) 3 of 2000

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gives effect to this right. The PAJA applies to all decisions of all State organisations exercising public power or performing a public function in terms of any legislation that negatively affects the rights of any person. The Act prescribes what procedures an organ of State must follow when it takes decisions. If an organ of State implements a decision that impacts on an individual or community without giving them an opportunity to comment, the final decision will be illegal and may be set aside. The Promotion of Administrative Justice Act 3 of 2000 also forces State organisations to explain and give reasons for the manner in which they have arrived at their decisions and, if social issues were involved, and how these issues were considered in the decision-making process.

The Promotion of Administrative Justice Act 3 of 2000 therefore protects the rights of communities and individuals to participate in decision-making processes, especially if these processes affect their daily lives.

4.1.5 Traditional and Khoi-San Leadership Act

The Traditional and Khoi-San Leadership Act 3 of 2019 aims:

- to provide for the recognition of traditional and Khoi-San communities, leadership positions and for the withdrawal of such recognition;
- to provide for the functions and roles of traditional and Khoi-San leaders;
- to provide for the recognition, establishment, functions, roles and administration of kingship or queenship councils, principal traditional councils, traditional councils, Khoi-San councils and traditional sub-councils, as well as the support to such councils;
- to provide for the establishment, composition and functioning of the National House of Traditional and Khoi-San Leaders;
- to provide for the establishment of provincial houses of traditional and Khoi-San leaders;
- to provide for the establishment and composition of local houses of traditional and Khoi-San leaders;
- to provide for the establishment and operation of the Commission on Khoi-San Matters;

- to provide for a code of conduct for members of the National House, provincial houses, local houses and all traditional and Khoi-San councils;
- to provide for regulatory powers of the Minister and Premiers;
- to provide for transitional arrangements;
- to amend certain Acts;
- to provide for the repeal of legislation; and
- to provide for matters connected therewith.

4.1.6 Protection, Promotion, Development and Management of Indigenous Knowledge Act 6 of 2019

The Protection, Promotion, Development and Management of Indigenous Knowledge Act 6 of 2019 intends:

- to provide for the protection, promotion, development and management of indigenous knowledge;
- to provide for the establishment and functions of the National Indigenous Knowledge Systems Office;
- to provide for the management of rights of indigenous knowledge communities;
- to provide for the establishment and functions of the Advisory Panel on indigenous knowledge;
- to provide for access and conditions of access to knowledge of indigenous communities;.
- to provide for the recognition of prior learning;
- to provide for the facilitation and coordination of indigenous knowledge-based innovation; and
- to provide for matters incidental thereto.

4.1.7 Marine Living Resources Act 18 of 1998

The Marine Living Resources Act 18 of 1998 intends:

- to provide for the conservation of the marine ecosystem, the long-term sustainable utilisation of marine living resources and the orderly access to exploitation, utilisation and protection of certain marine living resources; and

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- for these purposes to provide for the exercise of control over marine living resources in a fair and equitable manner to the benefit of all the citizens of South Africa; and
- to provide for matters connected therewith.

4.2 Additional governance tools

Legislation is not the only tool that authorities can use to achieve sustainable development and social development outcomes. There are several tools, policies and strategic planning instruments that can contribute to this.

4.2.1 Integrated Development Plans

For the purpose of this project, Integrated Development Plan (IDP) documents of the following municipalities need to be considered:

4.2.1.1 Namakwa District Municipality

In its IDP the Namakwa District Municipality states that its strategic objectives are:

- Monitoring and support local municipalities to deliver basic services which include water, sanitation, housing, electricity and waste management
- Support vulnerable groups in the district
- Improve administrative and financial viability and capability
- Promote and facilitate Local Economic Development (include tourism)
- Enhance good governance (include IGR) (IGR - intergovernmental relations)
- Promote and facilitate spatial transformation and sustainable urban development
- To render municipal health services
- To coordinate the disaster management and fire management services in the district
- Caring for the environment.

4.2.1.1.1 Richtersveld Local Municipality

The Richtersveld Local Municipality indicated in its IDP that its strategic goals/objectives are:

- For every household to have access to clean water, electricity, and sanitation

- To treat all their residents with pride and dignity
- To be an effective and efficient local government
- To be an effective instrument of change within its community
- To be a local government that is accountable with community driven development
- To be the gateway for local economic development and tourism in the north-western coast of the Northern Cape.

4.2.1.1.2 Nama Khoi Local Municipality

The key performance areas of the Nama-Khoi Local Municipality are:

- Basic services delivery
- Municipal financial viability and management
- Local economic development
- Municipal transformation and institutional development
- Good governance and community participation.

4.2.1.1.3 Kamiesberg Local Municipality

The Kamiesberg Local Municipality identified its key performance areas in its IDP as:

- Service delivery – to provide and maintain superior decentralised customer services (water, sanitation, roads, storm water, waste management and electricity)
- Local economic development
- Financial viability
- Municipal transformation
- Good governance.

4.2.1.2 West Coast District Municipality

The West Coast District Municipality stated in its IDP that its objectives are to:

- Care for the social well-being, safety and health of all our communities
- Promote regional economic growth and tourism
- Coordinate and promote the development of bulk and essential services and transport infrastructure

- Foster sound relationships with all stakeholders, especially local municipalities
- Maintain financial viability and good governance.

4.2.1.2.1 Matzikama Local Municipality

The Matzikama Local Municipality identified the following strategic objectives in its IDP:

- Provide municipal basic services to meet demands of growing population and development challenges
- Maintain sufficient revenue resources to enable the municipality to meet its constitutional obligations
- Coordinate, facilitate and stimulate sustainable economic development through strategy, policy and programme development
- Reduce poverty levels as measured by SAMPI
- Maintain sufficient organisation resources, enhance the involvement of the public in the development and decision making processes and provide ethical and professional services to support the needs of the communities
- Provide opportunities to officials and councillors for the development of professional and leadership skills and enhance employment equity in the organisation
- Develop and sustain our spatial, natural and built environment.

4.2.1.2.2 Cederberg Local Municipality

The Bergriver Local Municipality identified the following strategic goals:

- Strengthen financial sustainability and further enhancing good governance
- Sustainable service delivery
- Facilitate an enabling environment for economic growth to alleviate poverty
- Promote safe, healthy, educated and integrated communities
- A sustainable, inclusive and integrated living environment

4.2.1.2.3 Bergrivier Local Municipality

The Cederberg Local Municipality identified the following strategic objectives:

- Improve and sustain basic service delivery and infrastructure development
- Financial viability and economically sustainability

- Good governance, community development and public participation
- Facilitate, expand and nurture sustainable economic growth and eradicate poverty
- Enable a resilient, sustainable, quality and inclusive living environment and human settlements i.e. housing development and informal settlement upgrade
- To facilitate social cohesion, safe and healthy communities
- Development and transformation of the institution to provide a people-centred human resources and administrative services to citizens, staff and council

4.2.1.2.4 Saldanha Bay Local Municipality

The Saldanha Bay Local Municipality identified the following strategic actions to create additional growth:

- Retaining large existing exporting businesses
- Promote Aquaculture-, Fishing-, and Food processing sectors
- Tourism growth
- Attract new industrial investors by creating a more enabling environment
- Maximise the competitive advantages for ports
- Support local SME to access more opportunities
- Availability of credible vocational skills development and tertiary education

4.2.1.2.5 Swartland Local Municipality

The strategic goals of the Swartland Local Municipality are:

- Improved quality of life for citizens
- Inclusive economic growth
- Quality and sustainable living environment
- Caring, competent and responsive institutions, organisations, and business
- Sufficient, affordable and well-run services.

4.2.1.3 City of Cape Town Metropolitan Municipality

The City of Cape Town has sixteen objectives linked to its priorities and foundations:

- Economic growth

- Increased jobs and investment in the Cape Town economy

- Basic services
  - Improved access to quality and reliable basic services
  - End load-shedding in Cape Town over time
  - Well-managed and modernised infrastructure to support economic growth
- Safety
  - Effective law enforcement to make communities safer
  - Strengthen partnerships for safer communities
- Housing
  - Increased supply of affordable, well-located homes
  - Safer, better-quality homes in informal settlements and backyards over time
- Public space, environment and amenities
  - Healthy and sustainable environment
  - Clean and healthy waterways and beaches
  - Quality and safe parks and recreational facilities supported by community partnerships
- Transport
  - A sustainable transport system that is integrated, efficient and provides safe and affordable options for all
  - Safe and quality roads for pedestrians, cyclists and vehicles
- A resilient city
- A more spatial integrate and inclusive city
- A capable and collaborative city government.

4.2.2 Provincial Growth and Development Strategies

The Provincial Growth and Development Strategies of the Northern Cape and Western Cape Provinces need to be considered.

4.2.2.1 Northern Cape Strategic Plan 2020-2035

The four drivers of the Northern Cape Provincial Growth and Development Plan:

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- Economic transformation, growth and development

  To ensure economic growth and development that will lead to job creation and radical economic transformation for the people of the Northern Cape Province, ten economic drivers or development paths have been identified:

  - Agriculture and agro-processing
  - Mining and mineral beneficiation
  - Tourism market development
  - Rural development and land reform
  - Development of energy sector
  - Manufacturing and trade
  - Competitive infrastructure development
  - Employment and skills development
  - Innovation and knowledge economy
  - Marine economy

- Social transformation and human welfare

  To sustainably address the social injustices and inequalities in the province, social transformation must be accelerated and deepened towards human development and welfare. The following six drivers have been identified:

  - Quality basic education
  - Quality health care
  - Social cohesion and community participation
  - Social protection and safety
  - Sustainable human developments
  - Employment and skills development

- Environmental sustainability and resilience

  The Northern Cape Province has an abundance of natural resources and environmental assets. While these present a wide range of economic opportunities, a concerted effort must be made to ensure that these are protected and enhance to support the developmental objectives of the

province. As the province is an arid region, it must be ensured that enough is done to mitigate the real threat of climate change.

- Effective, efficient, and accountable governance

  A capable and accountable government based on strong inter-governmental cooperation and participatory governance with civil society will be better positioned and capable to perform seamless services based on the needs of those on whose behalf they govern. Three drivers have been identified to facilitate effective, efficient, and accountable governance:

  - Developmental and democratic state
  - Effective local government
  - International relations

4.2.2.2 Western Cape Provincial Strategic Plan 2019-2024

Vision has five strategic priorities with the following problem areas and focus areas:

- Safe and cohesive communities – a place where residents and visitors feel safe
  - Problem areas
    - Violence and violent crime
    - Police capacity and public trust
    - Cohesive communities
  - Focus areas
    - Enhanced capacity and effectiveness of policing and law enforcement
    - Strengthened youth-at-risk referral pathways and child- and family centred initiatives to reduce violence
    - Increased social cohesion and safety in public places
- Growth and jobs – an enabling environment for the private sector and markets to drive growth and create jobs
  - Problem areas
    - Weak economic performance persists
    - Unemployment persists
    - Climate change impacts and resource pressures

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- Focus areas
  - Increasing investment
  - Building and maintaining infrastructure
  - Growing the economy through export growth
  - Creating opportunities for job creation through skills development
  - Creating an enabling environment for economic growth through resource resilience

- Empowering people -residents have opportunities to shape their lives and the lives of others, to ensure a meaningful and dignified live
  - Problem areas
    - Children and families live in unhealthy, violent, neglectful and dysfunctional environments that impede proper development
    - Children have unequal access to quality holistic education and extended learning opportunities, which limits post-schooling success
    - Youth engage in unhealthy and risky behaviours, have few educational and economic opportunities, and become disconnected from productive society
    - Health outcomes are uneven between rich and poor and, despite successes in areas like HIV treatment and sexual and reproductive health, there is an inability to fulfil the growing demand for health services
  - Focus areas
    - Children and families
    - Education and learning
    - Youth and skills
    - Health and wellness

- Mobility and spatial transformation – residents live in well-connected, vibrant, and sustainable communities and move around efficiently on safe, affordable, low-carbon public transport
  - Problem areas
    - Poor communities far from social and economic opportunities

- Inadequate public transport
- Infrastructure backlogs and challenges

- Focus areas
  - Create better linkages between places through safe, efficient, and affordable public transport
  - Inclusive places of opportunities
  - More opportunities for people to live in better locations
  - Improving the places where people live

- Innovation and culture – government services are delivered to the people in an accessible, innovative, and citizen-centric way
  - Problem areas
    - Inward-focused organisational culture
    - Western Cape Government innovation exists, but is not fully embedded
    - Limited integration across the spheres of government and with external partners
    - Good governance is primarily driven by compliance processes
    - Talent and staff development is not responsive to the changing world of work
  - Focus areas
    - Citizen-centric culture
    - Innovation for impact
    - Integrated service delivery
    - Governance transformation
    - Talent and staff development

4.2.3 National Development Plan

On 11 November 2011 the National Planning Commission released the National Development Plan: Vision for 2030 (NPC, 2012) for South Africa and it was adopted as government policy in August 2012. The National Development Plan (NDP) was undertaken to envision what South Africa should look like in 2030 and what action

steps should be taken to achieve this (RSA, 2013). The aim of the NDP is to eliminate poverty and reduce inequality by 2030. The report identifies nine central challenges to development in South Africa:

1. Too few people work.
2. The standard of education for most black learners is of poor quality.
3. Infrastructure is poorly located, under-maintained and insufficient to foster higher growth.
4. Spatial patterns exclude the poor from the fruits of development.
5. The economy is overly and unsustainably resource intensive.
6. A widespread disease burden is compounded by a failing public health system.
7. Public services are uneven and often of poor quality.
8. Corruption is widespread.
9. South Africa remains a divided society (NPC, 2012).

The plan focuses on creating an enabling environment for development and wants to shift from a paradigm of entitlement to a paradigm of development that promotes the development of capabilities, the creation of opportunities and the involvement of all citizens (NPC, 2012). The National Development Plan (NPC, 2012) wants to achieve the following:

1. An economy that will create more jobs.
2. Improving infrastructure.
3. Transition to a low-carbon economy.
4. An inclusive and integrated rural economy.
5. Reversing the spatial effects of apartheid.

6. Improving the quality of education, training, and innovation.
7. Quality healthcare for all.
8. Social protection.
9. Building safer communities.
10. Reforming the public service.
11. Fighting corruption.
12. Transforming society and uniting the country.

Each of the points above is a chapter in the plan and contains a range of targets and proposals. Some are general statements of policy intent, while others are specific policy proposals, actions or processes that should take place (NPC, 2012).

4.2.4 Sustainable Development Goals

All 189 Members States of the United Nations, including South Africa, adopted the United Nations Millennium Declaration in September 2000 (UN, 2000). The commitments made by the Millennium Declaration are known as the Millennium Development Goals (MDGs), and 2015 was targeted as the year to achieve these goals. The United Nations Open Working Group of the General Assembly identified seventeen sustainable development goals (Figure 2), built on the foundation of the MDGs as the next global development target (UN, 2014). The sustainable development goals include aspects such as ending poverty, addressing food security, promoting health, wellbeing and education, gender equality, water and sanitation, economic growth and employment creation, sustainable infrastructure, reducing inequality, creating sustainable cities and human settlements, and addressing challenges in the physical environment such as climate change and environmental resources (UN, 2014). These aspects are included in the NPD, and it can therefore be assumed that South Africa's development path is aligned with the international development agenda.

Figure 2: Sustainable Development Goals (Source: www.un.org)

4.3 National and international standards

National and international industry standards aimed at sustainable development and social justice specifically have become abundant in the last decade. Many industries use these standards as indicators for best practice. The discussion below highlights only a few of these standards.

4.3.1 ISO 26000:2010/SANS 26000:2010

Performance standards have long been a voluntary tool used by industry to achieve certain outcomes. The first standard on social responsibility, ISO 26000 was published on 1 November 2010 (ISO, 2010). It was developed using a multi-stakeholder approach involving experts from more than 90 countries and 40 international or broadly based regional organisations involved in different aspects of social responsibility (ISO, 2010).

The South African Bureau of Standards (SABS), a statutory body that is mandated to develop, promote and maintain South African National Standards (SABS, [sa]) adopted the ISO 26000 Standard as a South African National Standard (SANS) 26000:2010.

Social responsibility is defined in the standard as the responsibility of an organisation for the impacts of its decisions and activities on society and the environment, through transparent and ethical behaviour that contributes to sustainable development, including health and welfare of society; takes into account the expectations of the stakeholders; complies with applicable law and is consistent with international behaviour norms, and is integrated throughout the organisation and practiced in its relationships (ISO, 2010).

The document identifies seven principles for social responsibility and seven core subjects that should be addressed by organisations. The seven principles for social responsibility are accountability, transparency, ethical behaviour, respect for stakeholder interests, respect for the rule of law, respect for international norms of behaviour and respect for human rights (ISO, 2010). The core subjects that should be addressed include organisational governance, human rights, labour practices, environment, fair operating practices, consumer issues and community involvement and development (ISO, 2010). Economic aspects, health and safety and the value chain are dealt with throughout the seven core subjects, and gender issues are considered.

ISO 26000 is a good introduction to what social responsibility is and what measures should be taken to move towards being a more socially responsible company. It deals with equity issues and can encourage social development initiatives by companies through activities such as social investment projects, employment creation, skills development and income creation. Any company operating in area where people are affected by their activities has a social responsibility towards the affected community, and as such it would be in the interest of TGS to address the core subjects as suggested by ISO 26000:2010.

4.3.2 International Social Performance Standards/Initiatives

There is a profusion of global initiatives aiming at assisting companies to make their operations more sustainable. Human rights, environmental protection and social justice are gaining support from industry. The social agenda forms an important part of this trend. Only a few relevant initiatives will be mentioned in this section.

The Global Reporting Initiative (GRI) is a leading organisation in the sustainability field that promotes sustainability reporting as a way for companies to become more sustainable and contribute to sustainable development. A company publishes a sustainability report to report the economic, social and environmental impacts of its everyday activities, present its values and governance model and explain the link between its strategy and its commitment to sustainable development (GRI, [sa]). The GRI have strategic partnerships with the United Nations Environment Programme, the United Nations Global Compact, the Organisation for Economic Co-operation and Development and the International Organisation for Standardisation, amongst others (GRI, [sa]). The social category relates to the impact of the company on the social systems in which it operates. The social category consists of four subcategories namely labour practices and decent work; human rights; society; and product responsibility. Each of the categories is unpacked by using a number of aspects that should be considered (GRI, [sa]). GRI Focal Points are national offices that drive the initiatives in particular countries and regions. On 26 February 2013 the GRI Focal Point South Africa was launched. South Africa is one of the countries with the largest number of GRI reporters in the world. The GRI Focal Point South Africa aims to work with multi-national companies to expand and share best practices across the continent (GRI, [sa]).

Many of the multi-lateral funding agencies such as the World Bank have social standards that they must uphold. The most frequently used in the EIA industry is the International Finance Corporation's (IFC) principles (IFC, 2012). The IFC is a member of the World Bank group, and as a part of their sustainability framework they created performance standards on environmental and social sustainability (IFC, 2012). The standards relevant to the social environment are the following:

1. Environmental and Social Standard 1. Assessment and Management of Environmental and Social Risks and Impacts
2. Environmental and Social Standard 2: Labour and Working Conditions
3. Environmental and Social Standard 4: Community Health and Safety

4. Environmental and Social Standard 5 Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

5. Environmental and Social Standard 8: Cultural Heritage

6. Environmental and Social Standard 10. Stakeholder Engagement and Information Disclosure (World Bank, 2016)

Issues such as gender, climate change, water and human rights are addressed across the standards. A guidance note accompanies each standard (IFC, 2012:4). Environmental and social risks and impacts must be managed by using an Environmental and Social Management System. The standard applies to all the activities funded by the IFC for the duration of the loan period. A number of private banks adopted most of the IFC standards in an initiative known as the Equator Principles (Esteves, Franks & Vanclay, 2012).

4.3.3 International Principles for SIA

The practice of SIA is guided by a set of *International Principles* that defines the core values, fundamental principles for development and principles specific to SIA practice (Vanclay, 2003). When the *International Principles* are considered, it is clear that SIA aspires to more than just assessing the impact of development on people and includes sustainable outcomes. The following specific principles refer to these sustainable outcomes (Vanclay, 2003):

1. Development projects should be broadly acceptable to the members of those communities likely to benefit from, or be affected by, the planned intervention.

2. The primary focus of all developments should be positive outcomes, such as capacity building, empowerment, and the realisation of human and social capital.

3. The term "environment" should be defined broadly to include social and human dimensions, and in such inclusion, care must be taken to ensure that adequate attention is given to the realm of the social.

4. Equity considerations should be a fundamental element of impact assessment and of development planning.

5. There should be a focus on socially sustainable development, with the SIA contributing to the determination of best development alternative(s) – SIA (and EIA) has more to offer than just being an arbiter between economic benefit and social cost.

6. In all planned interventions and their assessments, avenues should be developed to build the social and human capital of local communities and to strengthen democratic processes.

7. Local knowledge, experience and acknowledgement of different cultural values should be incorporated in any assessment.

8. Development processes that infringe the human rights of any section of society should not be accepted.

In addition to the *International Principles*, the international SIA community produced a document titled: *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects* (Vanclay, Esteves, Aucamp & Franks, 2015) in April 2015. The purpose of this document is to provide advice to various stakeholders (including proponents) about good practice SIA and social impact management (Vanclay et al., 2015). This document aspires to provide a much-needed benchmark for SIA practice across the globe.

5 Receiving environment

According to the National Environmental Management Act (NEMA, 1998) environment refers to the surroundings in which humans exist. When viewing the environment from a socio-economic perspective the question can be asked what exactly the social environment is. Different definitions for social environment exist, but a clear and comprehensive definition that is widely accepted remains elusive. Barnett & Casper (2001) offers the following definition of human social environment:

> *"Human social environments encompass the immediate physical surroundings, social relationships, and cultural milieus within which defined groups of people function and interact. Components of the social environment include built infrastructure; industrial and occupational structure; labour markets; social and economic processes; wealth; social, human, and health services; power relations; government; race relations; social inequality; cultural practices; the arts; religious institutions and practices; and beliefs about place and community. The social environment subsumes many aspects of the physical environment, given that contemporary landscapes, water resources, and other natural resources have been at least partially configured by human social processes. Embedded within contemporary social environments are historical social and power relations that have become institutionalized over time. Social environments can be experienced at multiple scales, often simultaneously, including households, kin networks, neighbourhoods, towns and cities, and regions. Social environments are dynamic and change over time as the result of both internal and external forces. There are relationships of dependency among the social environments of different local areas, because these areas are connected through larger regional, national, and international social and economic processes and power relations."*

Environment-behaviour relationships are interrelationships (Bell, Fisher, Baum & Greene, 1996). The environment influences and constrains the behaviour of people, but behaviour also leads to changes in the environment. The impacts of a project on

people can only be truly understood if their environmental context is understood. The baseline description of the social environment will include a description of the area within a provincial, district and local context that will focus on the identity and history of the area as well as a description of the population of the area based on a number of demographic, social and economic variables.

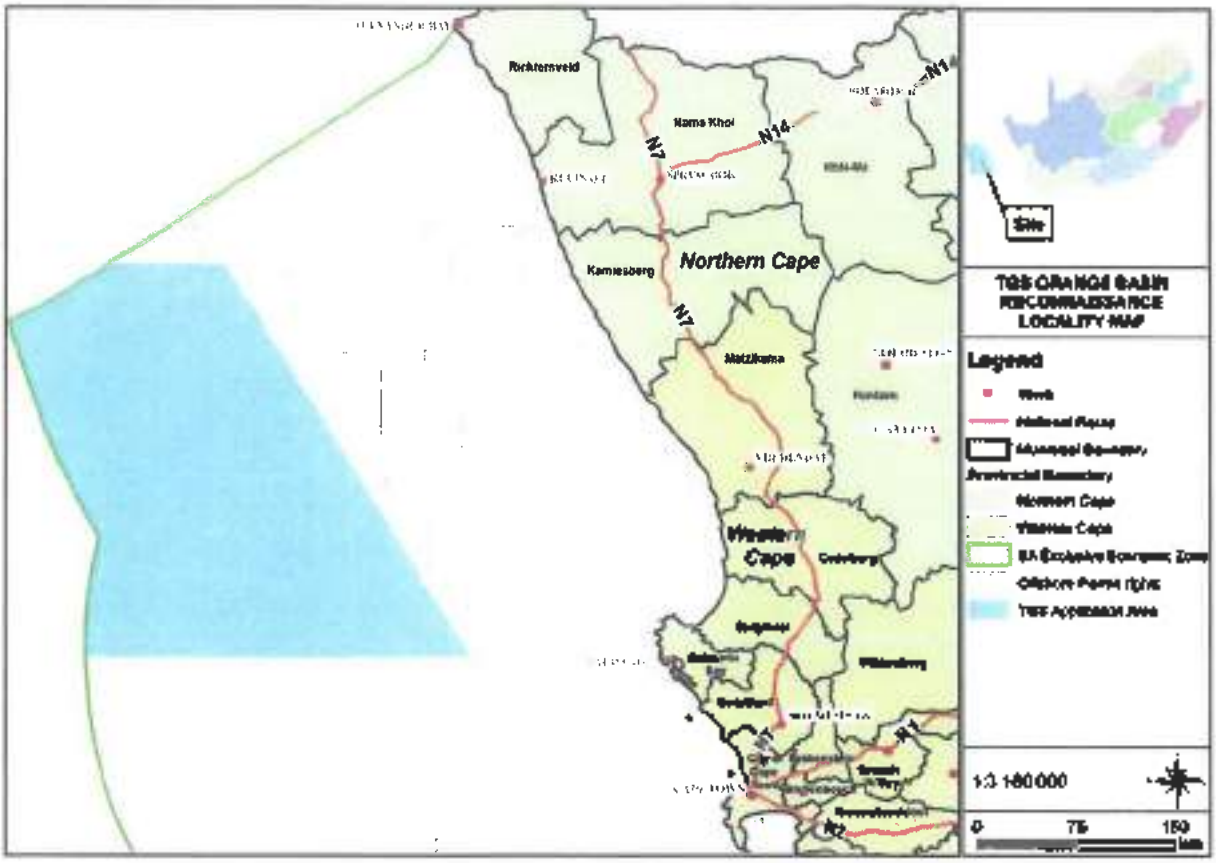
5.1 Description of the area

The proposed project area for the TGS Seismic Reconnaissance project is located on the edge of the South African exclusive economic zone in the Atlantic Ocean. The people potentially affected by the proposed project are those living in the areas adjacent to the ocean whose activities could potentially be affected. The following areas are included in the baseline description of the social environment:

- Northern Cape Province
  - Namakwa District Municipality
    - Richtersveld Local Municipality (Wards 2, 3, 4)
    - Nama Khoi Local Municipality (Ward 8)
    - Kamiesberg Local Municipality (Wards 1, 2)
- Western Cape Province
  - West Coast District Municipality
    - Matzikama Local Municipality (Wards 2, 5, 8)
    - Cederberg Local Municipality (Ward 5)
    - Bergrivier Local Municipality (Wards 6, 7)
    - Saldanha Bay Local Municipality (Wards 1, 3, 5, 6, 11, 12, 14)
    - Swartland Local Municipality (Ward 5)
  - City of Cape Town Metropolitan Municipality (Wards 4, 23, 29, 32, 54, 55, 74, 107, 113, 115)

Figure 3 shows the location of the proposed project area in relation to these municipal areas.

Figure 3: Location of the proposed project area.



5.1.1 Northern Cape Province

The Northern Cape Province is South Africa's largest province. It takes up almost a third of the country and covers an area of 372 889 km² (www.municipalities.co.za). It is bordered by the provinces of North West, Free State, Eastern Cape and Western Cape as well as the countries of Namibia and Botswana and the Atlantic Ocean. It consists of the Frances Baard, John Taolo Gaetsewe, Namakwa, Pixley Ka Seme and ZF Mgcawu District Municipalities.

The capital of the province is Kimberley and other towns in the province include Springbok, Kuruman, De Aar, Sutherland, Alexander Bay, Port Nolloth, Kathu, Okiep, Springbok, Aggeneys, Upington, Kakamas, Keimoes and Warrenton.

The economy of the province relies mainly on mining and agriculture. Commodities being mined include iron ore, copper, asbestos, manganese, fluorspar, semi-precious stones, and marble. Alluvial diamonds are being extracted from the beaches and sea

in the area around Alexander Bay and Port Nolloth. Agricultural products include sheep, wheat, fruit, grapes, wheat, peanuts, maize, and cotton. The province is known for its dried fruit, wine, and karakul pelt.

The spring-flowers in Namakwaland is a popular tourist attraction. The province also houses the southern hemisphere's largest astronomical observatory at Sutherland.

5.1.1.1 *Namakwa District Municipality*

The Namakwa District Municipality is the largest district municipality in the province and covers an area of 126 836 km² (www.municipalities.co.za). It is bordered by the ZF Mgcawu Local Municipality, the Cape Winelands, West Coast, Pixley Ka Seme and Central Karoo District Municipalities, the country of Namibia and the Atlantic Ocean. It is the largest district in the province, making up almost a third of the province.

The district consists of six local municipalities, namely the Hantam, Kamiesberg, Karoo Hoogland, Khai-Ma, Nama Khoi, and Richtersveld Local municipalities. The capital of the province is Springbok and other towns include Aggeneys, Alexander Bay, Brandvlei, Bulletrap, Calvinia, Carolusberg, Concordia, Eksteensfontein, Fraserburg, Garies, Hondeklip Bay, Kamieskroon, Kleinzee, Koingnaas, Komaggas, Kuboes, Leliefontein/Kamiesberg, Loeriesfontein, Middelpos, Nababeep, Nieuwoudtville, O'Kiep, Onderste Doorns, Pella, Pofadder, Port Nolloth, Richtersveld, Sanddrift, Springbok, Steinkopf, Sutherland, and Williston.

The main economic sectors are tourism and agriculture.

5.1.1.1.1 Richtersveld Local Municipality

The Richtersveld municipality is the smallest municipality in the district and covers an area of 9 608 km² (www.municipalities.co.za). The municipality borders the Atlantic Ocean and the main towns are Alexander Bay, Eksteensfontein, Kuboes, Port Nolloth, Richtersveld and Sanddrift. Port Nolloth is the main economic centre of the municipality.The main economic sectors are mining, agriculture, fishing and tourism0 Richtersveld Local Municipality IDP 2022/2027).

The main challenges that municipality faces relate to infrastructure, and socio-economic, spatial and housing issues, as well as issues relative to social facilities and services. The Richtersveld Municipal area is earmarked for a massive harbour development at Boegoebaai (about 60 km north of Port Nolloth and 20 km south of the border between Namibia and South Africa). This project is currently in its initial phase, and it is envisaged that this development will serve as an enabler of further development in the Northern Cape (Namakwa District Municipality IDP 2022-2027).

The Boegoebaai port is closely linked to the Northern Cape Green Hydrogen Strategy which was launched to the global community at the COP26 summit in Glasgow in November 2021 (www.globalafricanetwork.com). Green hydrogen refers to the production of hydrogen using renewable energy sources (www.un.org). Black/brown hydrogen is produced using coal and grey/blue hydrogen is derived from methane. Being an energy carrier, green hydrogen would act like a battery that allows the storage of excess energy created by renewable sources and would reduce the intermittency of renewables that cannot generate power all hours of the day, ensuring a sufficient and continuous supply of power for the grid.

5.1.1.1.2 Nama Khoi Local Municipality

The Nama Khoi Local Municipality covers an area of 17 990 km^2 (www.municipalities.co.za). It is home to Nama, Khoe and San people who have occupied the area for hundreds of years. The municipality borders the Atlantic Ocean, and the main towns are Bulletrap, Carolusberg, Concordia, Kleinzee, Komaggas, Nababeep, O'Kiep, Springbok, Steinkopf. The main economic activities are mining and tourism, but there are also some government departments. This region is known as the land of the Nama people.

5.1.1.1.3 Kamiesberg Local Municipality

The Kamiesberg Local Municipality covers an area of 14 208 km^2 (www.municipalities.co.za). The municipality borders the Atlantic Ocean and the main towns are Garies, Hondeklip Bay, Kamieskroon, Koingnaas, and Lekkefontein/Kamiesberg. Hondeklip Bay has a harbor that serves fishing and diamond boats (Namakwa District Municipality IDP 2022-2027). It is also a mariculture centre

and popular with tourists for scenic drives and 4x4 routes. Garies and Kamieskroon are known for wildflowers in spring, while Koingnaas is a mining town for alluvial diamonds.

5.1.2 Western Cape Province

The Western Cape Province is located on the southern tip of Africa between the Atlantic and Indian Oceans and is bordered by the Northern Cape and Eastern Cape Provinces. It covers an area of 129 462 km² (www.municipalities.co.za). The province is divided into one metropolitan municipality and five district municipalities. The capital of the province is the city of Cape Town and other major cities and towns include George, Knysna, Paarl, Swellendam, Oudtshoorn, Stellenbosch, Worcester, Mossel Bay and Strand.

The province has a well-established industrial and business base. Main economic activities include finance, real estate, ICT, retail, and tourism. Fishing is the most important industry along the west coast and sheep farming in the Karoo. In terms of agriculture main produce include grapes, fruit, vegetables, and wheat. A number of vineyards are located in the Western Cape Province.

5.1.2.1 West Coast District Municipality

The West Coast District Municipality covers an area of 31 118 km² (www.municipalities.co.za) and is bordered by the Namakwa and Cape Winelands District Municipalities, the City of Cape Town, and the Atlantic Ocean. The municipality consists of five local municipalities, namely the Swartland, Bergrivier, Matzikama, Cederberg and Saldanha Bay Local Municipalities.

The capital of the district is Moorreesburg and other main towns include Abbotsdale, Aurora, Bitterfontein, Chatsworth, Citrusdal, Clanwilliam, Darling, Doring Bay, Ebenhaezer, Eendekuil, Elands Bay, Graafwater, Grotto Bay, Hopefield, Jacobs Bay, Kalbaskraal, Klawer, Kliprand, Koekenaa, Koringberg, Lamberts Bay, Langebaan, Leipoldtville, Lutzville, Malmesbury, Molsviei, Moorreesburg, Nuwerus, Paternoster, Piketberg, Porterville, Putsekloof, Redelinghuys, Riebeeck Kasteel, Riebeeck West,

Rietpoort, Riverlands, Saldanha, St Helena Bay, Stofkraal, Strandfontein, Vanrhynsdorp, Velddrif, Vredenburg, Vredendal, Wupperthal, and Yzerfontein.

Despite lively economic activity in the Swartland, Saldanha and Bergrivier areas, large parts of the district remain impoverished. The district has the second lowest GDPR in the Western Cape Province and income inequality has worsened over the years (West Coast District Municipality IDP 2022-2027). The economic activities are mainly driven by activities within the manufacturing; agriculture, forestry and fishing; as well as wholesale and retail trade sector. The recent drought has had a significant impact on the agriculture, forestry and fishery sectors within the district.

5.1.2.1.1 Matzikama Local Municipality

The Matzikama Local Municipality borders the Northern Cape Province and the Atlantic Ocean. It is the largest of the five municipalities in the district, making up almost half of the district. It covers an area of 12 981 km² (www.municipalities.co.za). There are 18 towns and villages in the municipal area with most of the population being concentrated along the Olifants River and its canal system. The main towns and villages include Bitterfontein, Doring Bay, Ebenhaezer, Klawer, Kliprand, Koekenaa, Lutzville, Molsvlei, Nuwerus, Putsekloof, Rietpoort, Stofkraal, Strandfontein, Vanrhynsdorp,aand Vredendal.

The agriculture, forestry and fishery sector was the main driver of the municipality's economy, followed by the wholesale and retail trade, catering and accommodation sector (Matzikama Local Municipality IDP, May 2022). The municipality is under severe strain with regards to coastal resource use (mining pressure, marine living resources), exploitation of estuarine resources and coastal vulnerabilities (illegal off-road vehicles, illegal camping and coastal erosion). Due to the dwindling fishing stocks the capture fisheries industry closed down more than 10 years ago and the likeliness of it being restored to its original form is unlikely. The only remaining activity of this industry is subsistence and small scale fishing.

Operation Phakisa – Oceans Economy forms part of the Matzikama Coastal Management Plan, also in terms of the socio-economic development of the coastal

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zones (Matzikama Local Municipality IDP, May 2022). Operation Phakisa – Oceans Economy was launched in July 2014 as a priority programme of the South African Government with the aim to considerably grow the Ocean Economy's contribution to the country's GDP by 2033. It is a results-driven approach that involves clear plans and targets, ongoing monitoring of progress and making these results public. It focuses on bringing key stakeholders from the public and private sectors, academia as well as civil society organisations together to collaborate in (www.dffe.gov.za):

- Detailed problem analysis;
- Priority setting;
- Intervention planning; and
- Delivery.

The project focuses on six growth areas, namely:

- Marine transport and manufacturing;
- Offshore oil and gas exploration;
- Aquaculture;
- Marine protection services and ocean governance;
- Small harbours; and
- Marine tourism.

The six growth areas are supported by two enablers, namely:

- Skills and capacity building; and
- Research, technology and innovation.

5.1.2.1.2 Cederberg Local Municipality

The Cederberg Local Municipality covers an area of 8 007 km² (www.municipalities.co.za). It is bordered by the Atlantic Ocean and the Cederberg Mountains and is located on the Cape-Namibia corridor. The main towns in the area include Citrusdal, Clanwilliam, Elands Bay, Graafwater, Lamberts Bay, Leipoldtville, and Wupperthal.

The economic activities in the Cederberg Local Municipality are dominated by agriculture and fishing, manufacturing, wholesale and retail trade, catering and accommodation, and transport, storage and accommodation (Cederberg Local Municipality IDP 2022-23). The area consists of a mix of sparsely and densely populated towns with Clanwilliam and Citrusdal serving as the main agricultural

centres. The area is characterised by high levels of unemployment, poverty and social grant dependence. The road network is diverse with national, trunk, main and divisional roads of varying quality.

5.1.2.1.3 Bergrivier Local Municipality

The Bergrivier Local Municipality covers an area of 4 407 km² (www.municipalities.co.za). The main towns in the area include Aurora, Eendekuil, Piketberg, Porterville, Redelinghuys, and Velddrif. The agriculture sector is the largest employer in the municipal area with a contribution of 50.4% to total employment (Bergrivier Local Municipality IDP, May 2022). The four pillars for economic development in the municipal area are agriculture and agro processing; tourism; manufacturing; and the development of small and medium enterprises.

5.1.2.1.4 Saldanha Bay Local Municipality

The Saldanha Bay Local Municipality is the smallest of the five municipalities in the district and covers an area of 2 015 km² (www.municipalities.co.za). The main towns in the area are Hopefield, Jacobs Bay, Langebaan, Paternoster, Saldanha, St Helena Bay, Vredenburg.

The Saldanha Bay area plays an important role in the broader strategic framework of the South African Government as driven by the National Development Plan and National Growth Plan. It was identified as a special intervention area, attributed to the natural deep-water harbour and industrial development prospects that warrants its designation as a national growth management zone. The Saldanha Bay Industrial Development Zone (IDZ) was launched in October 2013 with the aim of serving as an important mechanism to achieve the government's aim of sustainable economic development and job creation in the localised economy. Diversification, and transformation of the historically under-developed and under-supported industrial maritime and energy sectors and broadening of the regional and national economic base through industrialisation (Saldanha Bat Local Municipality IDP, May 2022).

St Helena Bay is one of the world's principal fishing centres. Huge shoals of anchovies and pilchards fed in the area before they were depleted by overfishing. Twelve fish-

processing factories were established along the 21 km curve of the shore from West Point to Sandy Point and Stompneus. The bay is also well known for its snoek, especially during the winter months.

Saldanha Bay is the largest natural bay in South Africa and has a huge iron ore quay and is home to a large variety of fishing vessels. The town is not only important for export, but also hosts a number of other industries, such as crayfish, fish, mussels, oysters, seaweed and many more. It is also home to the South African Military Academy as well as SAS SALDANHA, a naval training unit.

The largest economic sectors in the municipal area are manufacturing, trade, and finance, while the agricultural sector is the largest contributor to employment. The fishing industry and fish processing are the largest primary and secondary industries in the municipality.

5.1.2.1.5 Swartland Local Municipality

The Swartland Local Municipality covers an area of 3 708 km^2 (www.municipalities.co.za). Main towns in the area include Abbotsdale, Chatsworth, Darling, Grotto Bay, Kalbaskraal, Koringberg, Malmesbury, Moorreesburg, Riebeeck Kasteel, Riebeeck West, Riverlands, and Yzerfontein.

The town of Malmesbury fulfils an important niche in the region due to its high development potential that can be attributed to factors like its relative accessibility along the N7 road/rail corridor; proximity to Cape Town; a diversified economic base that not only accommodates agriculture, but also well-developed industrial and commercial sectors; and supportive infrastructure. A number of people moved here and commute to jobs in Cape Town because of the high property rates in the Cape Town Metropolitan area and the tranquil environment that it offers.

Commercial services; Manufacturing; and Agriculture are the biggest contributors to the economy of the municipal area, with Agriculture being the second highest contributor to employment.

5.1.2.2 City of Cape Town Metropolitan Municipality

The City of Cape Town Metropolitan Municipality is situated in the southern peninsula of the Western Cape Province and covers an area of 2 461 km² (www.municipality.co.za). It is South Africa's second largest economic centre and the second most populous city after Johannesburg. It is the provincial capital as well as the legislative capital of South Africa. The city is known for its harbour, floral kingdom and well-known landmarks like Table Mountain and Cape Point.

Main towns and cities in the area include Athlone, Atlantis, Belhar, Bellville, Blackheath, Blouberg, Blue Downs, Brackenfell, Cape Point, Cape Town, Delft, Durbanville, Elsies River, Fish Hoek, Goodwood, Gordon's Bay, Grassy Park, Guguletu, Hout Bay, Khayelitsha, Kommetjie, Kraaifontein, Kuils River, Langa, Macassar, Matroosfontein, Melkbosstrand, Milnerton, Mitchells Plain, Muizenberg, Noordhoek, Nyanga, Parow, Philadelphia, Philippi, Robben Island, Scarborough, Simon's Town, Sir Lowry's Pass, Somerset West, Southern Suburbs, Strand, and Table View.

5.2 Description of the population

The baseline description of the population will take place on three levels, namely provincial, district and local. Impacts can only truly be comprehended by understanding the differences and similarities between the different levels. The baseline description will focus on the municipal areas along the west coast that are most likely to be affected by the proposed project. Where possible, the data will be reviewed on a ward level. The data used for the socio-economic description was sourced from Census 2011. Census 2011 was a *de facto* census (a census in which people are enumerated according to where they stay on census night) where the reference night was 9-10 October 2011. The results should be viewed as indicative of the population characteristics in the area and should not be interpreted as absolute.

The following points regarding Census 2011 must be kept in mind (www.statssa.co.za):

- Comparisons of the results of labour market indicators in the post-apartheid population censuses over time have been a cause for concern. Improvements to key questions over the years mean that the labour market outcomes based

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on the post-apartheid censuses must be analysed with caution. The differences in the results over the years may be partly attributable to improvements in the questionnaire since 1996 rather than to actual developments in the labour market. The numbers published for the 1996, 2001, and 2011 censuses are therefore not comparable over time and are different from those published by Statistics South Africa in the surveys designed specifically for capturing official labour market results.

- For purposes of comparison over the period 1996–2011, certain categories of answers to questions in the censuses of 1996, 2001 and 2011, have either been merged or separated.

- The tenure status question for 1996 has been dropped since the question asked was totally unrelated to that asked thereafter. Comparisons for 2001 and 2011 do however remain.

- All household variables are controlled for housing units only and hence exclude all collective living arrangements as well as transient populations.

- When making comparisons of any indicator it must be considered that the time period between the first two censuses is five years and that between the second and third census is ten years. Although Census captures information at one given point in time, the period available for an indicator to change is different.

5.2.1 Population and household sizes

According to the Community Survey 2016, the population of South Africa is approximately 55,7 million and has shown an increase of about 7.5% since 2011. The household density for the country is estimated on approximately 3.29 people per household, indicating an average household size of 3-4 people (leaning towards 3) for most households, which is down from the 2011 average household size of 3.58 people per household. Smaller household sizes are in general associated with higher levels of urbanisation.

The greatest increase in population since 2011 has been in the Swartland and Saldanha Bay Local Municipalities (Table 1) and the increases were well above the national average. The Richtersveld Local Municipality where Port Nolloth is located is the only one of the coastal municipalities in the Northern Cape that showed an increase in population. The Kamiesberg Local Municipality where Hondeklip Bay is located, saw the greatest decrease in population between 2011 and 2016. Population density refers to the number of people per square kilometre and the population density on a national level has increased from 42.45 people per km2 in 2011 to 45.63 people per km2 in 2016. The City of Cape Town had the highest population density in 2016, and the Kamiesberg Local Municipality the lowest. Figure 4 gives a comparison of the population density. The municipalities in the rural areas in the Northern Cape are the least densely populated, while the metropolitan areas in Cape Town have the highest population density. Figure 5 shows the number of people per ward. The wards in the rural areas tend to have less people spread over a greater area, while in the urban areas there are more people in a much smaller area.

Table 1: Population density and growth estimates (sources: Census 2011, Community Survey 2016)

Area	Size in km²	Population 2011	Population 2016	Population density 2011	Population density 2016	Growth in population (%)
Northern Cape	372,889	1,145,861	1,193,780	3.07	3.20	4.18
Namakwa DM	*126,836*	*115,842*	*115,488*	*0.91*	*0.91*	*-0.31*
Richtersveld LM	9,608	11,982	12,487	1.25	1.30	4.21
Nama Khoi LM	17,990	47,041	46,512	2.61	2.59	-1.12
Kamiesberg LM	14,208	10,187	9,605	0.72	0.68	-5.71
Western Cape	129,462	5,822,734	6,279,730	44.98	48.51	7.85
West Coast DM	*31,118*	*391,766*	*436,403*	*12.59*	*14.02*	*11.39*
Matzikama LM	12,981	67147	71,045	5.17	5.47	5.81
Cederberg LM	8,007	49,768	52,949	6.22	6.61	6.39
Bergrivier LM	4,407	61,897	67,474	14.05	15.31	9.01
Saldanha Bay LM	2,015	99,193	111,173	49.23	55.17	12.08
Swartland LM	3,708	113,762	133,762	30.68	36.07	17.58
City of Cape Town Metropolitan	*2,441*	*3,740,026*	*4,004,793*	*1,532.17*	*1,640.64*	*7.08*

Figure 4: Population density (source: Community Survey 2016)

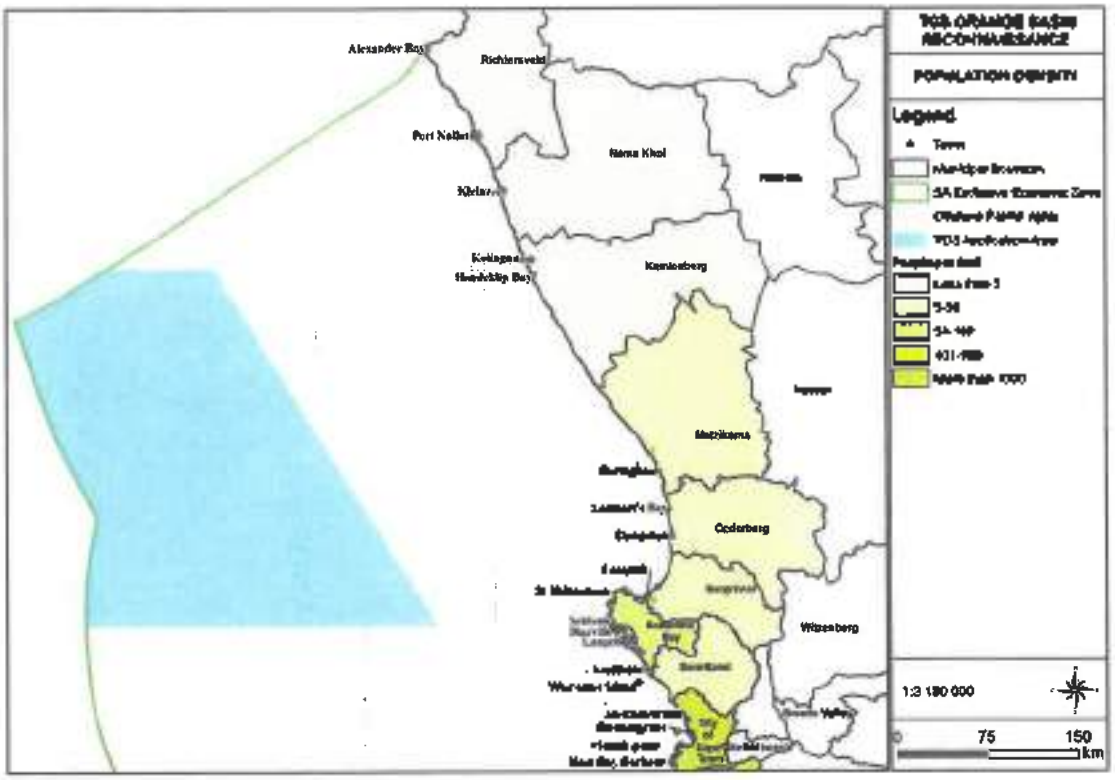
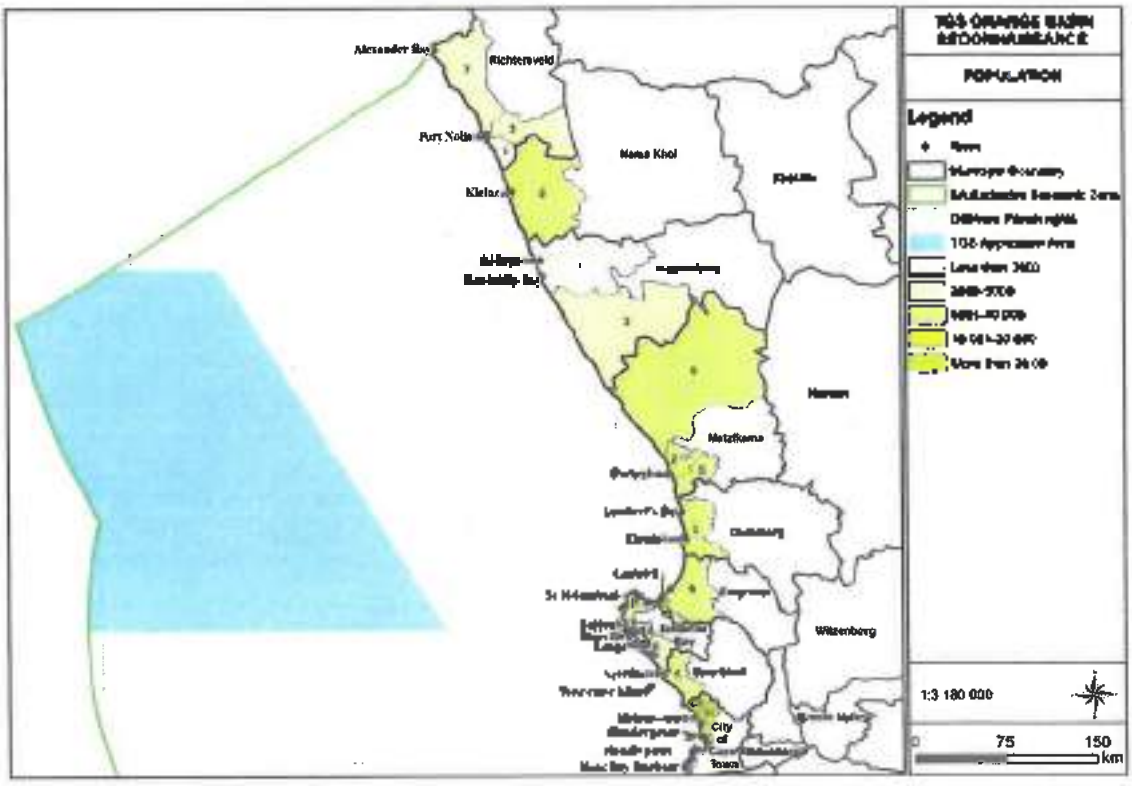


Figure 5: People per ward (source: Census 2011)



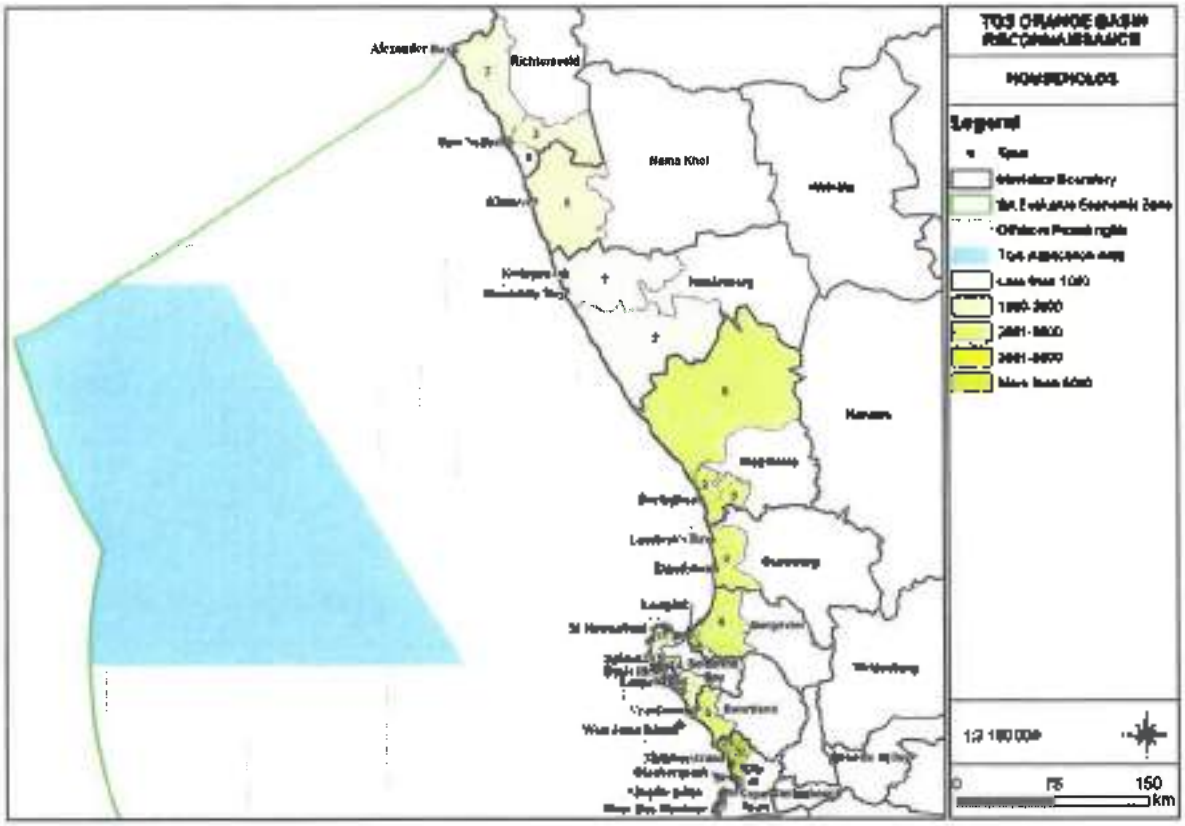
The number of households in the study area has increased on all levels (Table 2). The proportionate increase in households were greater than the increase in population on all levels. The greatest proportional increases in households were in the Swartland and Saldanha Bay Local Municipalities. The average household size has shown a decrease on all levels, which means there are more households, but with less members.

Table 2: Household sizes and growth estimates (sources: Census 2011, Community Survey 2016)

Area	Households 2011	Households 2016	Average household size 2011	Average household size 2016	Growth in households (%)
Northern Cape	301,406	353,709	3.80	3.38	17.35
Namakwa DM	*33,856*	*37,669*	*3.42*	*3.07*	*11.26*
Richtersveld LM	3,543	4,211	3.38	2.97	18.85
Nama Khoi LM	13,193	14,546	3.57	3.20	10.26
Kamiesberg LM	3,143	3,319	3.24	2.89	5.60
Western Cape	1,634,000	1,933,876	3.56	3.25	18.35
West Coast DM	*106,781*	*129,862*	*3.67*	*3.36*	*21.62*
Matzikama LM	18,835	20,821	3.57	3.41	10.54
Cederberg LM	13,513	15,279	3.68	3.47	13.07
Bergrivier LM	16,275	19,072	3.80	3.54	17.19
Saldanha Bay LM	28,835	35,550	3.44	3.13	23.29
Swartland LM	29,324	39,139	3.88	3.42	33.47
City of Cape Town Metropolitan	*1,068,573*	*1,264,849*	*3.50*	*3.17*	*18.37*

Figure 6 shows the number of households per ward. The wards in the Kamiesberg Local Municipality have the fewest people per ward.

Figure 6: Households per ward (source: Census 2011)



The total dependency ratio is used to measure the pressure on the productive population and refer to the proportion of dependents per 100 working-age population. As the ratio increases, there may be an increased burden on the productive part of the population to maintain the upbringing and pensions of the economically dependent. A high dependency ratio can cause serious problems for a country as the largest proportion of a government's expenditure is on health, social grants and education that are most used by the old and young population.

The Kamiesberg Local Municipality has the highest total dependency ratio (Table 3), while in the Richtersveld Local Municipality have the lowest. Employed dependency ratio refers to the proportion of people dependent on the people who are employed, and not only those of working age. The employed dependency ratio for the Kamiesberg and Nama Khoi Local Municipalities are the highest. This suggests high levels of poverty in these areas. Figure 7 and Figure 8 show the total and employed dependency ratios on a ward level.

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Table 3: Total dependency ratios (source: Census 2011).

Area	Total dependency	Youth dependency	Aged dependency	Employed dependency
Northern Cape	55.75	46.94	8.80	79.52
Namakwa DM	51.25	39.01	12.22	70.92
Richtersveld LM	42.51	33.96	8.55	61.38
Ward 2	36.82	32.89	3.93	56.70
Ward 3	39.54	32.95	6.59	64.57
Ward 4	48.60	35.93	12.67	63.98
Nama Khoi LM	49.45	37.16	12.29	73.74
Ward 8	45.05	35.42	9.63	76.99
Kamiesberg LM	57.89	41.84	16.05	78.37
Ward 1	54.81	40.19	14.62	79.04
Ward 2	46.90	33.04	15.86	69.06
Western Cape	44.96	36.44	8.52	65.47
West Coast DM	45.92	37.14	8.78	63.88
Matzikama LM	49.39	40.05	9.34	64.55
Ward 2	48.60	38.35	10.24	67.26
Ward 5	46.38	33.96	12.41	53.32
Ward 8	53.71	41.14	12.57	71.99
Cederberg LM	46.99	37.59	9.40	62.75
Ward 5	51.76	38.06	13.70	69.48
Bergrivier LM	46.89	36.62	10.27	61.61
Ward 6	46.60	37.11	9.49	65.08
Ward 7	55.44	23.94	31.50	68.70
Saldanha Bay LM	43.96	36.41	7.54	65.36
Ward 1	39.71	36.79	2.91	68.76
Ward 3	29.02	23.68	5.35	74.04
Ward 5	39.28	27.63	11.66	54.39
Ward 6	59.99	25.95	34.06	61.44
Ward 11	44.91	32.19	12.73	63.50
Ward 12	45.16	41.60	3.56	67.57
Ward 14	42.82	34.92	7.90	54.68
Swartland LM	44.68	36.21	8.47	64.27
Ward 5	50.76	33.31	17.44	58.03
City of Cape Town Metropolitan	43.61	35.65	7.97	69.39
Ward 4	35.96	31.80	4.16	52.38
Ward 23	38.49	26.83	11.66	47.23
Ward 29	47.25	40.95	6.30	69.98
Ward 32	44.89	41.04	3.85	68.39
Ward 54	39.01	16.17	22.84	51.04
Ward 55	41.63	26.22	15.41	56.16
Ward 74	40.68	33.04	7.63	58.62
Ward 107	40.60	28.96	11.64	46.30
Ward 113	36.71	26.07	10.64	47.93
Ward 115	26.32	14.33	12.00	60.94

Figure 7: Total dependency ratios (source: Census 2011)

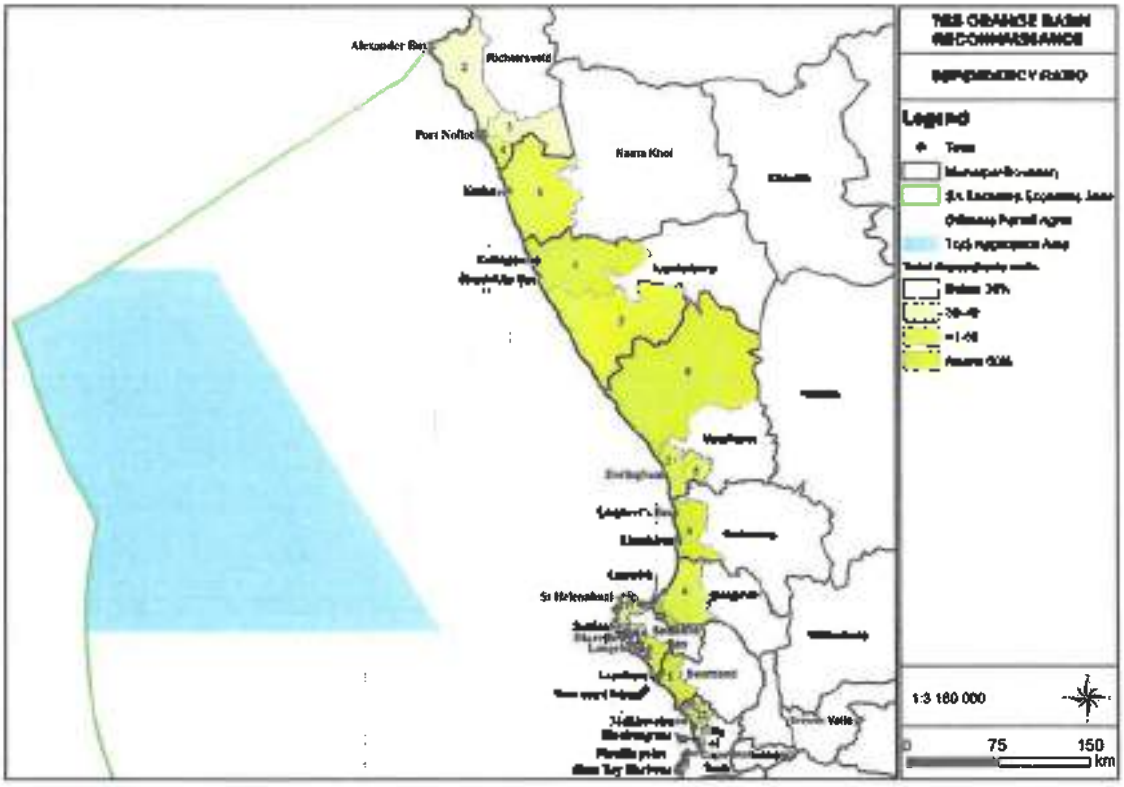
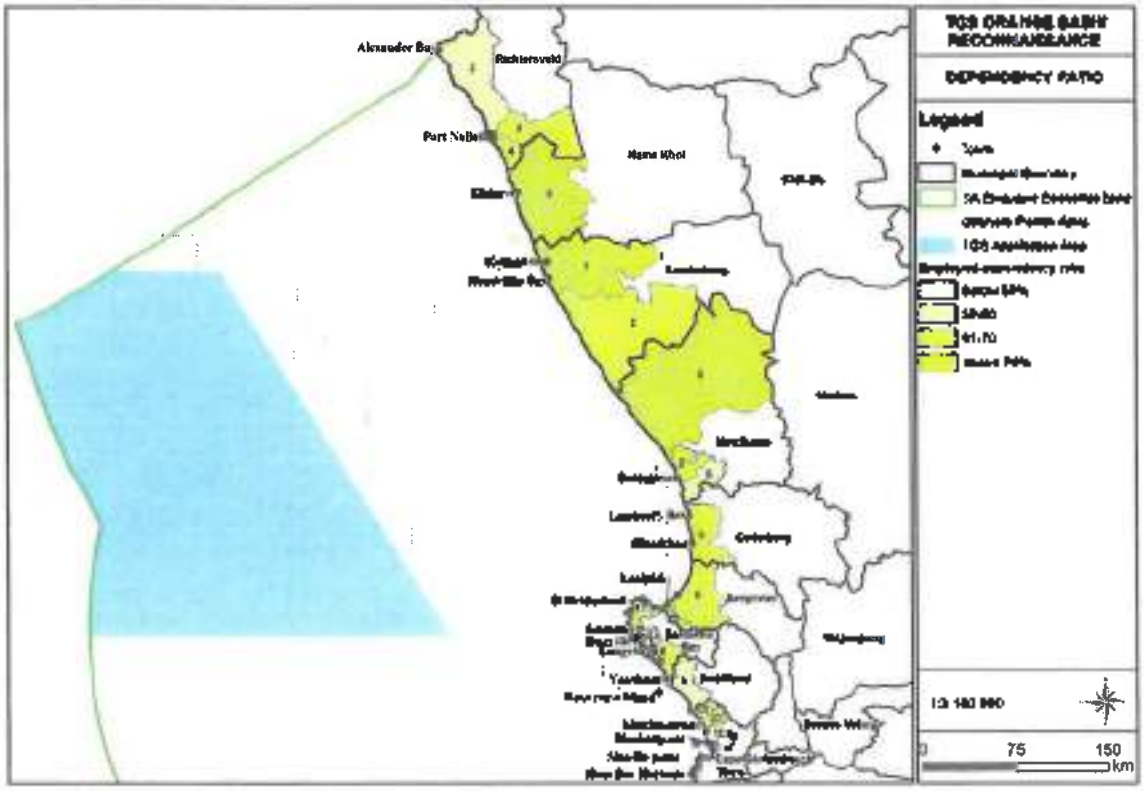


Figure 8: Employed dependency ratio (source: Census 2011).



Poverty is a complex issue that manifests itself in economic, social, and political ways and to define poverty by a unidimensional measure such as income or expenditure would be an oversimplification of the matter. Poor people themselves describe their experience of poverty as multidimensional. The South African Multidimensional Poverty Index (SAMPI) (Statistics South Africa, 2014) assess poverty on the dimensions of health, education, standard of living and economic activity using the indicators child mortality, years of schooling, school attendance, fuel for heating, lighting, and cooking, water access, sanitation, dwelling type, asset ownership and unemployment.

The poverty headcount refers to the proportion of households that can be defined as multi-dimensionally poor by using the SAMPI's poverty cut-offs (Statistics South Africa, 2014). The poverty headcount has increased on all levels since 2011 (Table 4), indicating an increase in the number of multi-dimensionally poor households.

The intensity of poverty experienced refers to the average proportion of indicators in which poor households are deprived (Statistics South Africa, 2014). The intensity of poverty has increased slightly on all levels. The intensity of poverty and the poverty headcount is used to calculate the SAMPI score. A higher score indicates a very poor community that is deprived on many indicators. The SAMPI score has decreased in the Northern Cape (Table 4) as well as the Northern Cape municipalities included in the study. In the Nama Khoi Local Municipality, the score remained the same although there was a slight increase in the intensity of the poverty. In the Western Cape the SAMPI score decreased on a provincial level, but in the West Coast District Municipality it has increased.

Table 4: Poverty and SAMPI scores (sources: Census 2011 and Community Survey 2016).

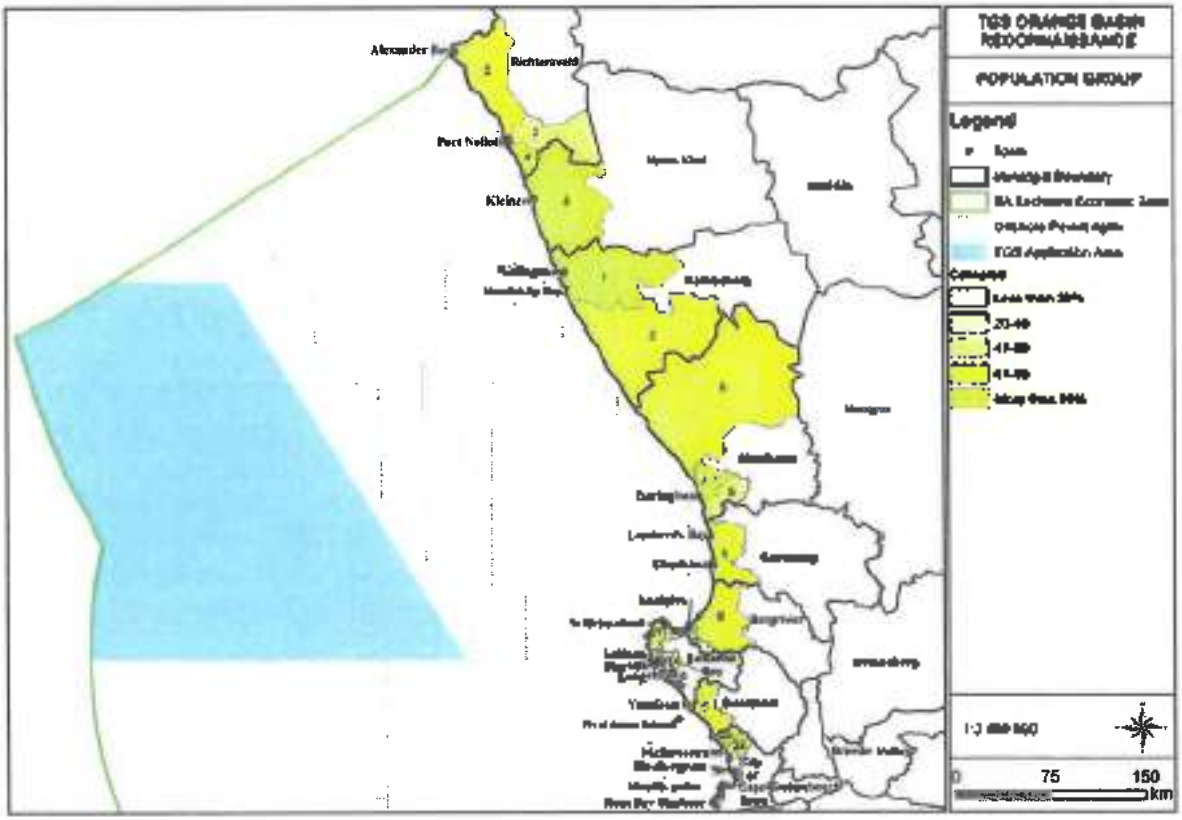
Area	Poverty headcount 2011 (%)	Poverty intensity 2011 (%)	SAMPI 2011	Poverty headcount 2016 (%)	Poverty intensity 2016 (%)	SAMPI 2016
Northern Cape	7.1	42.1	0.030	6.6	42	0.028
Namakwa DM	*3.2*	*40.2*	*0.013*	*7.8*	*41.6*	*0.022*
Richtersveld LM	3.1	39.9	0.012	1.9	38.3	0.007
Nama Khoi LM	2.5	40.4	0.010	2.5	41.7	0.010
Kamiesberg LM	5.1	40	0.020	3	39	0.012
Western Cape	3.6	42.8	0.015	2.7	40.1	0.011
West Coast DM	*2*	*41.9*	*0.008*	*2.9*	*44.5*	*0.013*

Matzikama LM	3.4	42.4	0.014	0.8	42.5	0.003
Cederberg LM	2.8	42.9	0.012	3.6	45.7	0.016
Bergrivier LM	1	43.7	0.004	1.6	41.5	0.007
Saldanha Bay LM	2.2	41	0.009	6.7	45.4	0.030
Swartland LM	1	40.6	0.004	0.9	39.9	0.004
City of Cape Town Metropolitan	*3.9*	*42.8*	*0.017*	*2.6*	*39.3*	*0.010*

5.2.2 Population composition, age, gender and home language

The majority of the people living in wards adjacent to the ocean are classified as belonging to the Coloured population group (Figure 9). The Coloured population group include Khoe and San people who in general find this classification offensive and they do not identify as such.

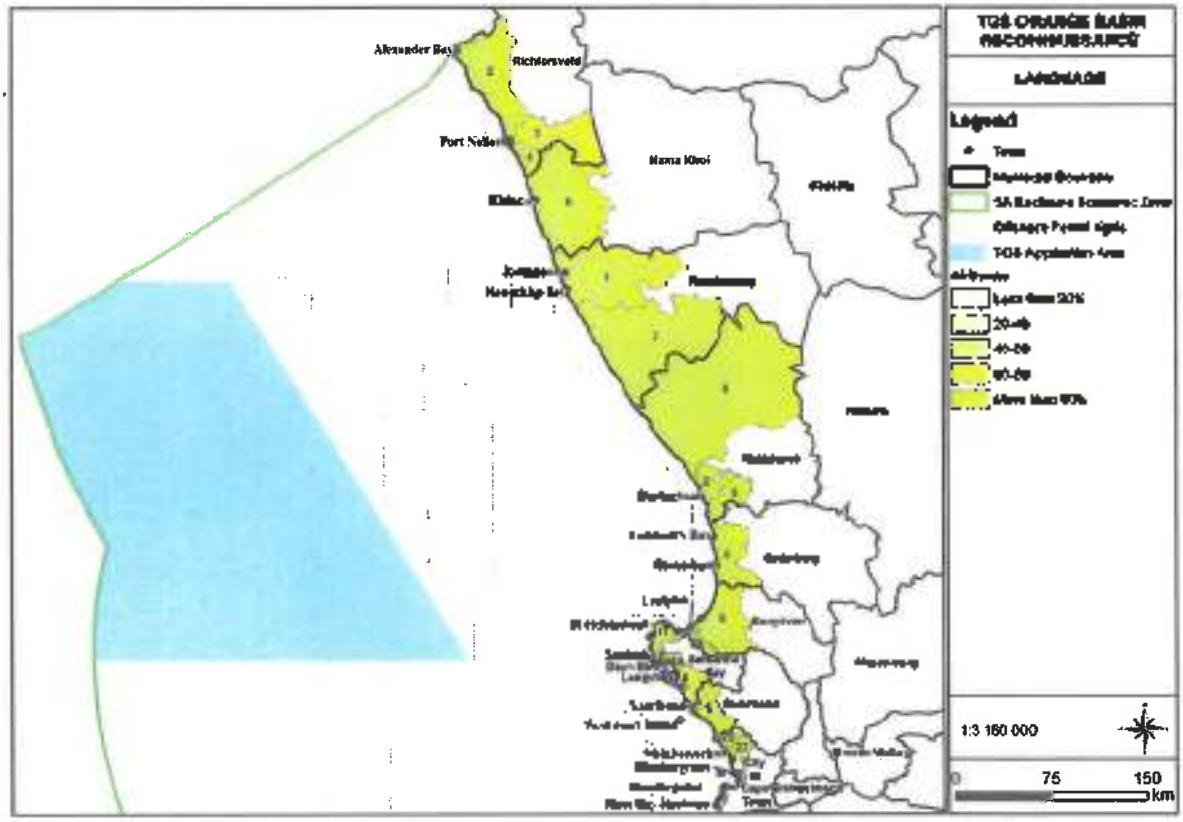
Figure 9: Classified as Coloured (shown in percentage, source: Census 2011)



The Kamiesberg Local Municipality has the highest average age (33.17 years) while the Saldanha Bay Local Municipality has the lowest (29.86 years). Average age varies on a ward level.

The gender distribution is more or less equal in most municipal areas, except for the Richtersveld Local Municipality where there is a bias towards males. This is most likely due to mining activities that are taking place in the area. On a ward level, most people have Afrikaans as home language (Figure 10).

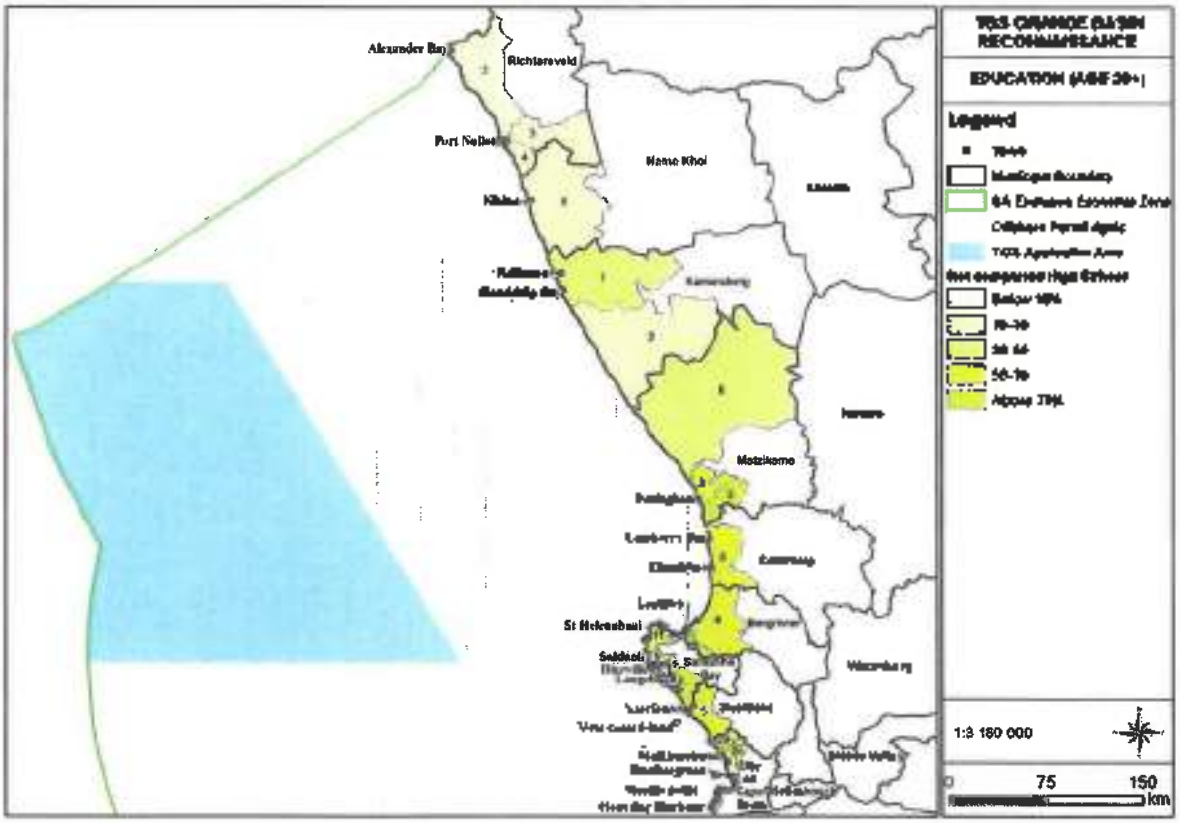
Figure 10: Home language Afrikaans (shown in percentage, source: Census 2011)



5.2.3 Education

The highest proportion of people who did not complete high school is in the Saldanha Bay (73.59%) and the Swartland (72.83%) Local Municipalities while the Matzikama (32.7%) and Nama Khoi (37.37%) Local Municipalities have the lowest proportion of people that did not complete high school (Figure 11).

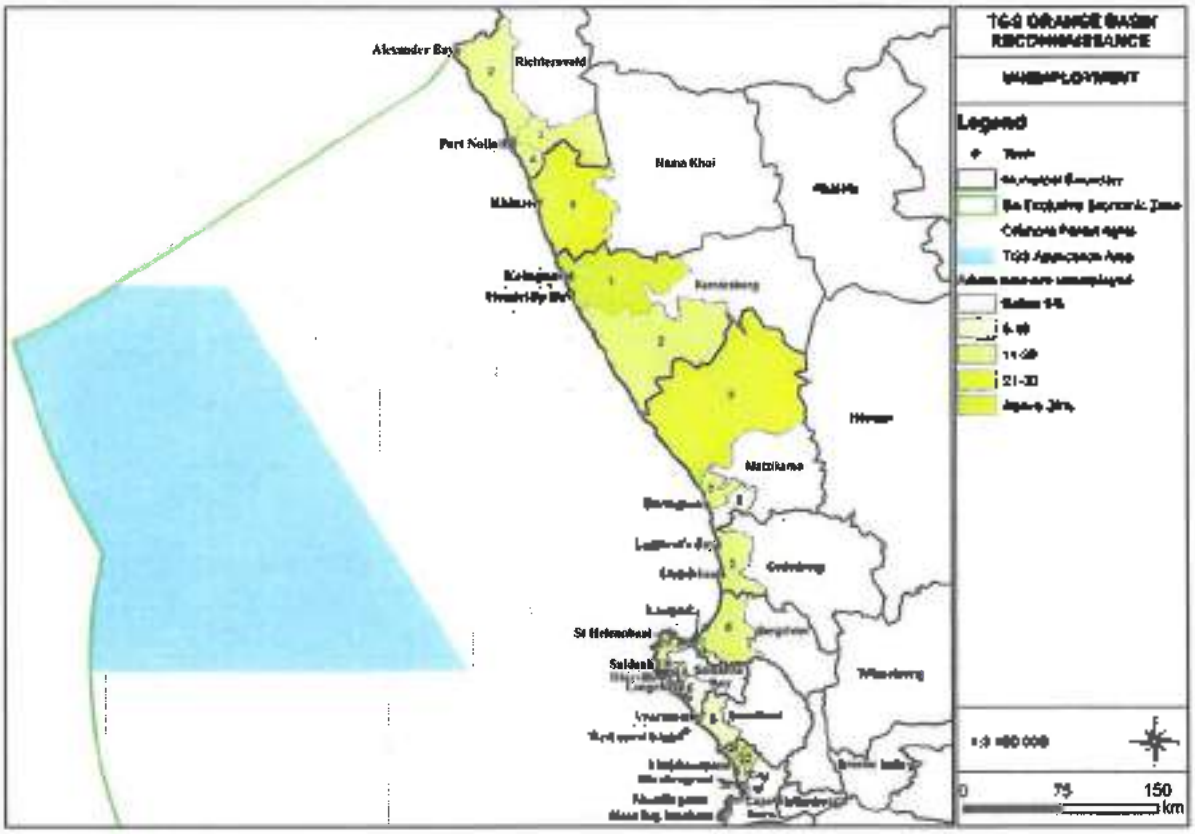
Figure 11: Proportion of people that did not complete secondary school (shown in percentage, source: Census 2011).



5.2.4 Employment

In 2011 the area with the highest proportion of unemployed people was ward 1 in the Kannieberg Local Municipality where Hondeklip Bay is located (Figure 12). The proportion of unemployed people include those actively seeking for work as well as discouraged work seekers. The majority of people who are working, is employed in the formal sector.

Figure 12: Proportion of adults that are unemployed (shown in percentage, source: Census 2011).

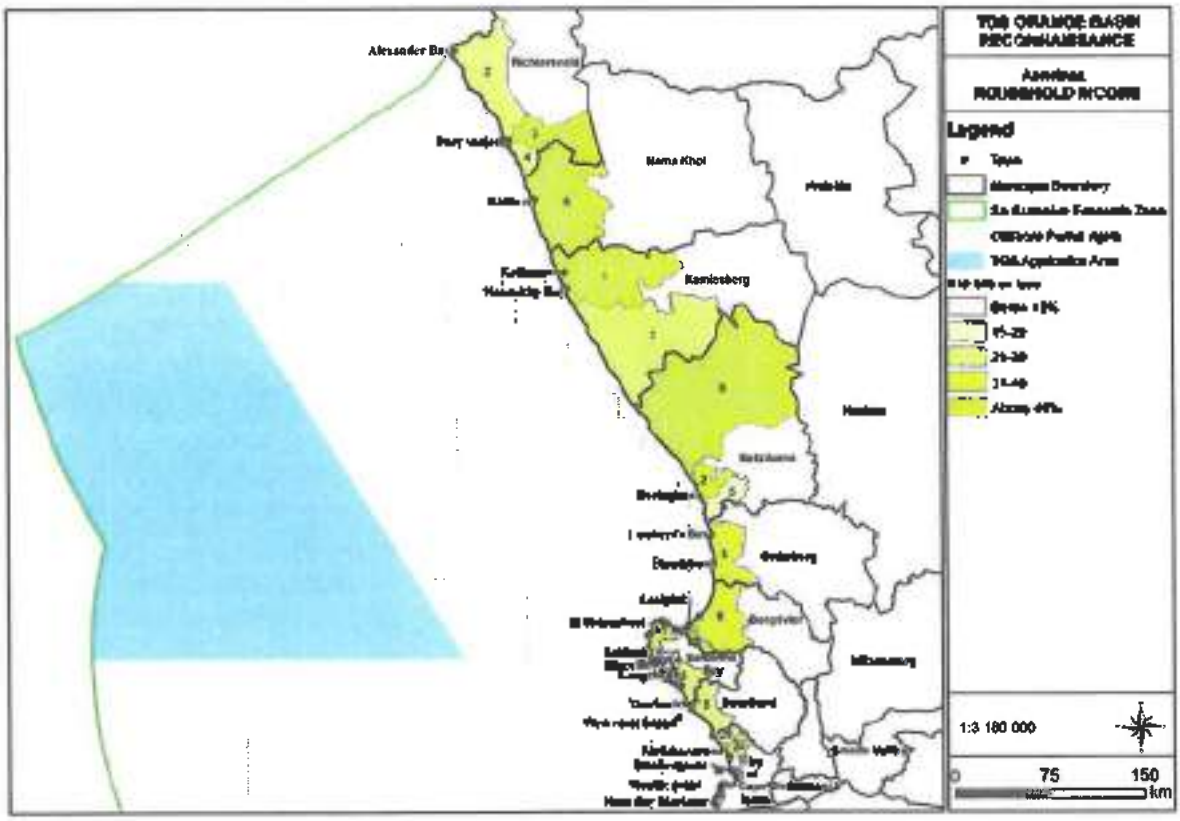


5.2.5 Household income

In 2011 almost a third of households on municipal level had an annual household income of R19 600 or less, with great variation between wards (Figure 13). Statistics South Africa (2015) has calculated the Food Poverty Line (FPL) for the Northern Cape Province as R310 per capita per month for 2011 where the FPL is the Rand value below which individuals are unable to purchase or consume enough food to supply them with the minimum per-capita-per-day energy requirement for good health. The FPL is one of three poverty lines, the others being the upper bound poverty line (UBPL) and the lower bound poverty line (LBPL). The LBPL and UBPL both include a non-food component. Individuals at the LBPL do not have enough resources to consumer or purchase both adequate food and non-food items and are forced to sacrifice food to obtain essential non-food items, while individuals at the UBPL can purchase both adequate food and non-food items. The LBPL for the Northern Cape Province was R457 per capita per month in 2011 and the UBPL R705 per capita per month

respectively. The FPL for Western Cape was R352 per capita per month, the LBPL was R545 and the UPL was R804. Based on this, a household with four members needed an annual household income of approximately R17 000 in 2011 to be just above the FPL. When comparing this with the SAMPI data it seems as if there are more households below the poverty lines in the area than who are multi-dimensionally poor. This is due to the poverty lines using a financial measure and do not take into consideration payment in kind and livelihood strategies such as subsistence farming. If these were to be converted into a Rand value, the poverty line picture may have a closer resemblance to the SAMPI data.

Figure 13: Proportion of households with an annual income of R19 600 or less in 2011 (shown in percentage, source: Census 2011).



5.2.6 Housing

The majority of households live in areas that are classified as urban, except in the Matzikama Local Municipality (Figure 14). The majority of people live in formal dwellings that that are houses or structures that are on a separate stand or yard. The incidence of informal dwellings is relatively low (Figure 15), except for Ward 1 of the

Saldanha Bay Local Municipality where the majority of people live in informal dwellings. Wards 32 and 74 also have a relatively large proportion of households living in informal dwellings.

Figure 14: Proportion of households that live in urban areas (shown in percentage, source: Census 2011).

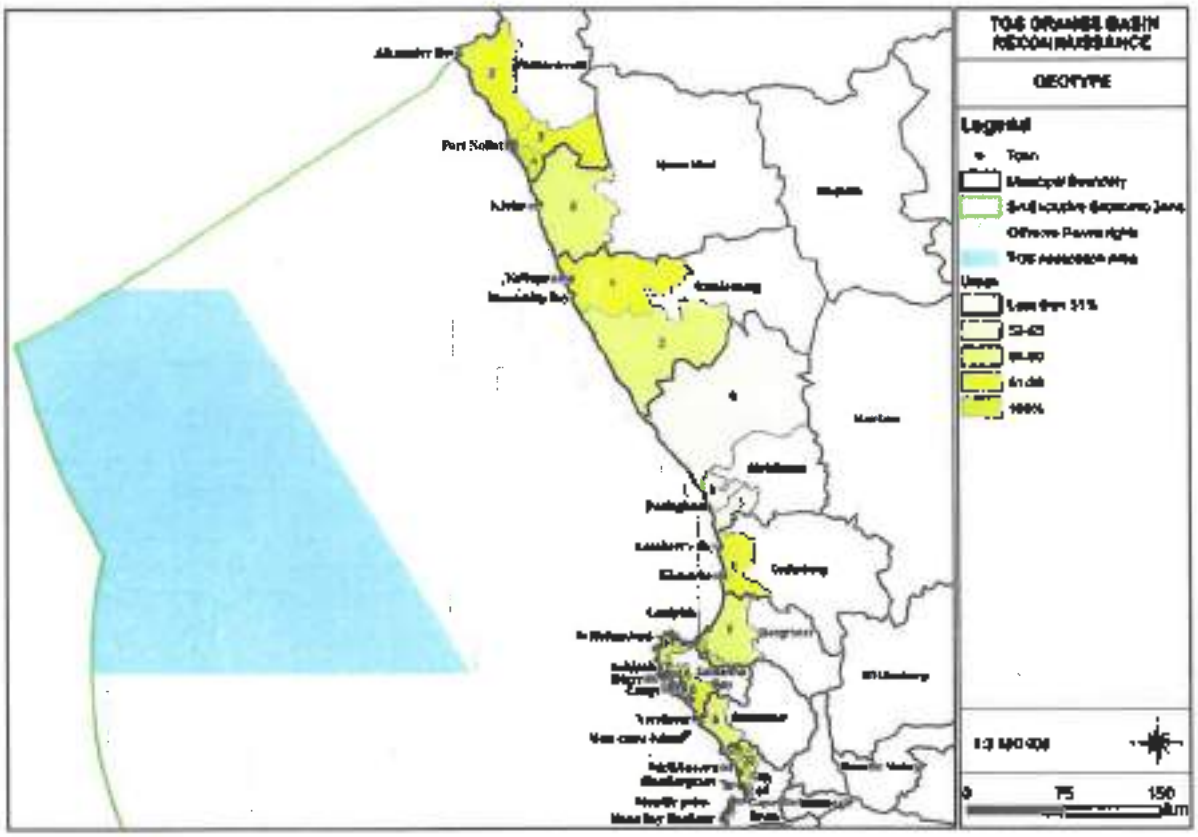
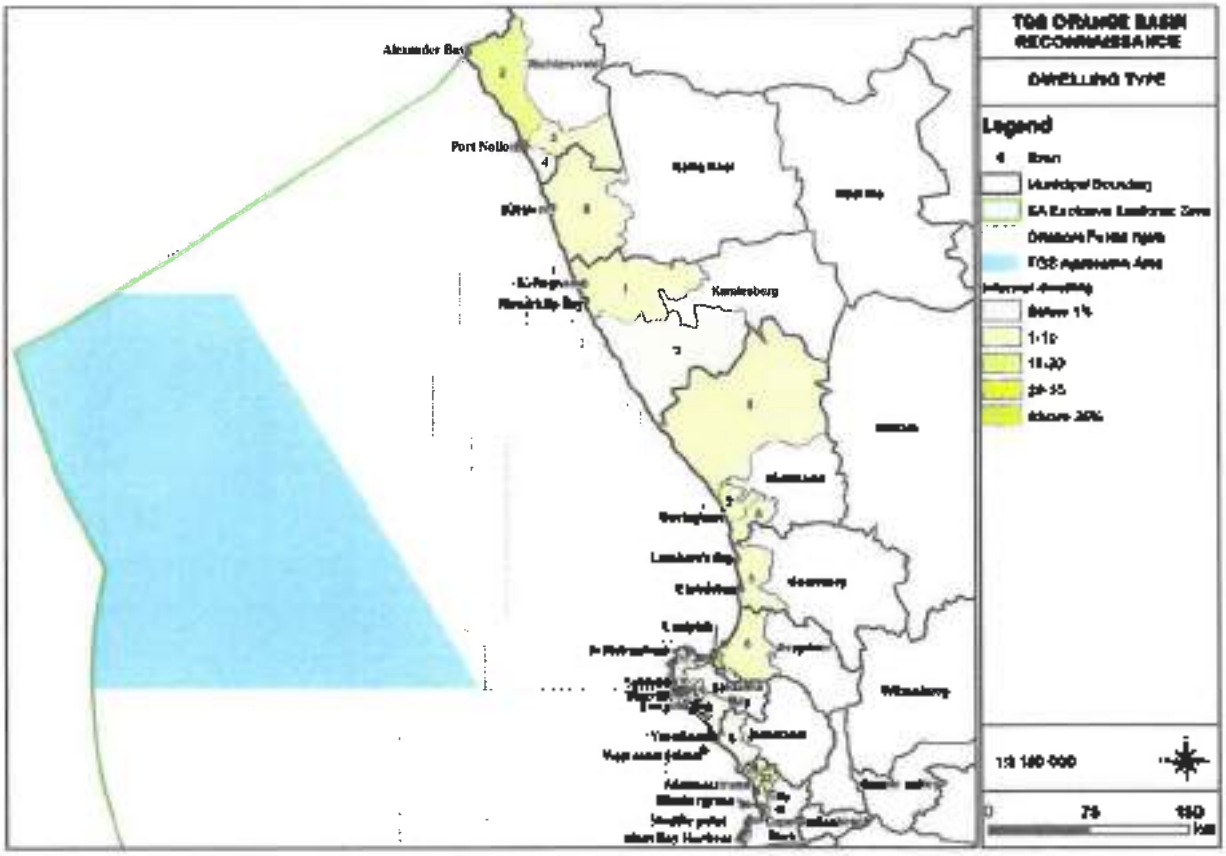


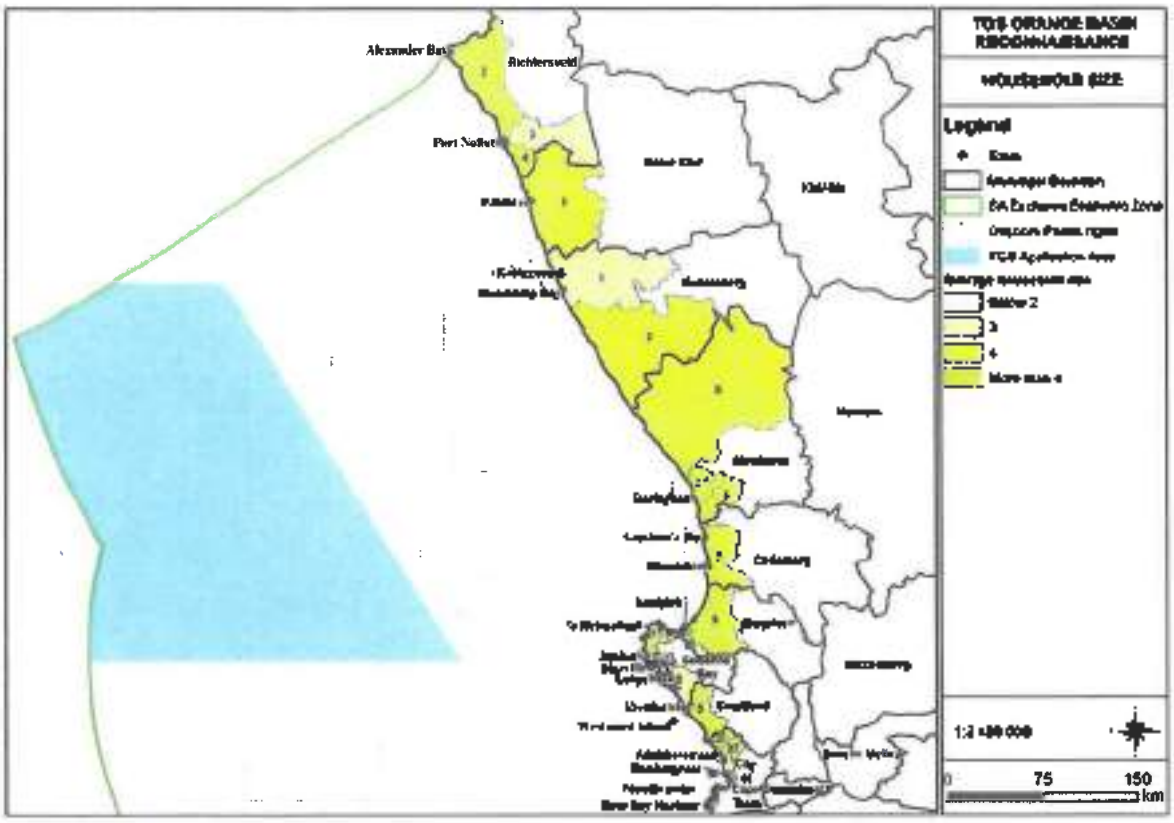
Figure 15: Proportion of households that live in informal dwellings (shown in percentage, source: Census 2011).



5.2.7 Household size

The average household size in the wards vary between 1.96 people per household and 4.86 people per household (Figure 16).

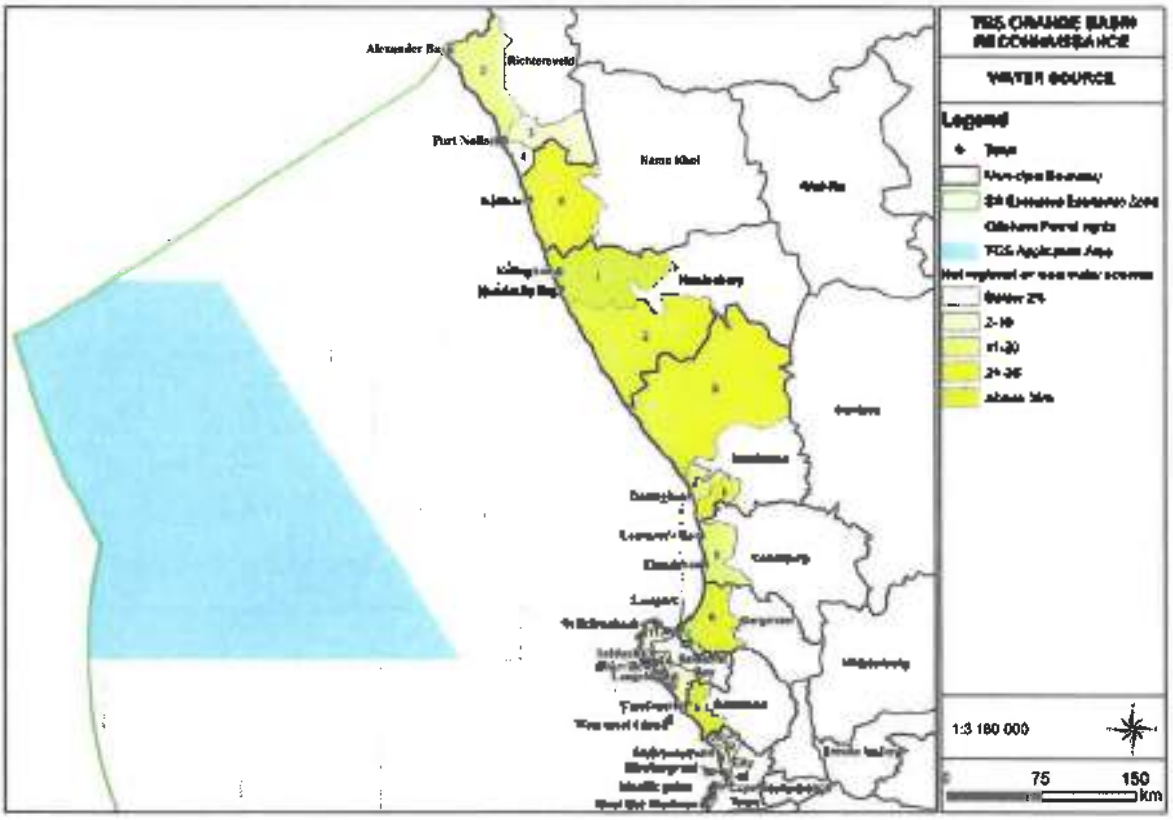
Figure 16: Average household sizes (source: Census 2011).



5.2.8 Access to water and sanitation

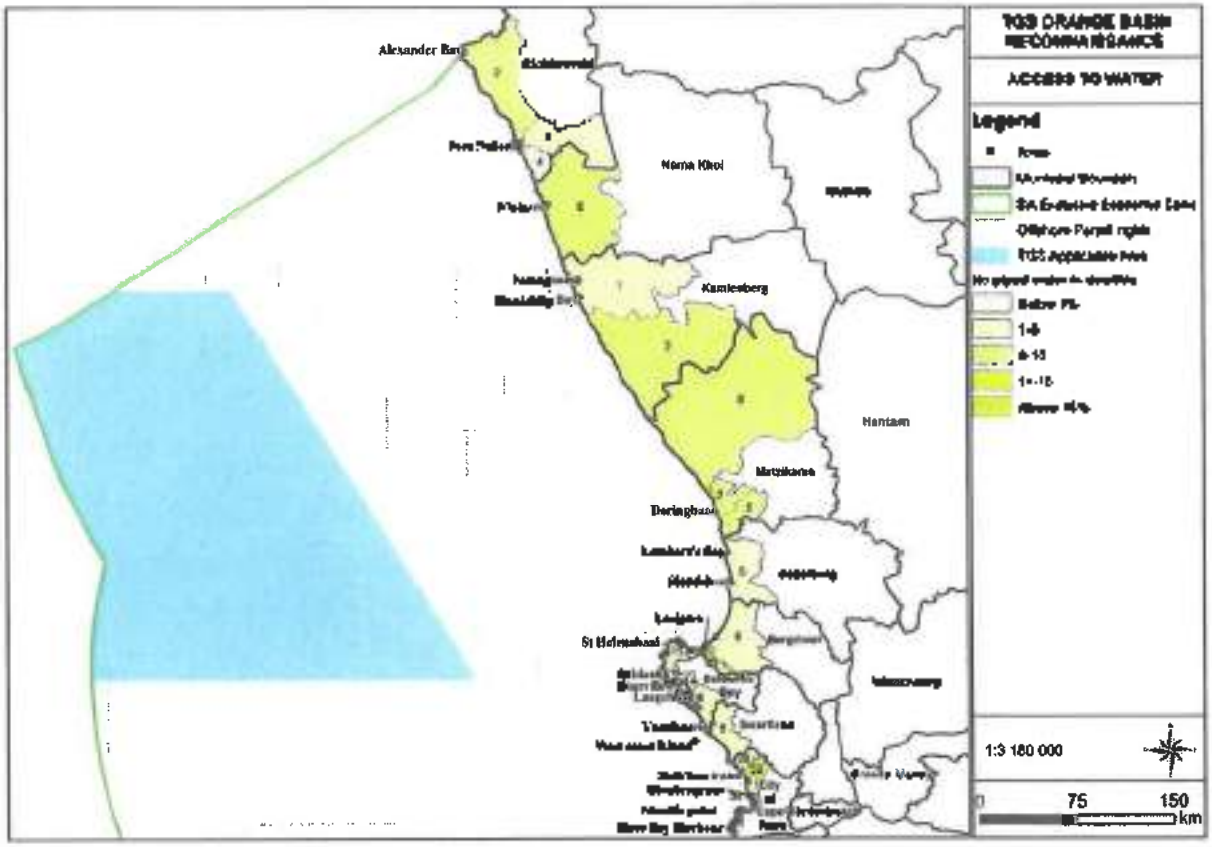
Access to piped water, electricity and sanitation relate to the domain of Living Environment Deprivation as identified by Noble et al (2006). Most households get their water from a regional or local water scheme, with the lowest incidence in Ward 1 of the Kamieskroon Local Municipality where Hondeklip Bay is located (Figure 17).

Figure 17: Proportion of households that does not get water from a regional or local water scheme (shown in percentage, source: Census 2011).



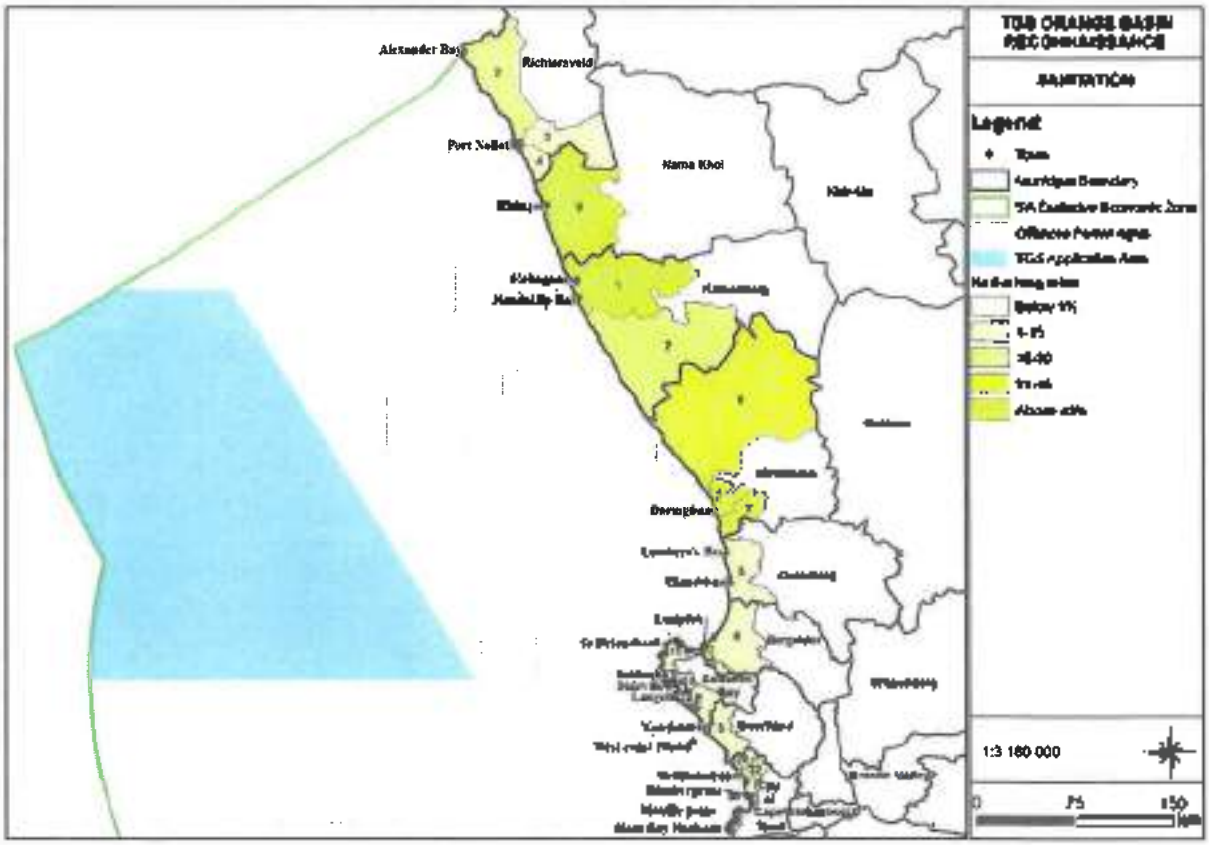
The incidence of access to piped water inside the dwelling varies and tend to be lower in the Northern Cape municipalities (Figure 18).

Figure 18: Proportion of households that does not have piped water in the dwelling (shown in percentage, source: Census 2011).



Access to a flush toilet is in general lower in the Northern Cape Municipalities (Figure 19).

Figure 19: Proportion of households that does not have a flush toilet (shown in percentage, source: Census 2011).



5.2.9 Energy

Electricity is seen as the preferred lighting source (Noble et al, 2006) and the lack thereof should thus be considered a deprivation. Even though electricity as an energy source may be available, the choice of energy for cooking may be dependent on other factors such as cost. The majority of households have access to electricity for lighting purposes (Figure 20) but a lower proportion use electricity for heating (Figure 21) and cooking (Figure 22) purposes.

Figure 20: Proportion of households that use paraffin, candles, wood or nothing for lighting purposes (shown in percentage, source: Census 2011).

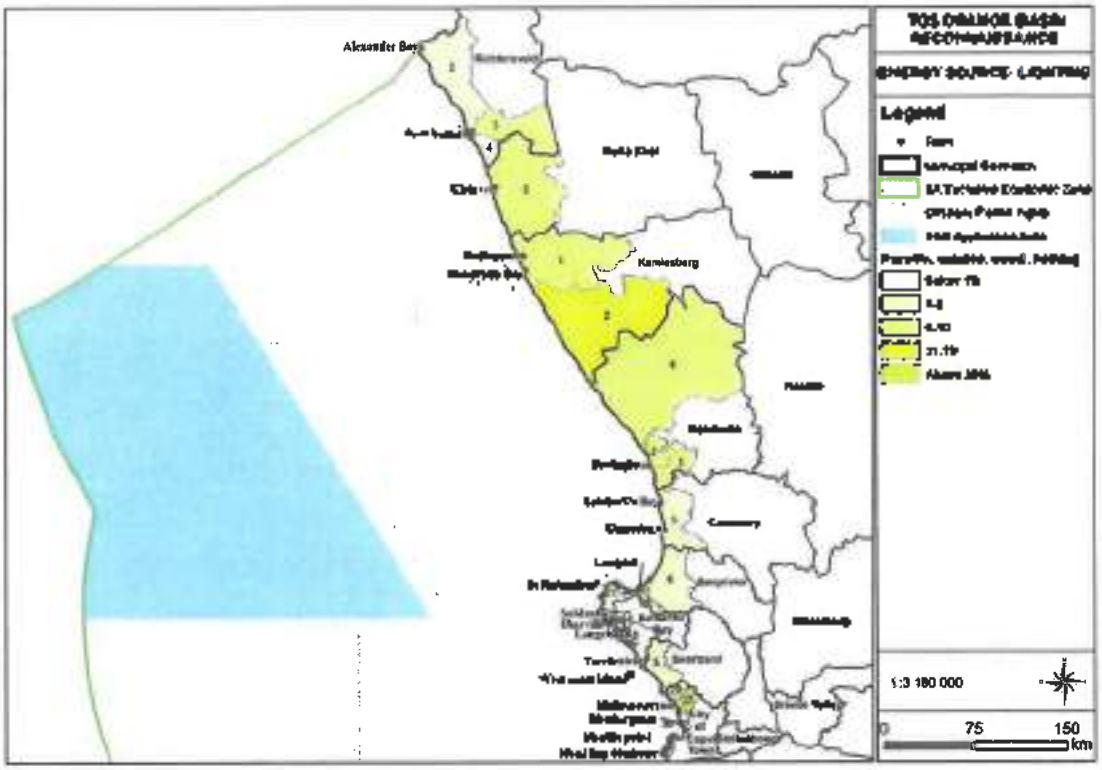


Figure 21: Proportion of households that use paraffin, wood, coal, dung or something else for heating purposes (shown in percentage, source: Census 2011).

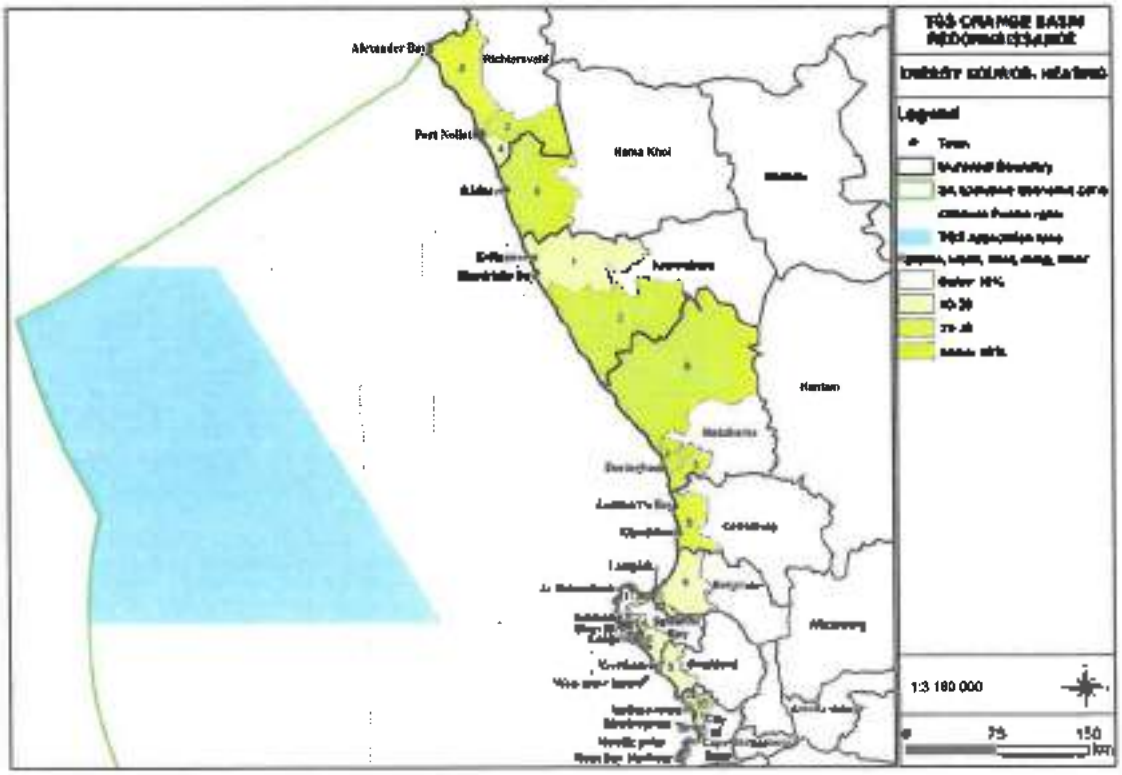
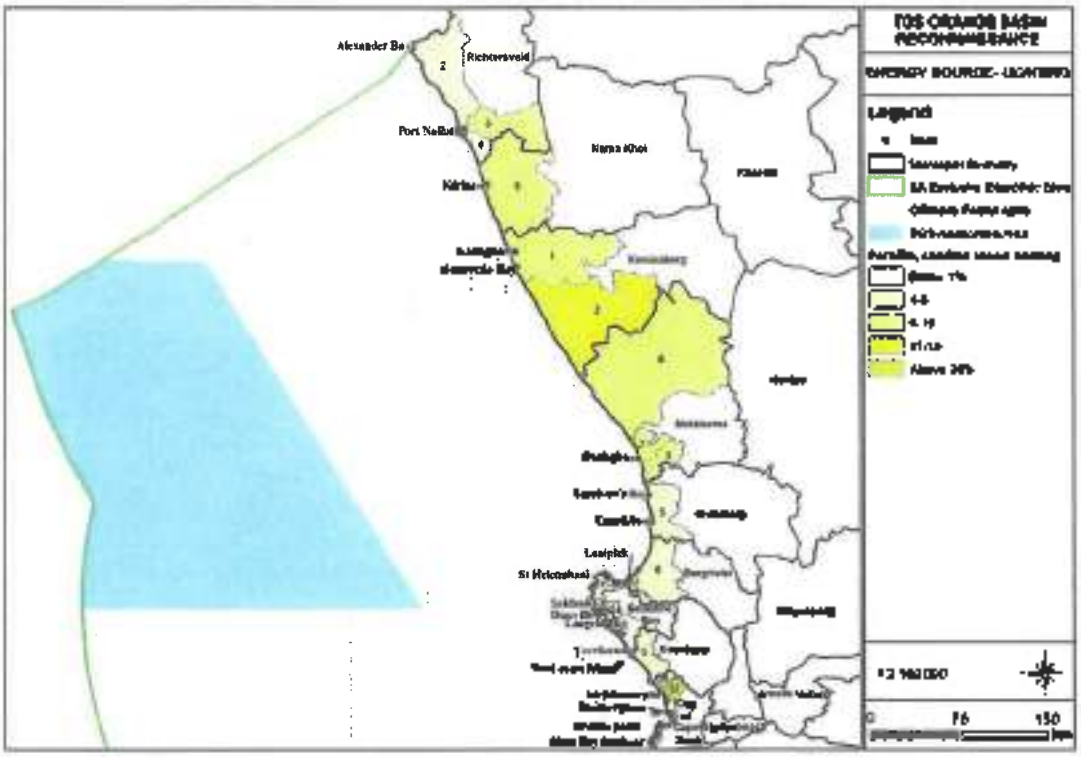


Figure 22: Proportion of households that use paraffin, wood, coal, dung or something else for cooking purposes (shown in percentage, source: Census 2011).



6 Stakeholder Identification and Analysis

6.1 Approach

Stakeholders include all individuals and groups who are affected by, or can affect, a given operation. Stakeholders consist of individuals, interest groups and organizations (Vanclay, Esteves, Aucamp & Franks, 2015). Stakeholder analysis is a deliberate process of identifying all stakeholders of a project - the individuals and groups that are likely to impact or be impacted by it - and understanding their concerns about the project and/or relationship with it (Vanclay et al, 2015). Stakeholder analysis assists the proponent with understanding the local cultural and political context. It is acknowledged that different stakeholder groups have different interests, and that there are individual differences within stakeholder groups. The purpose of this section of the report is to introduce the stakeholder groups that will be affected by the proposed projects. The following stakeholder groups were identified and their interest in the projects will be discussed briefly in the section below.

6.2 List of stakeholders

The following stakeholders that may have an interest in or affected by the proposed TGS seismic survey project have been identified:

Figure 23: Detail of Stakeholder Groups.

Stakeholder Grouping	Organisation
Internal Stakeholders	
TGS Geophysical Company (UK) Ltd	TGS Staff involved with the project
Seiche	Seiche Staff involved with the project
Government	
Governmental departments and directorates	• Western Cape Provincial Government • Northern Cape Provincial Government • Petroleum Agency of South Africa • Department of Environment, Forestry and Fisheries • Department of Mineral Resources and Energy • South African Navy Hydrographic Office (SANHO) • Namakwa District Municipality • West Coast District Municipality • City of Cape Town Metropolitan Municipality • Richtersveld Local Municipality • Nama Khoi Local Municipality • Kamiesberg Local Municipality • Matzikama Local Municipality

Stakeholder Grouping	Organisation
	• Cederberg Local Municipality • Bergrivier Local Municipality • Saldanha Bay Local Municipality • Swartland Local Municipality • South African Heritage Resources Agency (SAHRA)
State-owned entities and regulators	• Transnet National Ports Authority • South African Maritime Safety Authority
Business	
Fishing industry	Fishing industry associations Commercial fishing sectors: demersal trawl, midwater trawl, demersal hake longline, demersal shark longline, small pelagic purse-seine, large pelagic longline, tuna pole-line, traditional line fish, West Coast rock lobster, small-scale fisheries, beach-seine and gillnet fisheries (netfish), fisheries research
Petroleum and Gas industry	Various companies that have expressed interest in oil or gas exploration in the West Coast area Companies conducting seismic surveys
Other industries	Industries providing support services such as equipment, fuel, accommodation, meals and other supplies
Environmental	
Environmental interest groups	Green Connection Coastal Links We Are South Africans Other relevant environmental interest groups
Societal	
Social Organizations	Masifundise Development Trust Small-scale fisheries cooperatives such as Aukatowa small scale fisheries cooperative Small-scale fishing communities such as Steenbergs Cove ABALOBI Coastal Justice Network Community forums (e.g., employment, youth)
Residents/ Community	
Local coastal communities	Hout Bay, Saldanha Bay, St Helena Bay, Lambert's Bay, Hondeklip Bay, Port Nolloth, Velddrif, Paternoster, Jacobsbaai, Langebaan, Grotto Bay, Elands Bay, Strandfontein, Doringbaai
Local indigenous people	Nama, Khoi and San groups, including Cochoqua Tribal House, the Gurlqua Tribe and the Katz Korana Royal House

The identified level of interest of each stakeholder helps assist with designing the stakeholder engagement strategy for the project, and to decide how much time to devote to engaging with each stakeholder or group. The engagement levels required for each group of stakeholders as revealed through this analysis may be more than consultation, for example they may include partnerships, involvement in community

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development plans or community monitoring, strategic planning, or any other activity. Knowing the needs, issues and expectations of affected stakeholders assist with building and retaining good relationships with them, and with managing their expectations.

Table 5 below plots the stakeholders according to their ability to influence the company's activities (horizontal axis) and the degree to which they are affected by the proposed TGS activities, whether the impact is social, economic or environmental (vertical axis). In instances where the impact or influence is potentially significant individual stakeholder groups/organisations have been used. All other groupings are used in general.

Table 5: Stakeholder matrix.

Degree to which they are impacted on				
	High	Local coastal communities Local indigenous people	Fishing industry	TGS Geodata UK Ltd Saiche Petroleum and Gas industry
	Medium		Other industries Environmental interest groups Social Organizations	Governmental departments and directorates State-owned entities and regulators
	Low			
		Low	Medium	High
		Ability to influence company's activities		

When considering the project affected stakeholders it is important to consider the potential impacts after the seismic surveys are conducted. The stakeholders that will be impacted on most but have the least ability to influence the company's activities are local coastal communities and indigenous people, who is also seen as the most vulnerable group. Their fears about future impacts and uncertainty about the potential impacts on their livelihoods are already causing an impact on their emotional and physical wellbeing. There is a power imbalance between TGS and the local communities. It is therefore of great importance that TGS and the local communities

communicate frequently in an open and honest manner to avoid a standoff. Communities are supported by environmental and social interest organisation, and these organisations have the ability to mobilise community activists and fund potential court cases.

The community perception is that the government has already decided that it will allow this and similar projects to continue. The government is seen as a powerful stakeholder with significant ability to influence the decision-making process.

The placement of stakeholders in the stakeholder matrix may change with time, and it should be revisited frequently.

6.3 Local Indigenous people

South Africa has many different cultural groupings, among which the Khoisan are regarded as the original inhabitants of South Africa. This is not a homogenous group, and consists of smaller groups such as the Khoi, San, Nama and Griekwa. This group were of the first South Africans to experience the brutality of colonial suppression by the Portuguese under the leadership of Bartholomew Diaz in 1488 (Klaasen, 2018). In 1657 the first farms were taken from them and given to the Dutch settlers. For the Khoisan, land was not a commodity, but an integral part of their identity. Land was not for the possession of any one person, but for the use of all living there, even if it did not belong to the original group within that particular territory. Different worldviews regarding land caused great conflict. The land issue and identity of the Khoisan remained a contentious point right through the colonial and apartheid eras. The Khoisan were excluded through the controversial Restitution of Land Rights Act in 1994, as this only applied to land that were dispossessed after 1913. Their extended period of oppression excluded them from land claims, and as a result they were excluded from the reconciliation process post-apartheid. Nowhere in South Africa's Constitution of 1996 was there any space for groups like the Khoisan to reclaim dispossessed land. For the Khoisan land have both material and spiritual significance. The historical land issues are of great significance for the coastal communities.

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The Khoisan's approach to culture is a holistic one. Aspects such as land, identity, leadership structures, language and religion are all inter-related. The early Europeans were prejudiced towards the Khoisan as the Khoisan seemed to have missed every standard that indicated what was regarded as civilization according to European standards (Boezak, 2017): a king, jurisdiction, laws, script, arts, agriculture, money, marriage and religion. Despite scientific evidence supporting the Khoisan's claim that they are in fact South Africa's aboriginal people, the South African government has thus far not shown much political will to grant 'first nation' status to them. Their right to self-identification has been met with historical distortion and official denialism. After the abolishment of slavery, the free slaves and the Khoisan were all lumped together as the joint working classes and collectively called 'people of colour' (Boezak, 2017). Since 1948 the Apartheid regime continued to reclassify the majority of Khoisan people as 'Cape Coloured' and used the Group Areas Act of 1950 to forcefully remove them from their remaining ancestral land. The Khoisan Leadership Act is regarded as a step in the right direction, but some of the criteria are not taking into consideration their historical fragmentation.

The historical context of the Khoi and the San groups must be taken into consideration in interpreting and understanding their concerns with reference to the proposed project.

7 Social risk

Social risk is a confusing term because it has different meanings in different discourses. In the SIA/corporate project discourse, 'social risk' is a largely similar concept to 'non-technical risk' and is the preferred term (Vanclay et al, 2015). The World Bank defines social risk as "the possibility that the intervention would create, reinforce or deepen inequity and/or social conflict, or that the attitudes and actions of key stakeholders may subvert the achievement of the development objective, or that the development objective, or means to achieve it, lack ownership among key stakeholders". For the Bank, social risk is considered to be both risk (threats) to the success of the project, but also risk (social issues) created by the project, which in turn become threats to the project. In a corporate setting, social risk can be regarded as the business risks (e.g. extra costs) to the company that arise from any social impacts or social issues created by the project, such as through unforeseen costs of mitigation, future litigation and/or compensation pay-outs, worker strikes, retaliatory acts of sabotage, and reputational harm (Vanclay et al, 2015).

Non-technical risks relate to the managerial, legal, social and political issues faced by a project, in contrast to the technical risks (i.e. the physical, structural, engineering and environmental risks). Non-technical risks are potentially serious financial risks to a project because of the protest actions local communities can take, and therefore should be considered and addressed (Vanclay et al, 2015).

Risk inevitably involves a concern with good and bad outcomes (Elser, 2004). Such values will be implicit in any exchange. What any audience will be listening for is an indication of what they need to do – not simply for a prediction of what consequences may or may not happen, but also for an indication of how good or bad these consequences will be, and what they, or anyone else, is expected to do about it. The best way to communicate risk is to adopt a less didactic model of communication. It is already widely recognised that, to be effective, the communication of risks cannot be merely one-way. It must involve exchange and interaction between all parties. There are obstacles to putting such good intentions into practice. The 'experts' need to be prepared to give up not only time, but also some of their power (Elser, 2004).

The 'public' need to be willing to be engaged in the decision process and take some responsibility for the outcomes if these have been shaped to take account of their views. All this can be costly, in terms of time, patience and the risk of disappointment if not everything one wants could be achieved. The real advantage over the traditional, less consultative, approach is that the debate or discussion can focus on what people want to know and issues of value, rather than merely probability can be considered (Eiser, 2004).

Another important social factor to consider is the "social licence to operate". In 2003 Pierre Lassonde drew attention to the observation that *"Without local community support, your project is going nowhere."* He described social license as *"...the acceptance and belief by society, and specifically local communities, in the value creation of activities"*. Social licence cannot be obtained by going to a government ministry and making an application or simply paying a fee. It requires far more than money to truly become part of the communities in which a company operates (Lassonde 2003). A primary objective of gaining a social license is to minimize project risk. *"Successful operations require the support of the communities in which they operate now, and in the future, to ensure continued access to land and resources"* (Render 2005). The social license to operate can be further described as the degree of match between stakeholders' individual expectations of corporate behaviour and companies' actual behaviour.

Seismic surveys are currently a controversial and political subject in South Africa. On 1 September 2022 there was a high court ruling against Shell conducting seismic surveys. The ruling found that coastal communities were not properly consulted (Judgement on Sustaining the Wild Coast vs Minister of Mineral Resources and Energy and others, 1 Sept 2022). The debate about the potential impacts of seismic surveys has been ongoing and in the public domain for the last couple of years but intensifying in the second half of 2022. For many people it is an emotional issue and goes much deeper than scientific research on potential impacts on the marine environment. For some people the core of the issue is the impact on their indigenous and culture rights, their customs and traditions and their livelihoods.

Others feel that the seismic surveys are only the first step and that it will open the door to exploration for oil and gas. They are already aware of changes in the marine environment due to existing impacts such as shipping traffic, mining in the sea, climate change and over-fishing. Their concerns are related to the potentially negative impacts associated with the oil and gas industry, especially from an environmental perspective and the impact that using oil and gas will have on climate change. They feel that South Africa must move away from fossil fuels and act in line with the government's policies and international commitments in this regard. There are also people with the opinion that a developing country like South Africa cannot afford to not explore for oil and gas. Their feeling is that the energy transition will take some time, and that oil and gas are better than coal mines.

It is a contentious issue that can potentially cause damage to the social fabric of local communities, but also lead to civil unrest and reputational damage. From a social perspective these social risks must be highlighted. In the current socio-economic environment associated with the project area, there are significant non-technical risks associated with seismic surveys, irrespective of the company that will conduct the survey.

Table 6: Summary of potential social risks for the proposed project

Risk	Source	Motivation
Opposition to the project through appeals and court cases causing a significant delay in the process	Local indigenous communities and fishers Environmental NGOs Social Justice groups	During the SIA consultation process and as seen in the South African press it was clear that communities will not welcome seismic surveys. There is an example of a community winning a court case against a company wanting to do the survey. Communities may want to appeal the outcome of the EIA process and will resort to legal means if required because they know that resources are available to them from NGOs. These appeals and legal processes may cause a significant delay in the authorisation process which will have knock on effects.
Damage to corporate reputation	Local indigenous communities and fishers	TGS's corporate reputation can be damaged if communities feel that the process has not been conducted in what the communities see as a meaningful manner. Due to historical tension

		between some of the communities and another company doing seismic surveys that has attracted media attention in the past, there is a chance that this may be associated with TGS as many community members do not distinguish between the different surveying companies. This may impact TGS on an international level, as rights groups may be concerned about grassroots impacts, human rights and social and environmental justice, and the shares are influenced negatively.
Lack of social license to operate	Local indigenous communities and fishers Environmental NGO's Social Justice groups	Given the media attention surrounding the Shell ruling in September 2022 and the court interdict against Searcher in March 2022 there is a general mistrust against any company that want to conduct seismic surveys. Communities demand meaningful consultation, which go beyond the requirements of an EIA process. They want to feel that they can make informed decisions and have sufficient time to digest the technical information. Community members expressed misgivings about the government and its ability to protect their interest. They feel that the decision to support the application has already been made.
Community protests and potential for civil unrest.	Local indigenous communities and fishers	Communities feel angry and disempowered. They do not differentiate between the different companies that apply for seismic surveys. They see a different face standing in front of them, sharing similar information, but never providing answers to their questions. They feel that they are not listened to and disregarded. Several coastal communities expressed their frustration. The communities communicate with each other via WhatsApp groups, and there is a strong possibility of social mobilisation that can lead to civil unrest and worse case scenario to violent protests.

Social risk's population-based nature sets it apart from traditional risk events such as cyberattacks, workplace safety incidents, and natural disasters. Traditional risk events impact a distinct set of people, while social risk can impact broad segments of society.

Social risk has five characteristics (Ludke, 2021):

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- **Human.** Traditional forms of risk most often manifest themselves because of a discrete event or incident. Social risk is built on who we are as human beings and shaped by socio-economic status, social mobility, community environment and mental health.

- **Dynamic.** Social risk is always evolving and formed by how people react to events and ideas. For example, social risk is not necessarily the pervasive nature of socio-economic inequalities in the global economy, it is how the population react to these inequalities

- **Dispersed.** Social risk is a consequence of today's connected society where nearly everyone has the ability to increase their voice through technology and networks of family, friends, colleagues, and social media followers.

- **Distinctive.** Social risk is unique to each organization because it forms as humans organically react to events and ideas, no two social risk events are alike.

- **Scalable.** Social media platforms amplify public conversations. This accelerates social risk as it can scale very quickly from an isolated idea or conversation into a broader movement.

If TGS choose to identify and mitigate social risk, the following general recommendations should be considered:

- **Create an ecosystem of diverse partners.** A diverse ecosystem will create an "early warning system" to help identify social risk before it manifests as a threat or crisis—provided you stay engaged with this ecosystem in a genuine dialogue.

- **Ask, don't tell.** When developing a social risk management strategy, getting honest feedback can help you avoid pitfalls and build credibility. Similar to engaging partners, this must be approached by listening rather than telling.

- **Communicate constantly**. In an age of social risk, communicating is not about pushing information to audiences. Rather, it is a methodical approach to all facets of a communications strategy that fosters dialogue.

- **Act with humanity**. Social risk is driven by human emotions that must be respected and appreciated.

Addressing social risk requires looking at its causes from a systemic standpoint, not on an event-by-event basis. The solutions must be focused on the same societal level as its causes, including poverty, injustice, inequality, or misinformation. Social risk touches all of society, and it comes from the perceptions and beliefs all humans have.

8 Description of potential impacts

8.1 Social Impact Assessment

> *"Almost all projects almost always cause almost all impacts. Therefore, more important than predicting impacts is having on-going monitoring and adaptive management."* Frank Vanclay

Considering the statement above, it must be considered that some social impacts will not be discussed in detail and that the focus will be on the most severe impacts. Nevertheless, it must be considered that the social environment is dynamic and adapts to change. The focus should be on the active management of social impacts rather than on the prediction and once-off mitigation thereof. Successful mitigation and management of social impacts requires long-term commitment and involvement and should form part of the strategic planning and management of the project until decommissioning. Suggestions for the management of social impacts are included in the report in the form of a social impact management plan (SIMP). The implementation of the relevant management suggestions should start as soon as possible since the social impacts of the project started when the project was announced. Another important consideration in this project is the social context in which it will be executed. Impacts are assessed from a community perspective, and where it will influence a specific group of stakeholders it will be indicated as such. An attempt was made to simplify the impact assessment and to focus on aspects that can aid the decision-making process.

Social impacts are the result of social change, and to fully understand the potential impacts it is important to know the impact pathways. A social change process is a discreet, observable, and describable process that changes the characteristics of a society, taking place regardless of the societal context (that is, independent of specific groups, religions etc.). Social change processes can be measured objectively. The way in which social change processes are perceived, given meaning, or valued, depend on the social context in which various societal groups act. Some groups in society are able to adapt quickly and exploit the opportunities of a new situation. Others (e.g. vulnerable groups) are less able to adapt, and will bear most of the negative

consequences of change. These social change processes may, in certain circumstances and depending on the context, lead to the experience of social impacts. Social impacts are therefore completely context dependent (Vanclay, 2003).

8.2 Impact assessment criteria

It must be stated that the impact tables and ratings were adapted from the environmental sciences and that it is not always possible to compartmentalise the social impacts. For the sake of consistency this has been attempted, but it is not innate to social sciences. Allowance for the changing and adaptive nature of social impacts should be made when interpreting the impact tables.

The rating criteria used in determining the significance ratings are summarised in the tables below:

Figure 24: Criteria for determination of impact consequence.

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or

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	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible impact

Figure 25: Probability scoring.

Aspect	Score	Definition
	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

Figure 26: Criteria for the determination of prioritisation.

Aspect	Score	Definition
Cumulative impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).
Degree of Confidence	Low	<30% certain of impact prediction
	Medium	>30% and <60% certain of impact prediction
	High	>60% certain of impact prediction

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8.3 Social impacts and mitigation

In this section each impact will be described. The project will not have a construction phase and the mitigation measures for each impact that are relevant will be discussed at the end of the section.

8.3.1 Uncertainty

The fishing communities are uncertain about the impact that the seismic survey will have on their livelihoods. They feel that there is not enough information available to them to determine whether the surveys will have an impact on their activities. In the past year a number of companies approached them to participate in EIA processes about seismic surveys. They want to have some definitive answers about the potential impacts from specialists. They would like to engage with them for more than two hours to make sure that they understand exactly what the project entails and what the potential impacts are. Only then will they be able to make informed decisions. The fishing communities have made a living from the sea for hundreds of years and they have learned how to read the ocean and the weather to know where and when fish are moving. They are concerned that the surveys could disrupt the behaviour of snoek (that is endemic to the area and a major source of income) and other fish that they rely on. They have noticed changes in the patterns of the fish they catch due to industrial activities in the past. Some examples are the potato factory in Lambert's Bay that discharges warm water in the sea and the coffer dams constructed by the diamond mines. After a previous seismic survey at the Wild Coast, people observed dead Black Steenbras that were reported to have protruding nostrils. Furthermore, they also noticed changes in the patterns of the fish that they ascribed to climate change. For the fishing communities, the sea is an integral part of their identity, and they possess local knowledge that are not yet written up in scientific reports.

The marine fauna and fisheries reports indicate that low to negligible impacts on marine life and that all the impacts are reversible. However, the communities are not convinced. According to them, the fish can either go deeper in the sea to get away of the source of noise, which would be a tragedy for them, or they can go closer to the

shore, which would be beneficial for them. They feel that no-one can predict with certainty how the fish would respond to the noise, just that they would try to move away from the source.

The impact of seismic surveys on the catchability of marine fish remains a contentious issue for communities, with some claims that seismic surveys may negatively affect catch rates. However, little empirical evidence exists to quantify the impact or identify the mechanisms of such impact. The communities feel that there is simply not sufficient data available to negate or substantiate these claims and much more research on the topic is needed, especially from a local perspective. The consensus seems to be that there is a great knowledge gap in this regard. Community members feel that companies doing seismic surveys or those who have an interest in the data obtained through seismic surveys can make a great contribution to scientific knowledge of this field by funding independent research on the topic in South African waters.

People's livelihoods are already impacted by external factors such as fishing quotas, climate change, commercial over-fishing, mining in the sea and the recent Covid pandemic. They fear that the seismic surveys will contribute to an already dire situation and be a tipping point that will render them helpless and without their last source of income. They see seismic surveys as a gateway to oil and gas exploration and are concerned about the potential impacts that the results of the seismic surveys can unlock. There is a high level of uncertainty about the future of the ocean, which causes great concern and distress amongst the fishing communities, especially because the uncertainty is related to their livelihoods, and they are already struggling to make ends meet. Uncertainty also takes its toll on people psychologically and may result in mental health issues for some people in the long run.

8.3.2 Further marginalisation of vulnerable groups

In South Africa, claims for and access to natural resources are deeply embedded in people's histories, identities, and livelihood experiences. As in the case of land, access to and rights over fisheries resources is a highly contested issue where individuals and communities have equated such rights with human rights (Williams,2021).

Globally, fishing activities for many communities sees strong cultural and traditional links spanning many generations, and its value is seen beyond the means of earning a living (i.e. economic values). Whilst fishing takes place at sea, other activities related to fishing such as boat and net maintenance, the selling and trading of fish, etc. take place on land. Men and women are involved in fishing and indigenous knowledge and skills such as gutting and cleaning fish, reading the sea, and finding fish are transferred from generation to generation. The activities associated with fishing create a particular identity or characterise an area as a result of these activities (Williams,2021). Fishing is part of the cultural identity of the people living in fishing villages on the West Coast.

Many of the people on the West Coast belong to the Nama, Khoi or San people. Most of the Khoi people were traditionally cattle or sheep herders, while the San people were traditionally hunters and gatherers (www.san.org). They were the first inhabitants of southern Africa and one of the earliest distinct groups of homo sapiens. They have endured centuries of gradual dispossession at the hands of waves of new settlers, including the Bantu, whose descendants make up most of the black population of South Africa (https://foreignpolicy.com/2018/10/19/south-africas-first-nations-have-been-forgotten-apartheid-khoisan-indigenous-rights-land-reform/).
The process of land distribution instituted by the Government since 1994 has largely excluded the Khoi and the San people, as the government has not acknowledged them as the country's first peoples and their land was mostly taken before the apartheid era. There is a growing movement of indigenous activists that believe it is time to rightfully claim their traditional land.

One of the Khoi and San's biggest challenges is the racial classification system used in South Africa. They are being classified as 'Coloured' - a label that was used during Apartheid for citizens that did not fit the binary race model and included mixed-race children and Afrikaans-speaking non-whites. This categorisation condemned much of the Khoi and San's history to oblivion and facilitated the appropriation of their land. It excluded them from land restitution as it was conceived to be a benefit to black South Africans, and they were not considered to be black. As such the Khoi and San are

considered to be very vulnerable and marginalised groups. Being marginalised means that they may easily be overlooked by corporate groups or businesses unfamiliar with the local history. Their needs, their views and even themselves as a stakeholder group can easily be omitted – both intentionally and unintentionally. In a previous application for a seismic survey by another company in the area the Khoi and San felt that they were not consulted with. Therefore, they are sceptic about the intentions of any company doing seismic surveying. They felt that they were discriminated against by not being consulted during that previous application, deepening their status as marginalised groups, and causing distraught to them as groups. Many of the fishers are of Khoi and San descendance, and they feel that they simply cannot win in any situation – whether it is fishing rights, land rights or culture identity.

With increasing interest in the West Coast area by seismic surveyors, which is viewed as the precursor for oil and gas companies to start developing the area, these communities risk increased marginalisation and an increase in vulnerability with every application where their voices are not being heard. They feel that currently they need to fight to make their voices heard. They have been using legal avenues, as they feel that just speaking up is not effective and has failed to give them the desired outcomes. Communities feel that their cultural heritage is threatened.

The San has published the San Code of Research Ethics that provides a guideline for researchers and companies that want to work in their sphere of influence on how to conduct themselves and how to interact with the San. From their perspective, an EIA application is also viewed as a form of research. This guideline can be applied to the Khoi and other people in the fishing communities as well. The San Code of Research Ethics is based on:

- Respect for individuals, community and culture;
- Honesty;
- Justice and fairness;
- Care; and
- Process (following San research protocol).

The San Code of Research Ethics states that lack of care can be demonstrated by talking down to communities, confusing them with complicated scientific language, or

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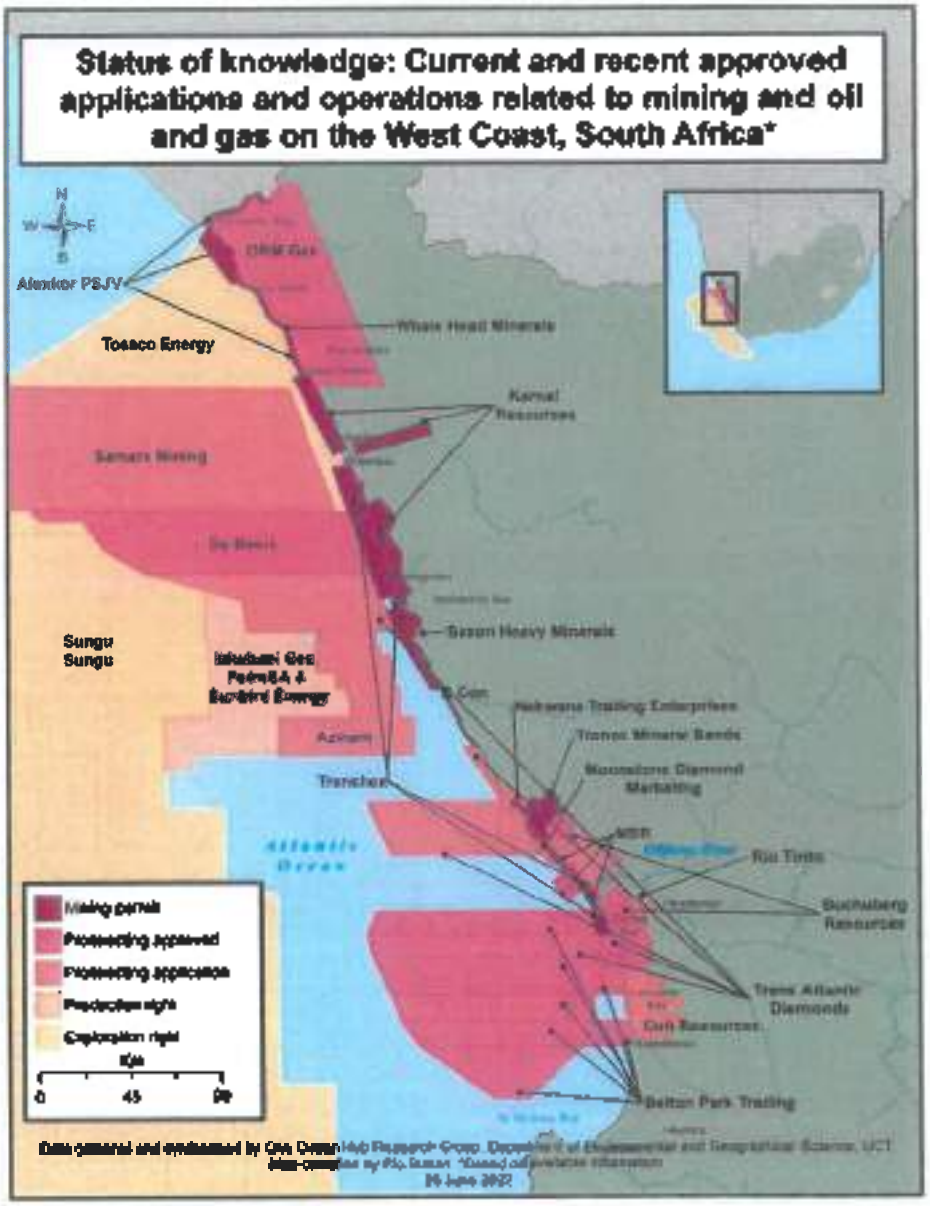
treating communities as ignorant. It further states that a lack of care is also represented by failing to ensure that something is left behind that improves the live of the San.

8.3.3 Concerns about cumulative impacts

A great source of concern for the fishing communities is the effect of cumulative impacts on their livelihoods and sense and spirit of place. There are a number of applications in process as well as approved applications relating to seismic surveys, mining, and oil and gas exploration in the West Coast area. There are also existing mining activities, significant shipping traffic and commercial fishing taking place in the ocean. The concern is that at some stage a tipping point will be reach where the marine life no longer recovers from the activities in the ocean or take a long time to recover to the extent that it would no longer be viable to make a living from the sea in those areas. In Norway small-scale fishing successfully co-exists with oil extraction in the ocean, but for the small-scale fishers on the West Coast, it remains uncertain to what extent it will be the case for them as well. Although cumulative impacts are assessed as part of the EIA process, there are limitations associated with budgets, timeframes, and access to resources. The competent authorities have a legal and moral duty to consider the cumulative impacts of the activities taking place and are planned to take place on the livelihoods and heritage of the vulnerable communities in the area from a strategic perspective. There must be a balance between the contribution these activities can make to South Africa's economy and sustaining the livelihoods of the vulnerable communities on the West Coast. The communities are clear that they do not necessarily want to stop development, they want to make sure that their livelihoods and heritage are protected, and that the rights of future generations will not be compromised. Once these have been affected negatively, it may not be possible to easily undo the damage.

Figure 27: Current and recently approved applications and operations relating to mining, oil and gas.



8.3.4 Perceived impact on livelihoods

A livelihood refers to the way of life of a person or household and how they make a living, in particular, how they secure the basic necessities of life, e.g., their food, water, shelter and clothing, and live in the community (Vanclay et al., 2015). The coastal communities in the area of interest are mostly fishing communities that make their livelihoods from the sea and have been doing so for generations. They rely on the ocean for food and economic security, as well as their identity and heritage. They

know how to make a living from the sea. If it is no longer possible for them to make a living from the sea, or if their ability to make a living from the sea is reduced it will result in a great increase in poverty in the area as there are very limited alternative options for them to make a livelihood. Their skill sets are strongly linked to the sea and cannot be transferred to other economic activities without skills development, training activities and the economic diversification of the area. Men and women rely on the sea for their livelihoods, and it is closely linked to the culture and identity of the people. This makes these communities extremely vulnerable. Furthermore, an increase in poverty in the area will place an additional burden on tax payers.

The small-scale fishers can travel approximately 15 nautical miles offshore with their boats. Some of them have indicated that they already sometimes need to go further to be able to catch enough fish, which is not only more expensive for them in terms of the diesel required for their boats, but it is also more dangerous. In the mining areas around Port Nolloth they are struggling to get access to the sea and the areas where they are allowed to fish are getting smaller.

Livelihoods are already compromised due to the fishing quota system, over-fishing, lack of employment opportunities, pollution, effects of climate change and the recent Covid 19 pandemic. However, with reference to the assessment of the impacts on the catch rates from the fisheries assessment undertaken by CapMarine (2022), the impact on livelihoods is not because of the actual impact on catch rates, but because of the perceived impact of the oil/gas industry on fishing industry.

8.3.5 Impacts on sense and spirit of place

Sense of place refers to an individual's personal relationship with his/her local environment, both social and natural, which the individual experiences in his/her everyday daily life (Vanclay et al, 2015). It is highly personal, and once it is affected, it cannot be restored. It is also difficult to quantify. The environmental philosopher Glenn Albrecht noted a consistent theme of distress caused by coal mining in Australia by the assault on the people's sense of identity, place, belonging, control, and good health. He identified a melancholia from the loss of solace and comfort connected with their home which he termed 'solastalgia' – a form of homesickness that one gets

when one is still at 'home' associated with the major project impacts they experienced (Albrecht et al, 2007). Social impacts can therefore range from significant health impacts to the loss of a cherished landscape and associated loss of a sense of place.

Spirit of place refers to the unique, distinctive, and cherished aspects of a place. Whereas 'sense of place' is the personal feelings an individual has about a place, spirit of place refers the inherent characteristics of the place (Vanclay et al, 2015). In this case the spirit of place includes the ocean and the properties assigned to it.

Many things can impact on a person's perception of sense of place. For the fishing communities the ocean is an integral part of their being, therefore anything that is perceived to potentially harm the ocean would also cause harm to them. The ocean provides them with food and thus keeping them from starvation. For many the sea is a sacred place. Its water has healing powers that take care of the sick. Many loved ones have given their lives to the ocean while they were out trying to make a living, and their remains have never been found. The sea kept their bones, making the ocean the graveyard where their loved one's rest. For some people the thought of disturbance in the sea causes great distress. The heritage aspects relating to this are discussed in the heritage impact assessment report. Although this cultural and spiritual connection with the sea might be difficult to understand for outsiders, it must be respected as a cultural right.

8.3.6 Impacts on the social licence to operate

Social licence to operate (SLO) is a popular expression to imply that the acceptance of the community is also necessary for a project to be successful. It appears as if TGS does not currently have social licence to operate in the fishing communities. Based on the events surrounding previous applications and recent reports about seismic surveys in the media, the communities expressed that they do not trust TGS or any other company conducting seismic surveys. Applications for seismic surveys and community opposition to these surveys have been widely reported and debated in the media during the last year (Compare News 24, 13 Jan 2022; Mail and Guardian, 20 Jan 2022; Eye Witness News, 1 September 2022 amongst others). Numerous NGOs specialising in social and environmental justice have aligned with communities and

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assist them with opposing seismic surveys. Some community members think that seismic surveys are opening the door for oil and gas exploration, which is a great concern for them, mostly due to the anticipated impacts on their livelihoods.

Given that there are a number of applications for seismic surveys in the Orange Basin, and that each application is subjected to a Basic Assessment process, communities are confused and reaching saturation regarding consultation. From their perspective, with each new application, it is a new face standing in front of them, from a new company, but "basically everyone wants the same thing". Communities do not distinguish between different seismic survey companies. They feel as if their questions are not answered, and concerns are not addressed – each consulting firm just repeat the same technical information about what a seismic survey entails to them. Although this is not TGS's fault and they are following a prescribed legal process, it impacts on their social licence to operate and on the seismic survey industry as a whole.

The term "social fabric" embraces numerous complex and interrelated phenomena, including demographic and economic factors, behavioural issues (e.g. investment choices, political dynamics), social institutions (e.g. families), social organisations (e.g. municipalities and churches), and social networks, or relationships amongst people. The social fabric is underpinned by people's beliefs and sentiments, including a sense of belonging and identification with a particular social unit (Atkinson et al, 2017).

The social fabric in the communities have been damaged through previous negative experiences with businesses in the area. A number of factories in the greater area have closed or moved away and in the process of doing so created great hardship for the communities remaining behind. Very little severance was paid, and this aggravated the communities. Mines closed without proper rehabilitation plans. In some places, access to the areas where they earn their livelihoods are becoming increasingly restricted, especially through the activities of mining companies. This has reached a point where the communities have realised that they need to fight for the protection of their livelihoods as historically companies have in most cases not treated them fairly or with respect. It is unlikely that any company that would like to undertake an activity in the ocean will be given social licence to operate by the community. The

TGS

community have been traumatised by historical events and behaviour of companies too many times. On the other hand, there are members in the community that welcome any new development and feel that living from the sea has its limitations and would soon be impossible. The dynamics between the different groups in the community, caused by the myriad of seismic survey applications, has already done significant harm to the social fabric of the fishing communities. People with individual agendas cause conflict in the community, and given the vulnerability of the community, the dire socio-economic conditions and high levels of poverty, illiteracy and unemployment, community members are susceptible to these forms of manipulation.

> ***Example of deterioration of social fabric:***
>
> *An individual rallied the youth in the community by telling them that they will be given work by a company doing seismic surveys (that was at the time busy with their public participation process) and ask them to complete forms and sign it. The company itself is unaware of this activity. Other members of the community find out about this and informed the consultants. Older community members fear that the signatures will be used to show community support to the project. Community members that lived together in peace and harmony for years are suddenly not talking to each other, and the community is divided.*

Another aspect that affects TGS's current social license to operate negatively, is that previous applicants such as Searcher and Shell failed to conduct sufficient meaningful consultation with the small-scale fishers in the past. The MPRDA Regulations as amended in 2020 define meaningful consultation as: *consulting in good faith, in a way that gives the landowner, lawful occupier and/or interested and affected persons all the relevant information, and reasonable time and opportunity to make an informed decision regarding the impact of the proposed activities.*

The communities feel disrespected and marginalised by the processes followed up to date by previous applicants in the area. Engaging with the communities in a meaningful way, following the appropriate structures and protocols, will go a long way in improving TGS's social license to operate. It does not guarantee that the communities will accept TGS or any other company wanting to conduct seismic

surveys. It must be kept in mind that improving social license to operate takes time and effort.

8.3.7 Stakeholder fatigue and disillusionment

Signs of stakeholder fatigue are visible in the communities. Stakeholder fatigue may occur where many stakeholder initiatives have taken place in the past, especially in circumstances where they did not lead to tangible outcomes for stakeholders. There are a number of applications for seismic surveying, exploration and mining in the area that the stakeholders were invited to. The most obvious way to deal with this would be to avoid working with communities, suffering from stakeholder fatigue (Durham et al, 2014), but this is not always possible and infringe on their rights. The EIA process requires public participation and information sharing. The volume of consultation and information shared are confusing to the communities. Stakeholders start to feel overloaded, which negatively affects their willingness to participate and lessens the quality of their input. Over time only those who are deeply interested, that is strongly supportive of strongly opposing may still participate. This can hinder potential projects, and can particularly occur when the stakeholders consulted are not actively involved in decision-making. To be effective and to reduce stakeholder fatigue, engagements need to be targeted, with clear aims and results. Stakeholders need to be clear on what the goal or end benefits to themselves would be for participating. It must be kept in mind that the more stakeholders contribute their time and knowledge, the more they will expect in return from the project, so one always need to ensure that the relationship remains balanced.

Related to stakeholder fatigue is stakeholder disillusionment, which can occur during a project or can be a legacy of past involvement in stakeholder participation. Disenchantment can result from failure to manage credibility, relevance and legitimacy, particularly when communication is poor or expectations are not met. Stakeholders can feel let down from previous involvement and disenchantment can also result from failure to keep promises. A number of stakeholders have already indicated that they feel their voices don't matter and participating in all the processes are not making a difference.

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Credibility, relevance and legitimacy can be enhanced when (www.i2insights.org):

- Other invited stakeholders are considered to be appropriate;
- Stakeholders with opposing views who are included are generally respected;
- There are clear objectives;
- The processes used are transparent and seen to be appropriate;
- There is continuity in the participation, allowing relationships to be maintained, trust to be developed, and stakeholder knowledge and skills to be built on;
- Attention is paid to appropriate timing of participation processes;
- Results are delivered in a timely manner;
- The participation and communication processes are effective and ongoing throughout the application process;
- Participation is adapted to changing circumstances;
- Understandable language is used;
- The process for participation for all stakeholders is clearly stated and appropriate;
- Stakeholders feel that their interests have been understood and taken into account;
- The multiple stakeholders involved are seen to be a balanced group;
- Use unbiased facilitators where possible.

TGS can only influence what happens in their own application. By attending to issues discussed and keeping promises made to stakeholders, they give their own application process the best possible chance and make it more likely that stakeholders will participate in the future.

8.3.8 Community expectations

Not everyone in the fishing communities is opposed to the project or to oil and gas exploration. Their perceptions are that the ability to make a living from the sea is already declining. It is a hard live and they want a better life for their children. There are very limited alternative opportunities for making a livelihood and very limited job opportunities. They will support industrial development in the area if it brings opportunities for their children for employment and skills development. They want to know that they will benefit from the process that will be set in motion by the seismic

surveys. They know they will not be direct beneficiaries from the extraction of oil and gas, but that they will be the ones that pay the price. Their expectations are that the oil and gas companies will invest in these communities and assist them with creating alternative livelihoods and obtaining the necessary skills and experience in that regard. Although TGS will be doing a survey to gather data that will be utilised by oil and gas companies, and TGS's activities will be of a temporary nature, with little benefit to the locals, the communities do not distinguish between data collection and exploration or extraction. For them these companies are one and the same, and they have similar expectations of TGS.

The proposed project collects data that would be of great value for the companies interested in extracting oil and gas in the area in future. Should this happen, it would have a positive impact on the economy of South Africa, seen together with the Government's plans for the development of a new industrial port at Boegoebaai. In a country with very high unemployment levels and suffering from a recession and an energy crisis, this is seen as a positive future development by many role players. As such, the communities feel that the government supports the application, and that community consultation is simply a matter of ticking the boxes. The question of who pays the price and who gets the benefit is relevant in this context. The price that the fishing communities will pay eventually, will be high as it may have an extremely negative impact on their livelihoods with little or no benefit to them, unless measures are put in place to protect their livelihoods. It must be considered that community livelihoods are broader than just catch rates and fishing, but includes the capabilities, assets (including both material and social resources) and activities required for a means of living.

8.3.9 Social unrest

Generally, social unrest occurs when a group gathers publicly to express dissatisfaction or anger centred around a common cause and is usually accompanied by a demand for societal change. Poor socio-economic conditions caused by unemployment rates, corruption, inflation, and bad governance can contribute to social unrest. South Africa has a history of using protests to air grievances. Social

unrest is often triggered by an event or action that provokes strong feelings amongst community members.

Some of the communities are adamant that they would not allow gas or oil extraction in the area, and that includes collecting the required data from the ocean. There have already been court cases in this regard, and there are also court cases that are ongoing. Some community members have threatened with violence against surveying vessels. Others have threatened that they will take action to fight seismic surveys, in any way that they seem appropriate. This is a very emotional issue for many people and that could erupt into social unrest. Related to this is potential for conflict between community members who support the project and those that are against the project.

8.3.10 Mitigation and management

TGS's activities for this application would be of short duration if approved, and if viewed in isolation considering only technical risks as discussed in various specialist reports conducted as part of the EIA process, the impacts will be negligible. However, communities feel that there are significant gaps in the available data and from a social perspective the non-technical or social risks can potentially cause significant impacts. Although the marine fauna and fisheries specialists have indicated that the impacts on the marine fauna would be negligible, the communities, with generations of experience in the ocean, fear that the behaviour of the fish will change and that this would affect their catch rates and consequently their livelihoods. What is seen as a minor impact in a large eco-system may be experienced as a major impact by an individual. The marine fauna might not be affected greatly, but the fishing community fear that marine fauna might change its behaviour in response and that is a main concern from a social perspective.

It must be considered that from a social perspective perceived impacts (something that is believed to be a potential impact rather than something that has been established as being an actual impact) should be treated as real impacts. Perceived impacts affect how people feel about the project and how they feel and behave generally, thus perception is reality for them (Vanclay et al, 2015). While the public's assessment of risk is perceptual in nature, their fears should not be dismissed as

irrational and therefore unimportant. Living with the fear and uncertainty is an impact in itself (Burdge, 1998).

There are current impacts on the livelihoods of the communities from aspects such as pollution, shipping traffic, mining in the sea, over fishing and climate change. The cumulative impact of additional activities in the ocean where these communities earn their livelihoods is of concern to them, especially if a number of companies engage in exploration activities in the area in an unplanned manner. They urge the government to approach the matter from a strategic perspective. The strategic approach is not the responsibility of TGS but must be managed by government.

The short-term nature of the seismic reconnaissance and proximity from communities must be considered when suggesting mitigation measures. The mitigation measures suggested must be seen as building blocks for any potential further developments or activities that may be conducted by TGS in future.

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Figure 28: Potential mitigation for impacts on existing livelihoods.

No	Mitigation Measures	Phase	Timeframe	Responsible party for implementation	Monitoring party (frequency)	Target	Performance indicators (monitoring tool)
1	TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities and include a communication strategy and grievance mechanism.	All phases	Commence in the planning phase and continue throughout the life of the project	TGS	Keep records of all communication with communities throughout the life of the project	Establish good relationships with fishing communities	Written community engagement protocol Communication register, social risk and incident register
2	TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. Collaboration across seismic operators with holders of hydrocarbon exploration and the industry as a whole to collectively fund pro-active research would provide opportunity for the development and implementation of a structured and experimentally sound acoustic study. This would quantitatively inform the authorities and stakeholders of acoustic impacts to the various faunal groups in South African Waters. Communities should be consulted on the issues that should be researched.	All phases	Commence in the planning phase and continue throughout the life of the project	TGS	Meetings with communities. Meetings with independent research organisations	Protect the livelihoods of the fishing communities	Minutes of meetings Written agreements with independent research organisations such as universities

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3	Consult with communities on ways in which to positively contribute to the communities.	All phases	Commence in the planning phase and continue throughout the life of the project	TGS	Meetings with communities	To give something back to the communities	Minutes of meetings Written agreements with candidates
4	A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with establishing the relationship between TGS and the traditional communities. If needed, the meetings can be facilitated by an external party. This is an explicit request from community members and failing to do so will increase the reputational risk for TGS and weakens their social licence to operate further. It will also cause significant delays in the application process. Given the current socio-political conditions in the coastal communities following prescribed legal processes is not sufficient to be seen as meaningful consultation from a community perspective.	All phases	Commence in the planning phase and continue throughout the life of the project	TGS	Meetings with leadership	To ensure that there will be no misunderstanding about what meaningful consultation entails in future it will also assist with clearing up past misapprehensions	Minutes of meetings

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5	Assessing all cumulative impacts of the seismic survey industry on the livelihoods of communities, addressing perceptions and alleviating fear from a strategic perspective is not TGSs' responsibility and falls outside the scope of one environmental impact assessment. It is the responsibility of the relevant authorities and the industry. However, the seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.	Before the study commence	Before the study commence	TGS to initiate discussions with the industry governing bodies.	Meetings with industry role players and relevant authorities	Ensure that communities can make informed decisions and engage in meaningful conversations about seismic surveys.	Workshops, awareness raising campaigns and community education

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8.4 Impact ratings

Impact	Phase	Pre-Mitigation							Post-Mitigation							Confidence	Impact Prioritisation		Priority Factor	Final Score
		Nature	Extent	Duration	Magnitude	Reversibility	Probability	Post-mitigation ER	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Post-mitigation ER		Cumulative impact	Irreplaceable loss		
Uncertainty	Planning	-1	4	4	4	3	5		-1	4	2	3	2	4	-11	High	3	3	1.50	-16.5
Concerns about cumulative impacts	Planning	-1	4	4	4	3	5		-1	4	2	3	2	4	-11	High	3	3	1.50	-16.5
Further marginalisation of vulnerable groups	Planning	-1	4	4	4	3	5		-1	4	2	3	2	4	-11	High	3	3	1.50	-16.5
Stakeholder fatigue and disillusionment	Planning	-1	4	3	3	2	4		-1	3	3	2	3	3	-8.25	High	2	1	1.13	-9.28
Perceived impact on livelihoods	Operation	-1	4	4	4	3	3	-11.25	-1	4	3	3	3	3	-9.75	Medium	2	3	1.38	-13.41
Impacts on sense and spirit of place	Operation	-1	4	5	3	3	3	-11.25	-1	4	5	3	3	3	-11.25	Medium	2	3	1.38	-15.47
Impacts on social licence to operate	Operation	-3	4	4	5	4	5		-1	4	2	4	3	4	-13	High	2	2	1.25	-16.25
Community expectations	Operation	-1	4	4	4	3	4	-15	-1	4	2	3	2	4	-11	High	2	3	1.38	-15.13
Social unrest	Operation	-1	4	2	3	3	3	-9	-1	4	2	3	2	3	-8.25	High	2	1	1.13	-9.28

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9 Conclusion and recommendations

TGS's activities for this application would be of short duration if approved, and if viewed in isolation considering only technical risks as discussed in various specialist reports conducted as part of the EIA process, the impacts will be negligible. However, communities feel that there are significant gaps in the available data and from a social perspective the non-technical or social risks can potentially cause significant impacts. Although the marine fauna and fisheries specialists have indicated that the impacts on the marine fauna would be negligible, the communities, with generations of experience in the ocean, fear that the behaviour of the fish will change and that this would affect their catch rates and consequently their livelihoods. What is seen as a minor impact in a large eco-system may be experienced as a major impact by an individual. The marine fauna might not be affected greatly, but the fishing community fear that marine fauna might change its behaviour in response and that is a main concern from a social perspective.

Another concern is the cumulative impact of activities in the ocean where these communities earn their livelihoods. Their fears about the tipping point where their source of livelihood does not recover from all the activities in the ocean, and they are no longer able to make their livelihood as fishing communities must be considered. Currently these communities are able to sustain themselves, although it is difficult. The communities are not against development, but they want to see it happen in a sustainable way that does not jeopardise their source of livelihood. They have already seen how their livelihoods are being affected by mining that is taking place in the sea, pollution, climate change, over fishing and businesses such as factories that come and go and often and do not leave in a socially responsible way.

TGS, as well as other companies that want to do surveys or exploration in the area, currently do not have social license to operate. A large part of this is due to a lack of meaningful consultation by previous applicants from a community perspective. If TGS or any other seismic survey company wants to proceed with the project, they will need

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to engage in meaningful conversation with the communities and try to restore relationships. From a community and social risk perspective this is not negotiable.

Seismic reconnaissance projects are controversial in South Africa and has been in the news frequently in the last year. For many stakeholders it is an emotional matter, for others the potential of impacting their livelihoods is the biggest fear. There are also stakeholders that feel that the exploration for fossil fuels is not in line with sustainable development and the fight against climate change. Other stakeholders feel that it is imperative for the growth and development of the South African economy to engage in these investigations. It is a complex and wicked[2] problem.

Based on the findings, the following recommendations are made:

- TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism.
- TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. Collaboration across seismic operators with holders of hydrocarbon exploration and the industry as a whole to collectively fund pro-active research would provide opportunity for the development and implementation of a structured and experimentally sound acoustic study. This would quantitatively inform the authorities and stakeholders of acoustic impacts to the various faunal groups in South African Waters.
- Consult with communities on potential ways in which to make a positive contribution to the communities.

[2] a **wicked problem** is a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize.

- A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with establishing the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective. Given the risk of stakeholder fatigue, it would be most beneficial if this can take place on an industry level.

- TGS should initiate discussions in their industry. The seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.

From a social perspective it is clear that the communities and majority of local people are opposed to the project. If the project is considered in isolation, the impacts are negligible. However, the project does not happen in a vacuum, and the social environment is much wider than the footprint of the project. If the social risks and potential damage to cultural and indigenous rights are considered the impact on the social fabric of already vulnerable communities may be significant. At this stage communities feel that they cannot make informed decisions. Although all legal processes have been followed, the seismic survey industry is not moving at the pace of the community, and in the long run this will be detrimental to the industry. Potential future benefits and the economic development of the country should the surveys find any significant resources are not disputed. From a social perspective it is recommended that the project proceed subject to the mitigation measures (i.e. meaningful consultation, local research, education, and awareness raising in the

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project-affected communities) forming part of the conditions for authorisation and being implemented prior to the commencement of the actual survey.

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Nama Khoi Local Municipality. **2022/2023 – 2027/28 Integrated Development Plan 2022/2023.**

Namakwa District Municipality. **Integrated Development Plan 2022-2027.**

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https://www.linkedin.com/pulse/your-stakeholders-getting-tired-you-alan-mee/ (accessed 19/09/2022)

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https://www.news24.com/fin24/economy/south-africa/another-seismic-survey-is-heading-to-sa-waters-this-time-from-australia-20220113 (Accessed 02/09/2022)

https://www.un.org/africarenewal/magazine/july-2022/green-hydrogen-viable-option-transforming-africas-energy-sector (accessed 16/09/2022)

Ilse Aucamp

Social Scientist

Summary

Ilse Aucamp holds a D Phil degree in Social Work obtained from the University of Pretoria in 2015. She also have Masters' degree in Environmental Management (Cum Laude) from the Potchefstroom University for Christian Higher Education which she obtained in 2004. Prior to that she completed a BA degree in Social Work at the University of Pretoria.

Dr Aucamp is an experienced facilitator, trainer and lecturer and presents modules on social impact assessment and public participation on several short and university courses. She is past chairperson of the sections coordinating committee of the International Association for Impact Assessment (IAIA) having been section chair for the SIA section before. She has served on the National Executive Committee of IAIA's South African affiliate for a number of years. She advises the Centre for Environmental Rights on social issues, and is also on the advisory panel of the SIAhub, an international website aimed at SIA practitioners. She is a co-author of the ***Social Impact Assessment: Guidance for assessing and managing the social impacts of projects*** document published by the International Association for Impact Assessment. In 2016 and 2017 she was invited to be part of the *Expert Meeting on Non-discrimination* for the World Bank's Environmental and Social Framework. The aim of the group is to assist the World Bank with writing guidance notes for the framework on how to engage with vulnerable groups such as children, the elderly and disabled people. In addition, Dr Aucamp assisted the Government of the Seychelles with developing a SIA framework for the country.

Dr Aucamp has managed and conducted several public participation processes during her career. Dr Aucamp has conducted more than 117 social impact assessments during the last nineteen years. These include assessments on different kinds of projects, from housing developments, energy projects, transport projects, to mining and recreational projects. Her experience includes facilitation and training, strategic assessments, social management and monitoring plans and social development initiatives.

Qualifications

- 1994, BA (Social Work), University of Pretoria
- 2004, Master's degree in Environmental Management (Cum Laude), Potchefstroom University for Christian Higher Education
- 2015, D Phil (Social Work) University of Pretoria.

Registration(s)

- South African Council for Social Service Professions(Registration number: 10 – 16558)

Further training 2001-

- Introduction to SIA - Burdge
- Sustainable Livelihoods Training – Khanya Development Trust
- Achieving the full potential of SIA – Vanclay & Esteves
- Involuntary Resettlement – Appleby, Rawa & Rivas de Neffa

Affiliations	• International Association for Impact Assessment (South Africa) – National Executive Committee member 2005 - 2010 • International Association for Impact Assessment – Chair of Section Coordinating committee 2009 – 2010 • International Association for Impact Assessment – Chair of Social Impact Assessment Section 2005 – 2008 • LEAD Fellow: Cohort 12 • Advisory panel member: socialimpactassessment.net (SIAhub); Centre for Environmental Rights
Countries of work experience	South Africa, Swaziland, Taiwan, United Kingdom, Angola, Namibia, Mozambique, Zambia, Seychelles, Lesotho, Nigeria
Nationality	South African
Years of experience	25
Date of birth	18 January 1973

Languages

	Speaking	Reading	Writing
Afrikaans	Excellent	Excellent	Excellent
English	Excellent	Excellent	Excellent

PROFESSIONAL EXPERIENCE

Social Impact Assessment and related projects 2001 -

- Renewable energy including Soventix – De Aar 225MW Solar PV project, Mogalakwena Solar Project and Scaffal Solar.
- Port feasibility and social assessments including Oranjemund Port Feasibility Study, Expansion of the Port of Lüderitz Feasibility Study and Expansion of the Port of Saldanha SIA.
- Industrial development including Kathu Supplier Park, Sephaku Chemical Plant, Phola-Kusile Coal Conveyor, Ferrometals Storm Water Management, Uranium plant – Welkom, Hoedspruit Ethanol Plant, Saldanha Separator Plant, Babelegi Smelter and Ubombu Sugar.
- Lesotho Lowlands Bulk Water Supply Scheme (Zone 2&3)
- Residential developments including Rietvlei and Rietspruit, Rietpoort Residential Development, Westonaria South Housing Development, Doornkuil Residential Development, Fleurhof Residential Development, Klapmuts Residential Development, Celebration Northriding and Perle de Fleuve residential development.
- Mines including Klipfontein Mine, New Largo Coal Mine, Sishen Mine: Western Waste Rock Dumps, Sishen Complex Mining Right Application,

Sishen Mine: expansion of Lylyveld South Pit, Smokey Hills Mine, Kalplats Mine, Burnstone Mine, Rössing Uranium, Kitumba Copper Mine, Wallmansthal Fluor mine, Zandkopsdrift mine, Leidon mine, Paardeplaats mine, Aquilla mine and Kalahari mine.

- Waste sites such as Kendal Ash Disposal Facility, Camden Ash Dump, Biotshepi Landfill and Eskom Landfill Lephalale.
- Power generation projects including Khanyisa Power Station, Coal 3 and 4 Power Stations, Vaal South power station and Waterberg power stations.
- Roads include the Strategic Socio-economic analysis N2/R72, upgrade of the K46 and Bushbuck Ridge bypass road.
- Terrain suitability study Palabora Mining Company.
- Recreational facilities such as Westridge Mall, West Rand Casino, Viking Bay and Rustenburg Mall.
- Lebone II College of the Royal Bafokeng.
- Shallcross, Stanger and Komatipoort Filling Stations.
- Social and Labour Plans such as Kalplats Mine, Kalahari Mine, Highveld Crushers.
- Social aspects of Social & Environmental Management System: Kelvin Power.
- Integrated Management Plan: Vredefort Dome World Heritage Site.
- Karoo Array Telescope.
- Coastal Livelihood Assessment Paternoster & Melkhoutfontein.
- Powerlines including Garona/Aries, De Beers/Eskom Voorspoed Mine, Mamelodi /Hatherley transmission lines, Soweto Integration Power Lines, Eskom /Tabor-Spencer, Eskom Kudu, Solar Park Integration Project, Eskom Camden-Theta Transmission lines and KZN Integration Project.
- Golf Estates including Lizard Point, The Ponds, Huddle Park, Royal Maluti and Northern Golf Courses.
- Township developments for Putfontein, Klipfontein, Vlakfontein, Duduza, Chief Alfred Luthuli, Rooikop Station, Payneville, Etwatwa and Mayfield, amongst others.

Closure planning

- Assessment of the local socio-economic impacts of the closure of Exxaro's Zincor plant near Springs, Gauteng
- Stakeholder Engagement Strategy for Social Mine Closure: Husab Mine, Erongo Region, Namibia

Social Audits/Due diligence 2001-

- Kelvin Power
- EnviroServ
- Shoprite Angola

Gender Analysis 2018-

- Lesotho Lowlands Bulk Water Supply Scheme (Zone 2&3)
- Human Rights Impact of Grave Relocation Mogalakwena Mine

Human Rights Analysis 2020-	• Human Rights Due Diligence ANRML Nigeria
Social Management Implementation: 2009 –	• Mokolo Crocodile Water Augmentation Project • Upgrade of Staff infrastructure in Etosha National Park (2012-2014)
Policy development 2015-	• Developed Stakeholder Engagement Policies, Plans and Procedures for Calgro M3 • Developed a Social Impact Assessment Policy for the Seychelles • Assessment of the impact of modernisation of mining on mine-affected communities as part of the the Research Programme on Successful Application of Technology Centred Around People (SATCAP) • Mineral Sector Support for Economic Diversification (MinDiver) Project, Nigeria – Project advisor: Development of Social Accountability framework, and Integration of Social Accountability Activities along the Mining Industry Value Chain and Project Life Cycle
Stakeholder Engagement 2001 –	• Stakeholder engagement lead: Mpofu Wind Farms • Facilitation of DWA National Estuarine Monitoring Programme workshop • Public participation on numerous small projects, e.g. Naschem Explosives Factory, Witwatersrand Gold Refinery, Middleburg Ferrochrome, Watervalboven Chemicals • Establishment of a Water Users association – Grootegeluk mine • Grootegeluk Coal Mine • Stuart Coal Colliery • Gauteng Government Precinct • Thabeng Eco reserve and Golf Estate • Mogol Club, Lephalale • Leeuwpan Environmental education centre • Ponds Golf Estate • Manzengwenya Dive Camp, St Lucia • Kalahari Mine • Huddle Park Golf Estate • De Beers/Eskom Voorspoed Mine power line • Eskom Tabor-Spencer power line • Colombus Stainless • Lebone II College of the Royal Bafokeng
Training 2001-	• Presented training on the implementation of voluntary principles on security and human rights to Calgro M3 • Presented and facilitated course on social entrepreneurship in partnership with the University of Pretoria, Unisa, SAVF and Future Families

- Facilitated, developed and coordinated the Population, Environment and Development (PED) Nexus course for the international non-government organisation Leaders in Environment and Development (LEAD), the United Nations Population Fund and the Department of Social Development
- Presenting module on Social Impact Assessment and Public Participation to Masters' Degree Students in environmental management at the University of the Orange Free State
- Presenting module on Social Impact Assessment and Public Participation to honours' degree students in environmental management at the University of South Africa
- Presenting module on Social Impact Assessment to final year students in environmental management at the Tshwane University of Technology
- Presenting module on Social/Community Issues in Risk Assessment for the Environmental Risk Assessment course at the Centre for Environmental Management at the University of the Northwest
- Presenting training courses in Environmental Management topics and Social Impact Assessment at the Centre for Environmental Management at the University of the Northwest
- Presenting training in Social Impact Assessment to Masters' Degree students in the Department of Geography and Environmental Sciences at University of the Northwest
- Presenting training in Social Impact Assessment to final year engineering students in the Department of Engineering at University of Pretoria
- Presenting training in Social Impact Assessment to Masters' Degree students in the Department of Social Work at University of Pretoria
- Assisted with developing and presenting the Masters' Degree in Social Impact Assessment at the Department of Sociology, University of Johannesburg and presented modules
- Presenting training in Social Impact Assessment and Environmental Impact Assessment for the NGO Leaders in Environment and Development and the Department of Social Development
- Drafted Guidelines for Socio-economic Impact Assessment for the Integrated Environmental Management Series Guidelines, Department of Environmental Affairs and Tourism
- Present SIA course at the Centre for Environmental Management.
- Present SIA course at Eskom.

Human behaviour studies 2009 -

- Human behaviour studies in gold mining areas as input for modelling for radiological impact assessment studies (Clients include Harmony, Anglo Gold Ashanti, Bosveld Phosphates, Tronox and others)

PROFESSIONAL HISTORY

Date	Company	Position
2013 -current	Equispectives Research and Consulting Services	Director
2006 -2014	Ptersa Environmental Management Consultants	Director
2005 - 2006	Strategic Environmental Focus	Public participation Co-ordinator & Social Scientist
2004 - 2005	EIMS	Manager: Stakeholder Engagement Unit
2004	Clean Stream Environmental Services	Senior Environmental Practitioner
2002 -2003	Ptersa Environmental Management Consultants	Social Scientist
2001 - 2002	Joy School of Teaching, Taichung, Taiwan	Teacher
1999 - 2000	RS Locums. United Kingdom of England	Locum Social Worker
1995 - 1999	South African National Defence Force	Senior Social Worker

PAPERS AND PUBLICATIONS

- **Aucamp, I** & Woodborne, S. 2021. Conceptualizing cumulative social impacts in complex development environments. In Blakley, J.A.E. and Franks, D.M. (Eds) *Handbook of Cumulative Impact Assessment*. Edward Elgar Publishing, United Kingdom
- **Aucamp, I.**, King, N. and Retief F. 2020. The social dimension of environmental management. In Smit, S.J. and Makomeni, T. (Eds). *Environmental Management. A business management approach*. Juta
- **Aucamp, I.**, & Woodborne, S. 2020. "Can social impact assessment improve social well-being in a future where social inequality is rife?" *Impact Assessment and Project Appraisal* DOI: 10.1080/14615517.2019.1676068
- **Aucamp, I.**, King, N. and Retief F. 2018. The social dimension of environmental management. In King, N.D., Strydom, H.A. and Retief, F.P. (Eds). *Fuggle & Rabie's Environmental Management in South Africa*. Juta
- **Aucamp, I.** & Lombard, A. 2017 "Can social impact assessment contribute to social development outcomes in an emerging economy?." *Impact Assessment and Project Appraisal* 1-13. IAPA Best paper of 2018
- **Aucamp, I.**, 2016. *Resilience and Wellbeing: A SIA perspective*. Paper presented at the annual conference of the International Association for Impact Assessment 2016 in Nagoya, Japan
- **Aucamp, I.**, 2016. *SIA in the context of poverty and inequality*. Paper presented at the annual conference of the International Association for Impact Assessment 2016 in Nagoya, Japan
- **Aucamp, I.**, 2015. *Social Impact Assessment as a tool for Social Development in South Africa: An Exploratory Study*. Unpublished D Phil thesis. University of Pretoria
- Vanclay, F., Esteves, A.M., **Aucamp, I.** & Franks, D. 2015. *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects*. Fargo ND: International Association for Impact Assessment

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- King, N., Aucamp, I.C. & Aucamp, S. *Human Rights and Effective Public Participation: Are we doing the right things or just doing things right?* Workshop presented at IAIAsa Conference, 2015, Champagne Castle, KwaZulu Natal.
- *New developments in the SIA field.* Paper presented at IAIAsa Conference, 2015, Champagne Castle, KwaZulu Natal.
- **Aucamp, I.**, Woodborne, S., Perold, J., Bron, A. & Aucamp, S. 2011. Looking beyond impact assessment to social sustainability. In Vanclay F. & Esteves A. (Eds), *New Directions in Social Impact Assessment: Conceptual and Methodological Advances.* Cheltenham: Edward Elgar
- *Can SIA be used as a tool for Social Development?* - Paper presented at the annual conference of the International Association for Impact Assessment 2014 in Vina del Mar, Chile
- *Ensuring that Environmental Management Plans contribute to ongoing environmental management and drive social and economic development in developing countries* – Paper presented with D Erasmus and C Norman at the annual conference of the International Association for Impact Assessment 2014 in Vina del Mar, Chile
- *Partnering in Impact Assessment – best practice guidelines* – document produced with J Arts, C Faith-Ell and A Esteves as a result of a series of workshops conducted at IAIA conferences between 2009 and 2013
- *The Legal Mandate for SIA in South Africa* - Paper presented at the annual conference of the International Association for Impact Assessment 2012 in Porto, Portugal
- *Social Experts, a necessity not a luxury* –Paper presented with L van der Merwe at the annual conference of the International Association for Impact Assessment 2012 in Porto, Portugal
- *Do you know who I am?* - Paper presented at the annual conference of the International Association for Impact Assessment 2011 in Puebla, Mexico
- *Moving beyond social impact assessment to social sustainability* - Paper presented at the annual conference of the International Association for Impact Assessment 2011 in Puebla, Mexico
- *Challenges to SIA in a South African Context* - Paper presented at the annual conference of the International Association for Impact Assessment 2009 in Accra, Ghana.
- *Social Impact Assessment as a planning tool - can social tools tango?* – Paper presented at the annual conference of the South African Affiliate of the International Association for Impact Assessment 2006 at Kwa Maritane, North West Province.
- *Power to the people – lessons learned from Social Impact Assessment for linear projects* - Paper presented at the annual conference of the International Association for Impact Assessment 2006 in Stavanger, Norway
- *Social Impact Assessment – A prickly pear in the toolbox* – Paper presented at the annual conference of the South African Affiliate of the International Association for Impact Assessment 2004 at Champagne Castle, Kwazulu-Natal
- *Social Impact Assessment in South Africa* – Paper presented at the annual conference of the International Association for Impact Assessment 2005 in Cambridge, Boston, USA
- *Social Impact Assessment and Housing Developments* – Paper presented at the World Congress on Housing 2005 in Pretoria, South Africa.
- Member of technical advisory committee for World Congress on Housing 2005. Transforming Housing Environments through design
- Conference coordinator – IAIAsa 2009 annual conference
- Member of international SIA steering group in IAIA developing guidelines for SIA
- Advisory member for the Centre for Environmental Rights

- Technical coordinator – IAIAsa 2016 annual conference in Port Elizabeth
- Technical programme member –IAIA International 2018 conference in Durban

San-Marié Aucamp
Research Psychologist

Summary	San-Marié is the founding member of Equispectives Research and Consulting Services with over 25 years' experience working in the social environment, predominantly in the mining sector. Experience in other sectors include energy, manufacturing, government, automotive, financial services, telecoms and IT, and FMCG. She has experience in compiling and reviewing Social and Labour Plans, conducting Social Impact Assessments and developing customised social monitoring and evaluation tools for clients.
Qualifications	Currently busy with PhD in Consulting Psychology at the University of South Africa MA (Research Psychology), University of Pretoria, 2003 University of Pretoria, Not for degree purposes – Mathematical Statistics 1 (while working full-time), 1996 University of South Africa, Not for degree purposes – Mathematics 3 & Computer Science 1 (while working full-time), 1994 Higher Education Diploma (Post graduate), University of Pretoria, 1992 BA (Hons) Psychology, University of Pretoria, 1991 BA (cum laude), University of Pretoria (majored in Psychology and Criminology), 1990
Registration(s)	Health Professions Council of South Africa – Research Psychologist and Psychometrist in independent practice
Affiliations	Psychological Society of South Africa – member Society for Industrial and Occupational Psychology of South Africa – member Services SETA – Past National Council Member
Countries of work experience	South Africa, Zambia, Botswana; Lesotho, Ghana, Kenya, Namibia, Hong Kong, Seychelles, Tanzania Managed multi-country projects (from South Africa) with fieldwork in Swaziland; Uganda; Rwanda; Nigeria; Cameroon; Namibia, Hungary, Japan, China, India
Nationality	South African
Years of experience	27

PROFESSIONAL EXPERIENCE

Social Impact Assessments & Social and Labour Plans **2007 –**	Design, execution and project management of SIA's, SLP's and social research input as part of multi-disciplinary projects Conducting baseline studies for SIA's using social indicators such as poverty rate, unemployment rate, crime, literacy levels, income, household size, access to water, etc. Reporting, data analysis and client liaison Review SLP's

Human behaviour studies 2009 -	Human behaviour studies in gold mining areas as input for modelling for radiological impact assessment studies
Social & marketing research 1997 –	Translating client needs in research projects – including measurement, tracking, monitoring and evaluation Design, implementation and project management of research projects (qualitative and quantitative methodologies, including statistics and indices) Reporting, analysis and client liaison Worked on more than 100 research projects Project size varies from about 10 to 3 500 respondents Project respondents varied in age, gender, cultural group and educational level Project types include employee satisfaction, customer satisfaction, product tests, branding, etc. Industry experience and clients include the mining, manufacturing, agriculture, government, automotive, financial services, telecoms and IT as well as FMCG sectors Worked on multi country projects as either team member or team leader
Training 1997 -	Research methodology for second year psychology students (1998) Guest lecturer in modules on Social Impact Assessment, Public Participation and Social and Labour Plans at UNISA, Tshwane University of Technology, University of Johannesburg, Centre for Environmental Management (North West University) Public meeting facilitation skills – SAPREF (2010) Social Impact Assessment Training – Seychelles (2017)
Social Life Cycle Assessment 2013 -	Develop data collection tool Data collection, interpretation and reporting of results Social life cycle assessment reporting Develop reference criteria/benchmarks to track social performance Audit/measure industry/client against benchmarks

PROFESSIONAL HISTORY

Date	Company	Position
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2004 - 2006	Synovate	Senior key accounts manager (main client: BMW)
2002 - 2004	ACNielsen	Client service executive
2000 - 2002	ACNielsen	Omnibus manager
1998 - 1998	University of Pretoria	Intern research psychologist & assistant lecturer
1995 - 1997	Department of Health	Administrative officer
1993 - 1995	Department of Health	Assistant administrative officer
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PUBLICATIONS

Fledderley-Van Dijk, C. & Aucamp, S. (1998, July). *Faces of complexity in research methodology: Delphi contributions.* Paper presented at the 14th World Congress of Sociology, Montréal, Canada.

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DECLARATION OF THE ENVIRONMENTAL SPECIALIST

I, Ilse Carin Aucamp, declare that –

General declaration:

- I act as an independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting undertaking the specialist work as required, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I have not, and will not engage in, conflicting interest in the undertaking of the activity.
- I understand to disclose to the applicant and competent authority all material information in my possession that reasonably has or may have the potential of influencing- any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- I have taken into account, to the extent possible, the matters referred to in Regulation 18 when preparing the report, plan or document.
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not.
- All the particulars furnished by me this form are true and correct.
- I will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations.
- I am aware of what constitutes an offence in terms of Regulation 48 and that a person convicted of an offence in terms of Regulation 48(1) is liable to the penalties as contemplated in Section 49B of the Act.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remunerative for work performed in terms of the Regulations.

Signature of the Specialist:

Name of Company: Equispectives Research & Consulting Services

Date: 28/11/2022

UNDERTAKING UNDER OATH/AFFIRMATION

I, Ilse Carin Aucamp, swear under oath/affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Name of Company: Equispectives Research & Consulting Services

Date: 28/11/2022

Signature of the Commissioner of Oaths:

Date: 28/11/2022

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DECLARATION OF THE ENVIRONMENTAL SPECIALIST

I, Jan-Marié Aucamp, declare that –

General declaration:

- I act as an independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting undertaking the specialist work as required, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I have not, and will not engage in, conflicting interest in the undertaking of the activity.
- I understand to disclose to the applicant and competent authority all material information in my possession that reasonably has or may have the potential of influencing- any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- I have taken into account, to the extent possible, the matters referred to in Regulation 18 when preparing the report, plan or document.
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not.
- All the particulars furnished by me this form are true and correct.
- I will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations.
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Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remunerative for work performed in terms of the Regulations.

Signature of the Specialist:

Name of Company: Equispectives Research & Consulting Services

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UNDERTAKING UNDER OATH/AFFIRMATION

I, San-Marié Aucamp, swear under oath/affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

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TGS: South Africa Orange Basin 3D Seismic Survey

Sound Transmission Loss Modelling

Environmental Impact Management Services Pty Ltd.

Ground Floor, Regus Business Centre,
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October 10, 2022

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Revision Record

Revision No.	Revision Date	Revision Description
1.0	27 September 2022	Technical review of draft report
1.1	28 September 2022	Seismic Survey area updated
1.2	7 October 2022	Recommended management measures section added and revised
1.3	10 October 2022	Final version submitted

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Executive Summary

Environmental Impact Management Services Pty Ltd. (EIMS) is proposing to undertake a 3D seismic survey within the Orange Basin off the West and South-West Coast of South Africa. The proposed survey areas are adjacent to a few Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs) including Childs Bank and Shelf Edge, and Cape Canyon and Associated Islands, Bays and Lagoon.

SLR Consulting Australia Pty Ltd. (SLR) has been appointed by EIMS as the independent underwater acoustic specialist to undertake a Sound Transmission Loss Modelling (STLM) study for the proposed exploration activities, in order to assist with the assessment of potential noise impact on marine fauna species of interest.

The noise modelling results have been used to identify zones of impact for marine mammals and other species of concern based on relevant noise impact assessment criteria. Zones of impact have been evaluated for physiological effects and behavioural disturbance, due to the immediate impact from single airgun pulses, as well as the cumulative effects of exposure to multiple airgun pulses over a period of 24 hours.

The noise impact assessment criteria for the marine fauna species of concerns are detailed in Section 2.0 of this report, and the identified relevant zones of impact are summarised in Section 5.4 and Section 5.5 of the report. The identified relevant zones of impact for marine mammals, fish and sea turtle species are summarised as follows:

Marine mammals

Impact from immediate exposure to individual airgun array pulses

Due to the high level of impulsive signal emissions from the array source, marine mammals are predicted to experience a permanent auditory threshold shift (PTS) at close proximity to the source arrays due to the immediate exposure to individual pulses. Marine mammals of all hearing groups except very-high-frequency cetaceans are predicted to experience PTS effect within approximately 50 metres from the 3D source array at all assessed water depth scenarios. The maximum zones of PTS effect for very-high-frequency cetaceans are predicted to be within 325 metres from the 3D array source.

The zones of a temporary auditory threshold shift (TTS) due to a single pulse exposure for marine mammals of all hearing groups except very-high-frequency cetaceans are predicted to be within approximately 100 m from the source array. The maximum zones of TTS effect for very-high-frequency cetaceans are predicted to be within 650 m from the array source.

Behavioural disturbance caused by the immediate exposure to individual pulses are predicted to be within 3.8 km from the array source for marine mammals of all hearing groups.

Impact from cumulative exposure to multiple airgun array pulses

The zones of cumulative impact (i.e., the maximum horizontal perpendicular distances from assessed survey lines to cumulative impact threshold levels) are estimated based on the modelling results and relevant assessment criteria. Among marine mammals of all six hearing groups, low-frequency cetaceans have the highest zones of PTS and TTS impact. The zones of PTS impact are predicted to range up to 340 metres for the 3D survey, from the adjacent survey lines for the relevant typical 24-hour survey operation

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scenarios considered, and the maximum zone of TTS impact is predicted to be around 5 km from the adjacent survey lines. Much lower zones of cumulative PTS and TTS impact are predicted for marine mammals of other hearing groups.

Fish

Impact from immediate exposure to individual airgun array pulses

The zones of potential injuries for fish species with a swim bladder, turtles and fish eggs and fish larvae are predicted to be within 180 m from the array source. However, fish species without swim bladders have higher injury impact thresholds, and therefore have smaller zones of potential injuries within 90 m from the airgun array source.

Impact from cumulative exposure to multiple airgun array pulses

The zones of potential mortal injuries for fish species with a swim bladder, fish eggs, and fish larvae are predicted to be within 30 m from the adjacent survey lines for all the 24-hour survey operation scenarios considered. For recoverable injury, the zones of impact are predicted to be within 80 m from the adjacent survey lines for fish with a swim bladder for all the operation scenarios considered. Fish without swim bladder are not expected to suffer or any potential injury.

The zones of TTS effect for fish species with and without swim bladders are predicted to be within 2.9 km from the adjacent survey lines for the relevant 24-hour survey operation scenarios considered.

Existing experimental data regarding recoverable injury and TTS impacts for fish eggs and larvae is sparse and no guideline recommendations have been provided. However, based on a subjective approach, noise impacts are expected to be moderate for fish eggs and larvae. Impact is expected to be low for all of them at intermediate and far field from the source location.

Sea Turtles

Impact from immediate exposure to individual airgun array pulses

The maximum zones of PTS effect for sea turtles are predicted to be within 19 m from the source location. On the other hand, the maximum zones of TTS effect for sea turtles are predicted to be within 24 m of the source array.

The behavioural disturbance for sea turtles caused by the immediate exposure to individual pulses are predicted to be within 1.3 km of the source array.

Impact from cumulative exposure to multiple airgun array pulses

Noise impacts related to recoverable injury and TTS on sea turtles are expected to be high at the near field from the source location. The maximum zones of PTS impact are predicted to range within 10 m of the source array. The maximum zones of TTS effect for sea turtles are predicted to be within 500 m of the source array.

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Appendices

Appendix A Acoustic Terminology

Appendix B Auditory Weighting Functions

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Acronyms and Abbreviations

CUI	Cubic Inch
dB	Decibel
EBSA	Ecologically or Biologically Significant Marine Area
GEBCO	General Bathymetric Chart of the Oceans
G-Gun	Gundalf-Gun
MPA	Marine Protected Area
NMFS	National Marine Fisheries Services
NOAA	National Oceanic and Atmospheric Administration
PE	Parabolic Equation
Pk	Peak
PSD	Power Spectral Density
psi	Pounds (force) per square inch
PTS	Permanent Threshold Shift
RMS	Root Mean Square
SEL	Sound Exposure Level
SEL_{cum}	Cumulative Sound Exposure Level
SOFAR	Sound Fixing and Ranging
SPL	Sound Pressure Level
STLM	Sound Transmission Loss Modelling
TTS	Temporary Threshold Shift
UTM	Universal Transverse Mercator
WOA09	World Ocean Atlas 2009
WP	Working Group

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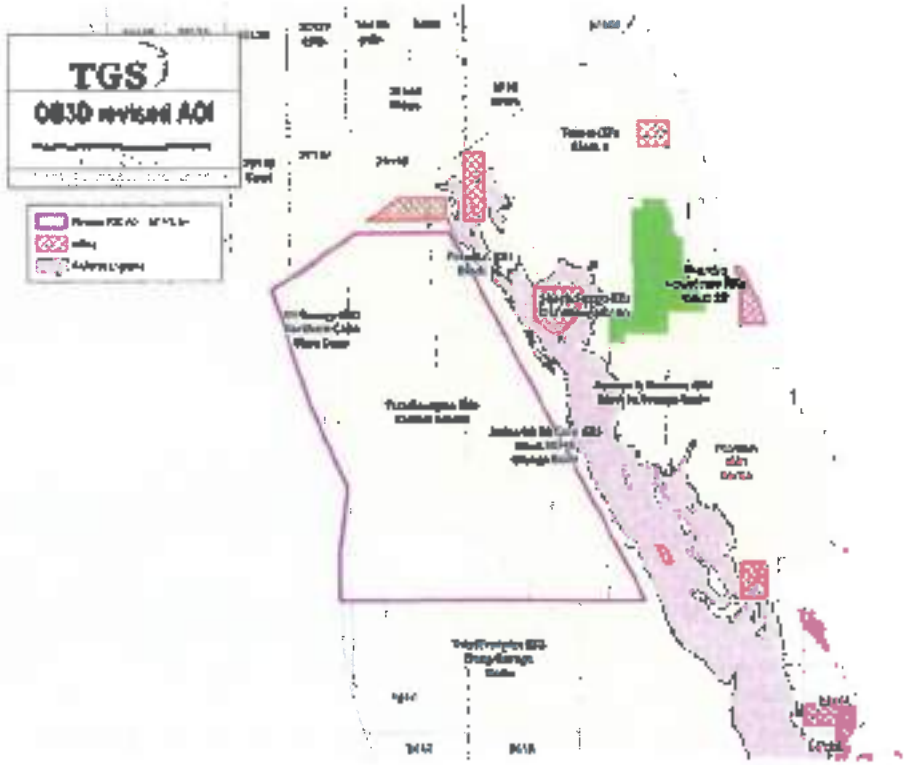
1.0 Introduction

1.1 Project Background

TGS is proposing to undertake a 3D seismic survey within the Orange Basin off the West Coast of South Africa. Water depths in the proposed survey area range from 1,500 m to beyond 3,600 m. The proposed 3D survey acquisition area is within the entire Reconnaissance area of approximately 30,000 km^2 as shown in Figure 1.

Figure 1 Proposed 3D Seismic Survey area off the West Coast of South Africa (purple polygon)



There are a few Ecologically or Biologically Significant Marine Areas (EBSAs) and Marine Protected Areas (MPAs)[1] adjacent to the proposed survey area, particularly the Child Bank and Shelf Edge, as well as Cape Canyon and Associated Islands, Bays and Lagoon, as shown in Figure 2 below:

- Childs Bank and Shelf Edge (Childs Bank) which is a unique submarine bank feature occurring within South Africa's Exclusive Economic Zone (EEZ), rising from ~180 m to ~400 m in water depth on the western continental margin on South Africa; This area includes seven ecosystem types, including those comprising the bank itself, the outer shelf and the shelf edge, supporting hard and unconsolidated ecosystem types. Two of these ecosystem types are Vulnerable and five are Least Concern.

[1] https://www.mandela.ac.za/Research-Projects/EBSA-Portal/South-Africa accessed on May 20th, 2021.

- **Cape Canyon and Associated Islands, Bays and Lagoon** which comprises a collection of special features, ecosystems and species that support a rich diversity and high productivity. The area supports numerous threatened species and ecosystems, and many fragile, sensitive species.

Figure 2 **EBSA boundaries (black polygons) for 'Childs Bank and Shelf Edge' (left) and 'Cape Canyon and Associated Islands, Bays and Lagoon' (right). Dark blue areas represent Marine Protected Areas (MPAs).**

SLR Consulting Australia Pty Ltd. (SLR) has been appointed by Environmental Impact Management Services Pty Ltd (EIMS) as the independent underwater acoustic specialist to undertake a Sound Transmission Loss Modelling (STLM) study for the proposed exploration activities, in order to assist with the assessment of potential noise impact on marine fauna species of interest, particularly for these major marine sensitive areas of concern detailed as above.

1.2 Structure of the Report

This modelling study for the proposed 3D seismic surveys within the Orange Basin off the west coast of South Africa includes the following modelling components:

- Airgun source modelling, i.e., modelling of sound energy emissions from the source array proposed to be used in the 3D seismic survey, including the far-field signature and its power spectral density (PSD), as well as the beam pattern of the source array.
- Short range modelling, i.e., prediction of the received noise levels over a range of up to four kilometres from the selected array source location of various depths, in order to investigate sound field variations due to the water depth changes, as well as to assess the potential high-risk immediate noise impact to marine fauna species of interest.
- Long range modelling, i.e., prediction of the received noise levels over a range of up to two hundred kilometres from the selected array source locations, in order to assess the potential noise impact from the surveys on relevant far-field marine sensitive areas.
- Cumulative noise exposure modelling, i.e., prediction of the cumulative SELs over a 24-hour period for selected representative survey scenarios adjacent to marine sensitive areas, to assess the potential cumulative noise impact to marine fauna species of interest.

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Section 1.0 of the report provides relevant noise impact assessment criteria for marine fauna species of interest. Section 3.0 details the modelling methodology, procedure and results for the seismic survey array source modelling. Section 4.0 outlines the methodologies and procedures for the seismic survey acoustic modelling components (including short range and long-range transmission loss modelling and the cumulative noise exposure modelling). Section 0 presents the major modelling results and the estimated zones of impact for marine fauna species of interest. Section 6.0 provides a discussion of the acoustic modelling study and some recommendation management measures. Relevant references cited throughout the report are listed in Section 9.0.

Relevant acoustic terminologies used throughout the report are presented in Appendix A. An explanation of marine mammal and sea turtle auditory weighting functions are presented in Appendix B. Classifications of various marine mammal hearing groups are presented in Appendix C. Supplementary noise modelling figures are presented in Appendix D.

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2.0 Underwater Noise Impact Assessment Criteria

2.1 Impact of Noise on Marine Fauna Species

The effects of noise and the range over which these effects take place depend on the acoustic characteristics of the noise (e.g., source level, spectral content, temporal characteristics[2], directionality, etc.), the sound propagation environment as well as the hearing ability and physical reaction of individual marine fauna species. The potential impacts of noise on marine fauna species include audibility/detection, masking of communication and other biological important sounds, behavioural responses and physiological impacts which generally include discomfort, hearing loss, physical injury, and mortality (Richardson et al. 2013; Erbe et al. 2018; Popper and Hawkins 2019a).

When the animal is in close proximity to the acoustic source, physical injuries can occur. As the animal is further away from the source, the impacts are expected to gradually decrease, up to a distance where the impacts are negligible. The theoretical zones of noise influence according to Richardson et al. (2013) based on the severity of the noise impact are illustrated in Figure 3.

Figure 3 Theoretical zones of noise influence (adapted from Richardson et al. 2013)

2.1.1 Audibility

A sound is audible when the receiver is able to perceive it over background noise. The audibility is also determined by the threshold of hearing that varies with frequency. The frequency dependant hearing sensitivity is expressed in the form of a hearing curve (i.e., audiogram). In general, marine mammals and fish species usually have U-shaped audiograms, meaning that within their respective hearing ranges, they are more sensitive to the sound energy component in the mid frequency range, and less sensitive to the

[2] Impulsive noise is typically very short (with seconds) and intermittent with rapid rise and decay back to ambient levels (e.g., noise from pile driving, seismic airguns and seabed survey sonar signals).

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energy components in the lower and upper frequency ranges (Finneran 2016, Southall et al. 2019; Popper et al. 2019b).

For fish species, their sound detection is based on the response of the auditory portion of their ears (i.e., the otolithic organs) to particle motion of the surrounding fluid (Popper and Hawkins 2018). Some fish species have the ability to detect sound pressure via gas-filled structures near the ear and/or extensions of the swim bladder that functionally affect the ear, in addition to purely the fluid particle motion, which as a result increase hearing sensitivity and broaden the hearing bandwidth (Nedelec et al. 2016; Popper and Hawkins 2018).

2.1.2 Masking

Masking occurs when the noise is high enough to impair detection of biologically relevant sound signals such as communication signals, echolocation clicks and passive detection cues that are used for navigation and finding prey. The zone of masking is defined by the range at which sound levels from the noise source are received above threshold within the 'critical band'[3] centred on the signal (Richardson et al. 2013), and therefore strongly dependent on background noise environment.

The potential for masking can be reduced due to an animal's frequency and temporal discrimination ability, directional hearing, co-modulation masking release (if noise is amplitude modulated over a number of frequency bands) and multiple looks (if the noise has gaps or the signal is repetitive), as well as anti-masking strategies (increasing call level, shifting frequency, repetition, etc.) (Erbe 2016).

2.1.3 Response

Responses to noise include changes in vocalisation, resting, diving and breathing patterns, changes in mother-infant relationships, and avoidance of the noise sources. For behavioural responses to occur, a sound would mostly have to be significantly above ambient levels and the animal's audiogram.

The behavioural response effects can be very difficult to measure and depend on a wide variety of factors such as the physical characteristics of the signal, the behavioural and motivational state of the receiver, its age, sex and social status and many others. Therefore, the extent of behavioural disturbance for any given signal can vary both within a population as well as within the same individual. Behavioural reactions can vary significantly, ranging from very subtle changes in behaviour to strong avoidance reactions (Ellison et al. 2012; Richardson et al. 2013).

2.1.4 Hearing Loss / Discomfort

Physiological effects of underwater noise are primarily associated with the auditory system which is likely to be most sensitive to noise. The exposure of the auditory system to a high level of noise for a specific duration can cause a reduction in the animal's hearing sensitivity, or an increase in hearing threshold (Finneran 2016, Popper and Hawkins 2019a; Southall et al. 2019).

If the noise exposure is below some critical sound energy level, the hearing loss is generally only temporary, and this effect is called temporary hearing threshold shift (TTS). If the noise exposure exceeds the critical sound energy level, the hearing loss can be permanent, and this effect is called permanent hearing threshold shift (PTS).

[3] In biological hearing systems, noise is integrated over several frequency filters, called the critical bands.

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2.1.5 Physical Injury

In a broader sense, physiological impacts also include non-auditory physiological effects. Other physiological systems of marine animals potentially affected by noise include the vestibular system, reproductive system, nervous system, liver or organs with high levels of dissolved gas concentrations and gas filled spaces. Noise at high levels may cause concussive effects, physical damage to tissues and organs, cavitation or result in rapid formation of bubbles in venous system due to massive oscillations of pressure (Groton 1998).

From an adverse impact assessment perspective, among the potential noise impacts above, physiological impacts are deemed as the primary adverse impact, and behavioural responses as the secondary adverse impact. The following sub-sections outline the corresponding impact assessment criteria for marine mammals and fish and sea turtle species, as well as human divers and swimmers, based on a review of relevant guidelines and/or literature published.

2.2 Marine Mammals, Fish and Sea Turtles

There have been extensive scientific studies and research efforts to develop quantitative links between marine noise and impacts on marine mammal species, fish, and sea turtles. For example, Southall et al (2019) have proposed noise exposure criteria associated with various sound types, including impulsive noise (e.g., piling noise and seismic airgun noise) and non-impulsive noise (e.g., vessel and drilling noise)) for certain marine mammal species (i.e., cetaceans, sirenians and carnivores), based on review of expanding literature on marine mammal hearing and on physiological and behavioural responses to anthropogenic sounds. Popper *et al.* (2014) proposed sound exposure guidelines for fishes considering the diversity of fish, the different ways they detect sound, as well as various sound sources and their acoustic characteristics. Finneran et al (2017) presented a revision of the thresholds for sea turtle injury and hearing impairment (TTS and PTS).

The following subsection provides the noise exposure levels above which adverse effects on various groups of marine mammals, fish, and sea turtles. The latter is based on all available relevant data and published literature (i.e., the state of current knowledge). For more details, see Appendix B.

2.2.1 Noise Impact Criteria for Marine Mammals

The newly updated scientific recommendations in marine mammal noise exposure criteria (Southall et al, 2019) propose PTS-onset and TTS-onset criteria for impulsive noise events.

- The PTS-onset and TTS-onset criteria for impulsive noise are outlined in Table 1, which incorporate a dual-criteria approach based on both peak sound pressure level (SPL) and cumulative sound exposure level (SEL) within a 24-hour period (SEL_{24h}).
- For behavioural changes, the widely used assessment criterion for the onset of possible behavioural disruption in marine mammals is root-mean-square (RMS) SPL of 160 dB re 1 µPa for impulsive noise, as shown in Table 2.

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Table 1 PTS and TTS threshold levels for individual marine mammals exposed to impulsive noise events (Southall et al. 2019)

Marine mammal hearing group	PTS and TTS threshold levels – impulsive noise events			
	Injury (PTS) onset		TTS onset	
	Pk SPL, dB re 1µPa	Weighted SEL_{24h}, dB re 1µPa²·S	Pk SPL, dB re 1µPa	Weighted SEL_{24h}, dB re 1µPa²·S
Low-frequency cetaceans (LF)	219	183	213	168
High-frequency cetaceans (HF)	230	185	224	170
Very-high-frequency cetaceans (VHF)	202	155	196	140
Sirenians (SI)	226	203	220	175
Phocid carnivores in water (PCW)	218	185	212	170
Other marine carnivores in water (OCW)	232	203	226	188

Table 2 The behavioural disruption threshold level for individual marine mammals – impulsive noise (NOAA 2019)

Marine mammal hearing group	Behavioural disruption threshold levels, RMS SPL, dB re 1µPa
	Impulsive noise
All hearing groups	160

2.2.2 Noise Criteria for Fish, Fish Eggs, and Fish Larvae

In general, limited scientific data are available regarding the effects of sound for fishes. As such, assessment procedures and subsequent regulatory and mitigation measures are often severely limited in their relevance and efficacy. To reduce regulatory uncertainty for all stakeholders by replacing precaution with scientific facts, the U.S. National Oceanic and Atmospheric Administration (NOAA) convened an international panel of experts to develop noise exposure criteria for fishes and sea turtles in 2004, primarily based on published scientific data in the peer-reviewed literature. The panel was organized as a Working Group (WG) under the ANSI-Accredited Standards Committee S3/SC 1, Animal Bioacoustics, which is sponsored by the Acoustical Society of America.

The outcomes of the WG are broadly applicable sound exposure guidelines for fish, fish eggs and fish larvae (Popper et al 2014), considering the diversity of fish and the different ways they detect sound, as well as various sound sources and their acoustic characteristics. The sound exposure criteria for sound sources relevant to the project including impulsive noise from seismic airguns is presented in Table 3.

Within the two tables, where data exist that can be used to suggest provisional guidelines, received signal levels are reported in appropriate forms (e.g., peak SPL, SEL). Where insufficient data exist to make a recommendation for guidelines, a subjective approach is adopted in which the relative risk of an effect is placed in order of rank at three distances from the source – near (N), intermediate (I), and far (F) (top to bottom within each cell of the table, respectively). In general, "near" might be considered to be in the tens of meters from the source, "intermediate" in the hundreds of meters, and "far" in the thousands of meters. The relative risk of an effect is then rated as being "high," "moderate," and "low" with respect to

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source distance and animal type. The rating for effects in these tables is highly subjective and represents general consensus within the WG.

It should be noted that the period over which the cumulative sound exposure level (SEL_{cum}) is calculated must be carefully specified. For example, SEL_{cum} may be defined over a standard period (e.g., 12 hours of seismic survey or for the duration of an activity), or over the total period that the animal will be exposed. Whether an animal would be exposed to a full period of sound activity will depend on its behaviour, as well as the source movements. To be in line with assessment criteria for marine mammals, an exposure period of 24 hours is specified for fish. The receiving exposure levels over this period are expected to reflect the total exposure at near field where the major adverse impacts are expected to occur for fish species.

Table 3 Noise exposure criteria for seismic airguns – fish, fish eggs and fish larvae (Popper et al. 2014)

Type of animal	Mortality and potential mortal injury	Impairment			Behaviour
		Recovery injury	TTS	Masking	
Fish: no swim bladder (particle motion detection)	>219 dB SEL_{cum} or >213 dB Pk SPL	>216 dB SEL_{cum} or >213 dB Pk SPL	>>186 dB SEL_{cum}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: swim bladder is not involved in hearing (particle motion detection)	210 dB SEL_{cum} or >207 dB Pk SPL	203 dB SEL_{cum} or >207 dB Pk SPL	>>186 dB SEL_{cum}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: swim bladder involved in hearing (primarily pressure detection)	207 dB SEL_{cum} or >207 dB Pk SPL	203 dB SEL_{cum} or >207 dB Pk SPL	186 dB SEL_{cum}	(N) High (I) High (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae	>210 dB SEL_{cum} or >207 dB Pk SPL	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Notes: Peak sound pressure levels (Pk SPL) dB re 1 µPa; Cumulative sound exposure level (SEL_{cum}) dB re 1 μPa^2-s. All criteria are presented as sound pressure even for fish without swim bladders since no data for particle motion exist. Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

2.2.3 Noise Criteria for Sea Turtles

Popper et al. (2014) suggested threshold levels for the occurrence of mortality and potential mortal injuries (PTS) of sea turtles. However, these adopted levels were extrapolated from other animal groups such as fish, based on the logic that the hearing range of turtles is much closer to that of poorly hearing fish.

More recently, Finneran et al (2017) revised the sea turtle thresholds (PTS) by reviewing individual references from at least five different species (see Appendix C) to construct their composite audiograms and provide thresholds for onset of temporary hearing impairment (TTS). Finneran et al (2017) agreed that sea turtles, even within their best hearing range, have low sensitivity with audiograms more similar

to those of fish without specialized hearing adaptations for high frequency like some marine mammals. The revised thresholds for sea turtles are presented in Table 4.

Table 4 PTS and TTS threshold levels for sea turtles exposed to impulsive noise events (Finneran et al. 2017)

Type of animal	PTS and TTS threshold levels – impulsive noise events			
	Injury (PTS) onset		TTS onset	
	Pk SPL, dB re 1µPa	Weighted SEL_{24hr}, dB re $1\mu Pa^2 \cdot S$	Pk SPL, dB re 1µPa	Weighted SEL_{24hr}, dB re $1\mu Pa^2 \cdot S$
Sea turtles	232	204	226	189

The behavioural threshold for sea turtles was initially established by McCauley *et al.* (2000) at 166 dB re 1 µPa SPL rms and then it was adopted by the National Marine Fisheries Services (NMFS) to identify the distances at which behavioural response may occur. However, the received sound level at which sea turtles are expected to actively avoid repeated air gun exposures is 175 dB re 1 µPa SPL rms (McCauley et al. 2000) as shown in Table 5. Therefore, this threshold has been applied by NMFS to estimate sea turtle behaviour reactions to repeated air gun activities such as survey seismic events (Finneran et al. 2017).

Table 5 The behavioural threshold level for sea turtles – air guns events (McCauley et al. 2000; Finneran et al. 2017)

Type of animal	Behavioural disturbance threshold levels – air guns events
	RMS SPL, dB re 1µPa
Sea turtles	175

2.3 Zones of Bioacoustics Impact

Received noise levels can be predicted using known source levels in combination with models of sound propagation transmission loss between the source and the receiver locations. Zones of impact can then be determined by comparison of the predicted received levels to the noise exposure criteria for the marine fauna species of concern.

It should be noted that the proposed noise exposure assessment criteria for impulsive noise events are all significantly higher than typical natural ambient noise levels, which have overall RMS SPLs in the range of 80 – 120 dB re 1 µPa in the case of calm to strong sea state conditions, respectively. Therefore, the natural ambient noise is not given consideration in the assessment of the zones of impact.

Predicted zones of impact define the environmental footprint of the noise generating activities and indicate the locations within which the activities may have an adverse impact on marine fauna species of interest, either behaviourally or physiologically. In this report, zones of impact are defined as follows:

- For immediate impact from single pulses – the zone of impact represents the maximum horizontal distance from the sound source; and
- For cumulative impact from a typical survey operation scenario – the zone of impact represents the maximum perpendicular horizontal distance from an active seismic survey line.

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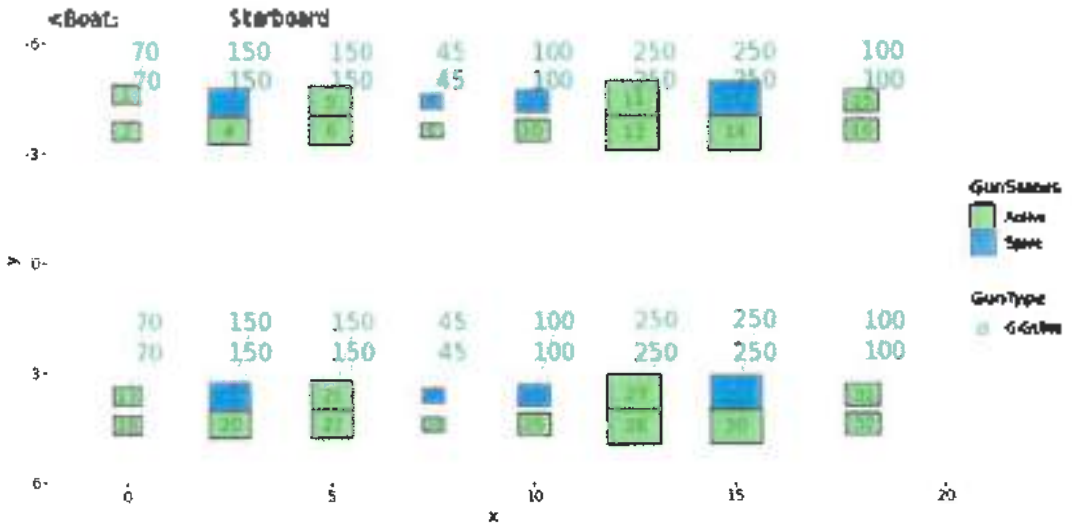
In all cases, zones of impact are conservatively determined by using the maximum predicted noise level across the water column to determine the zone of impact. Since noise levels vary with depth at any location, there will be areas in the water column within the identified zone of impact that are exposed to lower noise levels than implied by the identified zones of impact, which represent the worst case.

3.0 Seismic Airgun Array Source Modelling

3.1 Airgun Array Configuration

The seismic airgun array proposed is a 3 370 cubic inch (CUI) G-Gunll array (32 total airguns, 24 active) with its configuration shown in Figure 4 as below. The array consists of 24 active G-Gun airgun units and has an average towing depth of 7.0 m and an operating pressure of 2,000 pounds per square inch (psi).

Figure 4 The configuration of the 3 370 CUI G-Gunll array



3.2 Modelling Methodology

For each source array configuration, the outputs of the source modelling include:

- A set of "notional" signatures for each of the array elements; and
- The far-field signature of the array source, including its directivity/beam patterns.

3.2.1 Notional Signature

The notional signatures are the pressure waveforms of individual source elements at a standard reference distance of 1 metre.

Notional signatures are modelled using the Gundalf Designer software package (2018). The Gundalf source model is developed based on the fundamental physics of the oscillation and radiation of source bubbles as described by Ziolkowski (1970), and for an array source case, taking into account non-linear pressure interactions between source elements (Ziolkowski et al. 1982; Dragoset 1984; Parkes et al. 1984, Vaage et al 1984; Laws et al. 1988 & 1990).

The model solves a complex set of differential equations combining both heat transfer and dynamics and has been calibrated against multiple measurements of both non-interacting source elements and interacting clusters for all common source types at a wide range of deployment depths.

3.2.2 Far-field Signatures

The notional signatures from all airguns in the array are combined using appropriate phase delays in three dimensions to obtain the far-field source signature of the array. This procedure to combine the notional signatures to generate the far-field source signature is summarised as follows:

- The distances from each individual acoustic source to nominal far-field receiving location are calculated. A 9 km receiver set is used for the current study;
- The time delays between the individual acoustic sources and the receiving locations are calculated from these distances with reference to the speed of sound in water;
- The signal at each receiver location from each individual acoustic source is calculated with the appropriate time delay. These received signals are summed to obtain the overall array far-field signature for the direction of interest; and
- The far-field signature also accounts for ocean surface reflection effects by inclusion of the "surface ghost". An additional ghost source is added for each acoustic source element using a sea surface reflection coefficient of -1.

3.2.3 Beam Patterns

The beam patterns of the acoustic source array are obtained as follows:

a) The far-field signatures are calculated for all directions from the source using azimuthal and dip angle increments of 1-degree;

b) The power spectral density (PSD) (dB re 1 $\mu Pa^2s/Hz$ @ 1 m) for each pressure signature waveform is calculated using a Fourier transform technique; and

c) The PSDs of all resulting signature waveforms are combined to form the frequency-dependent beam pattern for the array.

3.3 Modelling Results

3.3.1 Notional Signatures

Figure 5 shows the notional source signatures for the four airgun array elements. Each line within the figure represents the notional source signature of the corresponding array element as shown in Figure 4.

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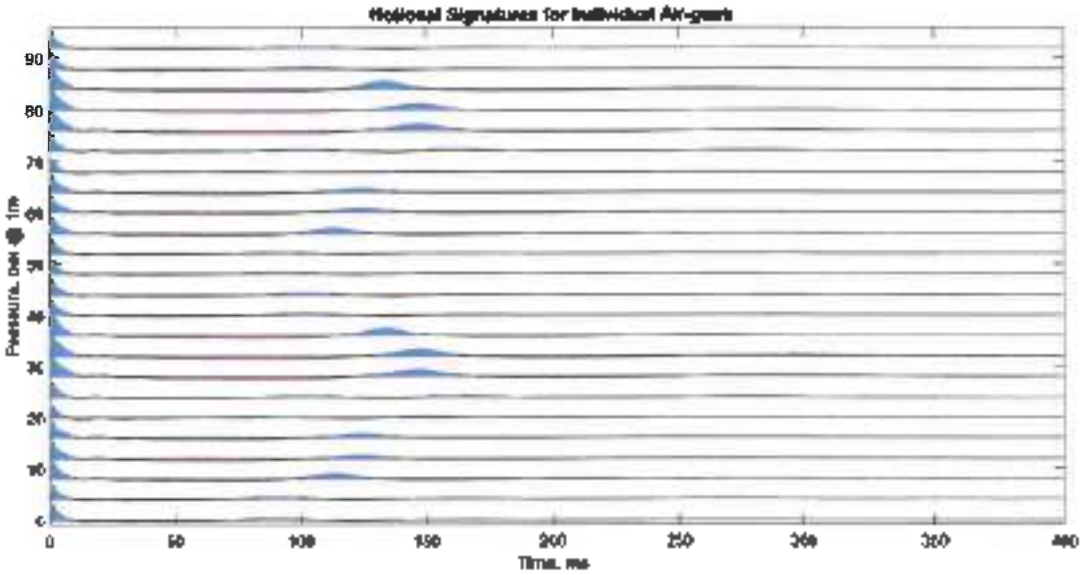
Figure 5 Notional source signatures for the 3 370 cui G-Gundi array



3.3.2 Far-field Signature and its Power Spectral Density

Figure 6 shows the far-field signature waveform and the proposed airgun array's power spectral density (simulated by the Gundalf Designer software, 2018). The signatures are for the vertically downward direction with surface ghost included. The source modelling result shows the parameters presented in Table 6.

Table 6 Source levels of the array source

Source Levels	3D source array
Peak sound pressure level (Pk SPL) (dB re 1 µPa @ 1 m)	257.9
Root-mean-square sound pressure level (RMS SPL) (dB re 1 µPa @ 1 m with a 90%-energy pulse duration of 12.5 milliseconds)	244.9
Sound exposure level (SEL) (dB re µPa^2-s @ 1 m)	233.9

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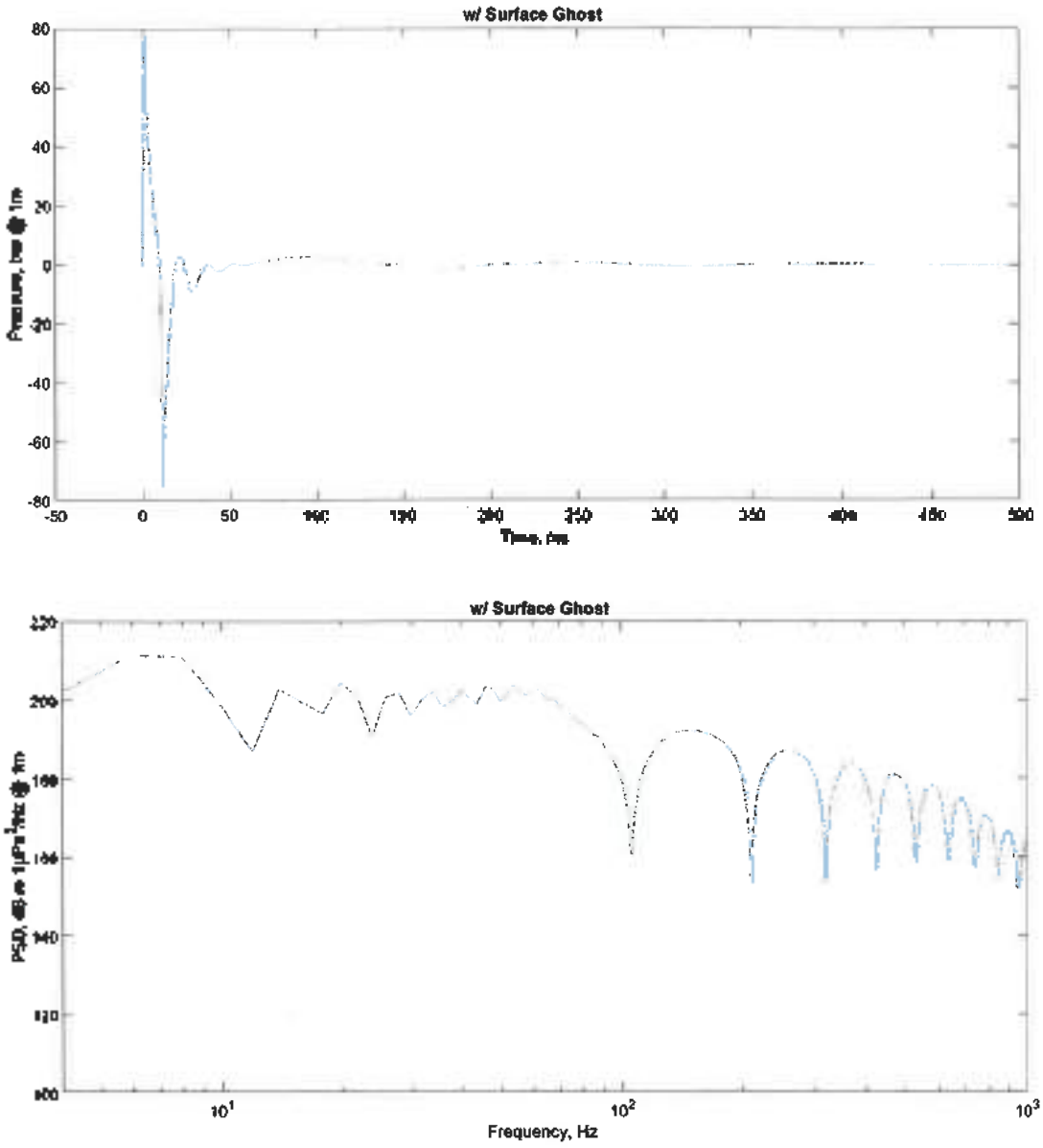
Figure 6 The far-field signature in vertically downward direction (top) and its power spectral density (bottom) for the 3 370 CUI G-Gun array



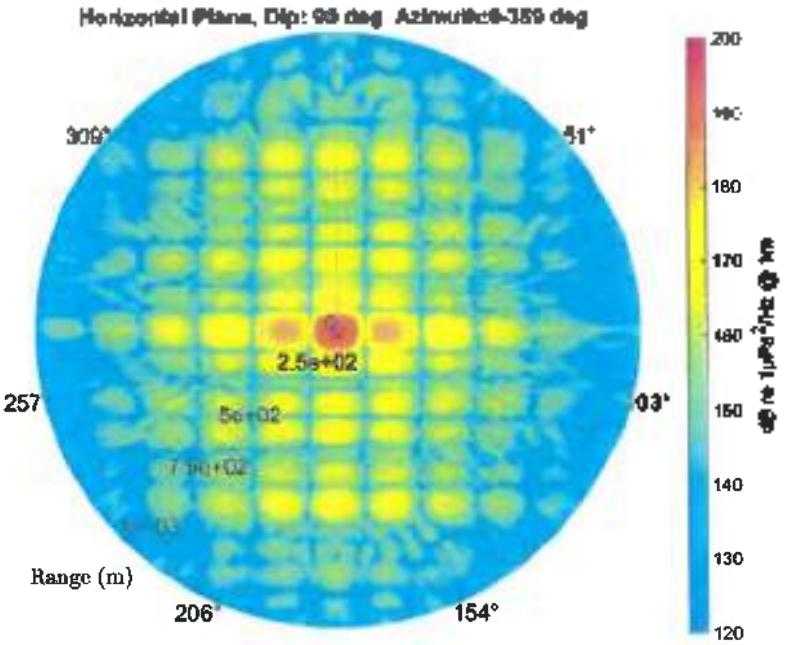
3.3.3 Beam Patterns

Array far-field beam patterns of the following three cross sections are presented in Figure 7:

1. The horizontal plane (i.e., dip angle of 90 degrees) with azimuthal angle of 0 degree corresponding to the in-line direction;
2. The vertical plane for the in-line direction (i.e., azimuthal angle of 0 degree) with dip angle of 0 degree corresponding to the vertically downward direction; and
3. The vertical plane for the cross-line direction (i.e., azimuthal angle of 90 degrees) with dip angle of 0 degree corresponding to the vertically downward direction.

The beam patterns in Figure 7 illustrate strong angle and frequency dependence of the energy radiation from the array. The beam pattern of the horizontal plane shows relatively stronger energy radiation in the cross-line direction than in the in-line direction. The beam patterns of the in-line and cross-line vertical planes have the strongest radiation in the vertical direction.

Figure 7 **Array far-field beam patterns for the 3 570 CUI G-Gun II array, as a function of orientation and frequency. (a) - The horizontal plane with 0 degree corresponding to the in-line direction; (b) – The vertical plane for the in-line direction; (c) – The vertical plane for the crossline direction. The 0-degree dip angle corresponds to vertically downward direction**



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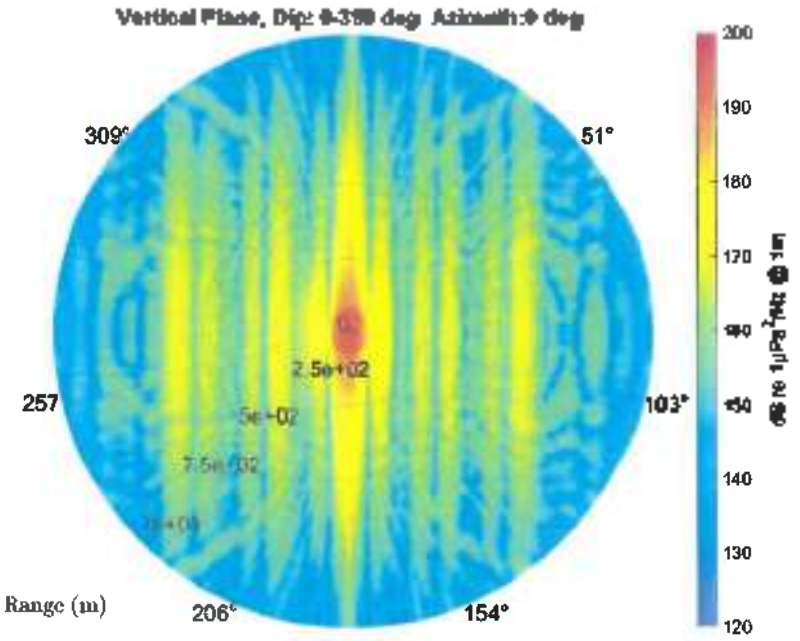
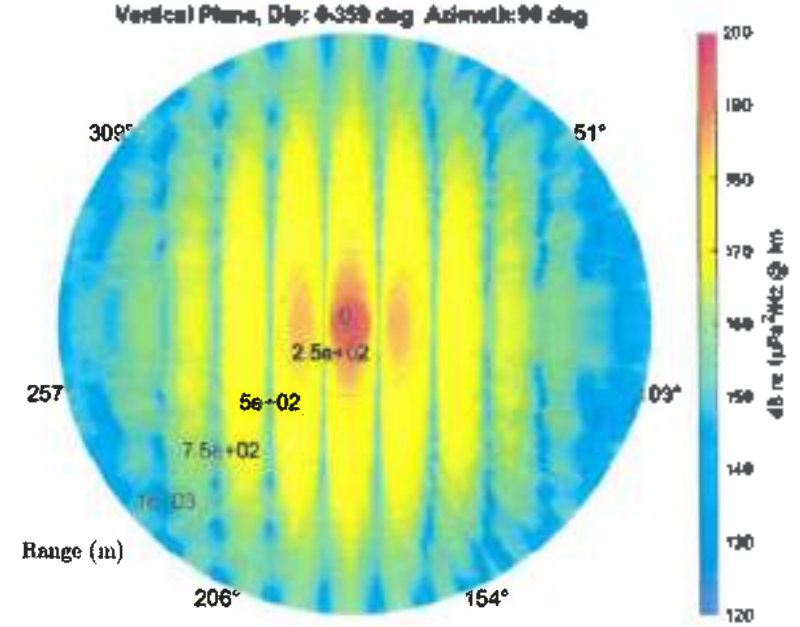

Vertical Plane, Dip: 0-359 deg Azimuth:0 deg
309°
51°
257
103°
206°
154°
2.5e+02
5e+02
7.5e+02
Range (m)
200
190
180
170
160
150
140
130
120


Vertical Plane, Dip: 0-359 deg Azimuth:90 deg
309°
51°
257
103°
206°
154°
2.5e+02
5e+02
7.5e+02
Range (m)
200
190
180
170
160
150
140
130
120

4.0 Sound Transmission Loss Modelling

4.1 Modelling Input Parameters

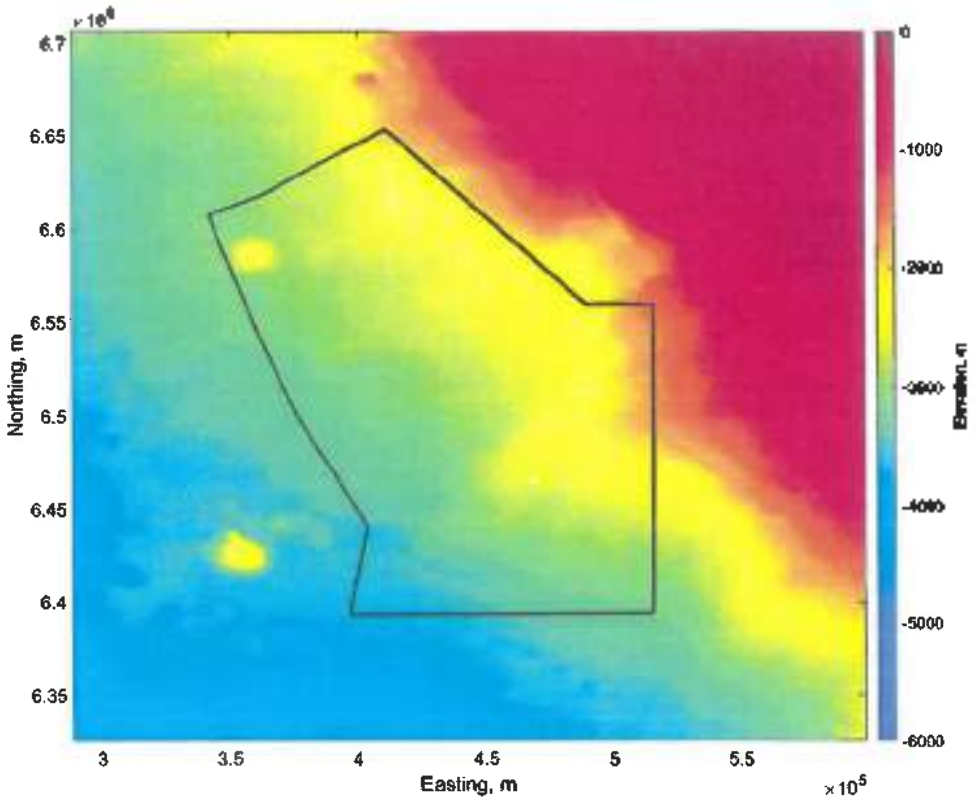
4.1.1 Bathymetry

The bathymetry data used for the sound propagation modelling were obtained from the General Bathymetric Chart of the Oceans (GEBCO) dataset grid (GEBCO 2022). This is the fourth GEBCO grid developed through the Nippon Foundation-GEBCO 'Seabed 2030 Project' (https://seabed2030.org).

The ocean currents within the survey area are not expected to have significant effects on sound propagation, due to limited current heights compared with overall water depths and low current speed compared with sound speed within typical sea water.

The bathymetric imagery within and surrounding the acquisitions area are presented in **Figure 8**.

Figure 8 **Bathymetry data for study area. The proposed 3D seismic area is shown with a black polygon, based on WGS 84/UTM Zone 33S**



4.1.2 Sound Speed Profiles

Temperature and salinity data required to derive the sound speed profiles were obtained from the World Ocean Atlas 2009 (WOA09) (Locarnini et al. 2010; Antonov et al. 2010). The hydrostatic pressure needed

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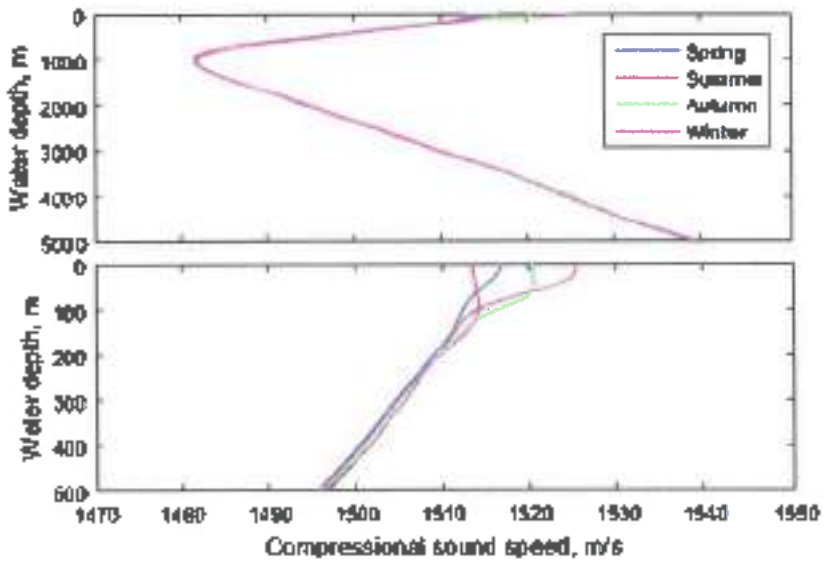
for calculation of the sound speed based on depth and latitude of each particular sample was obtained using Sanders and Fofonoff's formula (Sanders and Fofonoff 1976). The sound speed profiles were derived based on Del Grosso's equation (Del Grosso 1974).

Figure 9 presents the typical sound speed profiles for four seasons around the survey area. The figure demonstrates that the most significant distinctions for the profiles of four seasons occur within the mixed layer near the surface. The summer season has the strongest downwardly refracting feature among the four seasons, and the winter season exhibits a deeper surface duct than the other three seasons. Due to the stronger surface duct within the profile, it is expected that the winter season will favour the propagation of sound from a near surface acoustic source array. Based on a conservative consideration, winter season sound speed profile was selected as the modelling input.

As can be seen in the figure below, the overall speed profiles of different seasons across the water column are quite similar, although in shallower water (less than 200 m) there is slight seasonal variation. As such, the differences in sound fields between different seasons are not expected to be significant.

Figure 9 **Typical sound speed profiles within the survey area for different Southern Hemisphere seasons. The top panel shows profiles across the entire water column, and the bottom panel shows profiles across the water column section near the surface**



4.1.3 Seafloor Geoacoustic Model

To inform the 2018 national marine ecosystem classification and mapping efforts in southern Africa, Sink et al. (2019) collated sediment data from numerous samples acquired by grab or core under 13 different projects to produce a national layer of sediment types for southern Africa and adjacent ocean regions. The data sample classification reveals that the seafloor of the Western South African and Namibia shelves is primarily composed of mud sediment with a noticeable proportion of sand.

Relevant literature also shows that from continental shelf to deep sea basin, the sediment spatial distribution has general transition from sand/mud to deep sea ooze sediment, as a result of the regional

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oceanography and terrigenous sediment supply, as well as the deep-sea sedimentary processes (Dingle et al. 1987; Dutkiewicz et al. 2015).

For the stratified layers beneath the superficial sediment layer within the offshore Orange Basin, relevant geological modelling studies (Paton et al. 2007; Campher et al. 2009) show that, for a typical east-west trending transect across the Orange Basin, a dominant layer of leaky shale/mudstone is predicted to be up to 2,000 m – 4,000 m from the seabed depth, followed by layers of sandstone and rock basement.

Based on above, as well as a conservative consideration, it was proposed that for the entire modelling area, the seafloor geoacoustic model comprises of a 50 metre thick fine and silty sand sediment layer, followed by a soft to set-cemented mudstone/shale sediment layer and a semi to full-cemented mudstone /shale substrate as detailed in Table 7. The geoacoustic properties for silty mud and sand are as described in Hamilton (1980), with attenuations referred to Jensen et al (2011). The elastic properties of silt and sand are treated as negligible.

Figure 10 shows the reflection coefficient variation with grazing angle and frequency for the proposed seafloor geoacoustic scenario, calculated using the plane-wave reflection coefficient model (Porter 2001, 2020). As shown in the figure, the seafloor acoustic reflection is dominated by the top sediment layer across the frequency range, with high reflection at low grazing angles and low reflection (high refraction) at higher grazing angles.

Table 7 Geoacoustic parameters for the proposed seafloor model

Seafloor Materials	Depth Range, m	Density, ρ, (kg.m^{-3})	Compressional Wave	
			Speed, c_p, (m.s^{-1})	Attenuation, α_p, (dB/λ)
Fine/silty sand	0 - 50	1,900	1,650	0.8
Soft to semi-cemented mudstone / shale sediment layer	50 - 500	2,000	1,900	1.0
Semi-/full- cemented mudstone /shale half-space	500 - ∞	2,300	2,500	1.0

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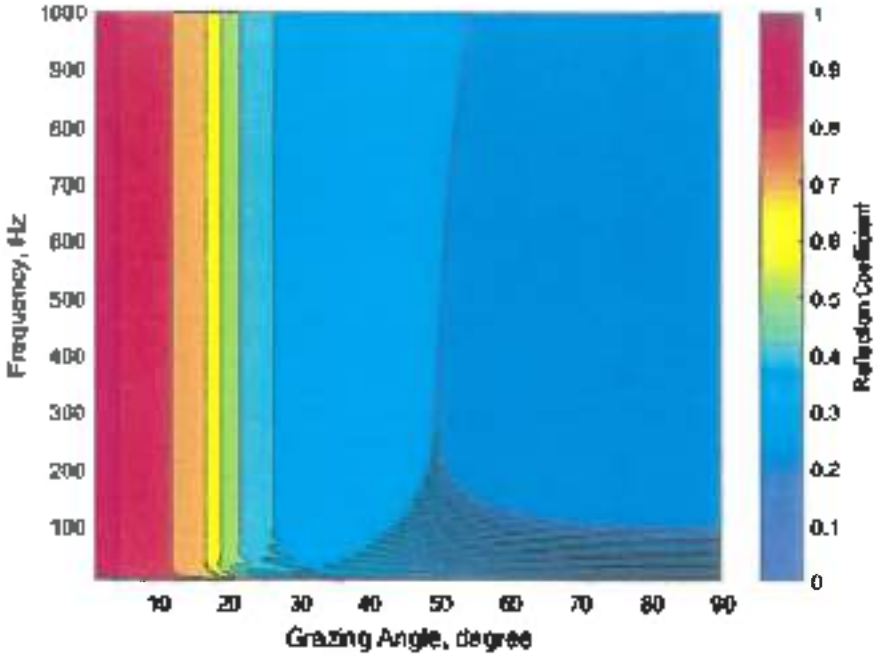
Figure 10 **Reflection coefficient vs grazing angle and frequency for the proposed geoacoustic model**



4.2 Methodology and Procedure

The sub-sections below describe the modelling methodologies and procedures for predicting received noise levels of relevant metrics associated with seismic survey activities.

The modelling components as detailed in Section 4.2.1 to Section 4.2.5 involve SELs and noise levels in relevant acoustic metrics (i.e., Peak SPLs and RMS SPLs) for single shots from the G-Gun II 3,370 CUI Source Array for the 3D seismic survey, as well as for the cumulative SELs within a 24-hour period for the representative 3D survey scenarios.

4.2.1 Short Range Modelling

Short range modelling has been used to model received SELs in relatively close proximity to the airgun source, with consideration of the near-field effect of the sound field. As such, the predictions for the short range case are modelled by reconstructing the received signal waveforms from individual airgun source units within the array.

The wavenumber integration modelling algorithm SCOOTER (Porter 2001, 2020) is used to calculate the transfer functions (both amplitudes and phases) between sources and receivers. SCOOTER is a finite element code for computing acoustic fields in range-independent environments. The method is based on direct computation of the spectral integral and is capable of dealing with an arbitrary layered seabed with both fluid and elastic characteristics.

The following procedures have been followed to calculate received SELs for short range cases:

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1. The modelling algorithm SCOOTER is executed for frequencies from 1 Hz to 1 kHz, in 1 Hz increments. The source depth is taken to be the array depth of 8.0 m. A receiver grid of 1 m in range (maximum range 4.0 km) and 1 m in depth is applied for the selected receivers. For each gridded receiver, the received SEL is calculated by following steps 2) – 5);
2. The range from the source to each receiver is calculated, and the transfer function between the source and the receiver is obtained by interpolation of the results produced by modelling algorithm SCOOTER in Step 1). This interpolation involves both amplitude and phase of the signal waveform in frequency domain;
3. The complex frequency domain signal of the notional signature waveform for each source element is calculated via Fourier Transform, and multiplied by the corresponding transfer function from Step 2) to obtain the frequency domain representation of the received signal from the source element;
4. The waveform of received signal from the array source is reconstructed via Inverse Fourier Transform. The received signal waveforms from all airgun sources in the array are summed to obtain the overall received signal waveform; and
5. The signal waveform is squared and integrated over time to obtain the received SEL value. Alternatively, the SEL value can also be calculated via integration of the energy power density (ESD) over frequency in Step 3).

4.2.1.1 Modelling scenarios

The modelling inputs for the short range modelling case, such as sound speed profile and seabed geoacoustic models, has been detailed in Section 4.1. To analyse the received SEL variations with water depth changes, modelling has been undertaken for four (4) water depth cases for the 3D survey area (i.e., 1,900 m, 2,500 m, 3,100 m, and 3,700 m).

4.2.2 Long Range Modelling

The long range modelling generally involves complex and variable environmental factors (such as sound speed profiles and bathymetric variations) along an extended range of sound propagation environments, and requires an efficient modeling prediction algorithm with reasonable accuracy. Therefore, the modelling prediction for the long range case is carried out using the far-field source levels of octave frequency bands and their corresponding transmission loss calculations.

The fluid parabolic equation (PE) modelling algorithm RAMGeo (Collins 1993) is used to calculate the transmission loss between the source and the receiver. RAMGeo is an efficient and reliable PE algorithm for solving range-dependent acoustic problems with fluid seabed geo-acoustic properties.

The received sound exposure levels are calculated following the procedure as below:

1. One-third octave source levels for each azimuth to be considered are obtained by integrating the horizontal plane source spectrum over each frequency band, these levels are then corrected to SELs;
2. Transmission loss is calculated using RAMGeo at one-third octave band central frequencies from 8 Hz to 1 kHz, with a maximum range of 200 km and at 5-degree azimuth increments. The bathymetry variation along each modelling track is obtained via interpolation from the bathymetry dataset;

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3. The one-third octave source SEL levels and transmission loss are combined to obtain the received SEL levels as a function of range, depth and frequency.
4. The overall received SEL levels are calculated by summing all frequency band SEL levels.

4.2.2.1 Source locations

Three (3) long range modelling source locations are proposed for the 3D seismic survey as detailed in **Table 8** and shown in **Figure 11**. The modelling is representative of the noise propagation within the proposed 3D seismic area. Source location L1 is adjacent to the marine sensitive area, L2 represents the average depth of the south survey area and L3 is located towards the deeper water environment of the survey area.

Table 8 Details of the three selected source locations for the long range modelling

Source Location	Water Depth, m	Coordinates (Easting, Northing)	Locality
L1	1,900	(411159, 6653271)	north of the survey area adjacent to Childs Bank marine sensitive area
L2	3,100	(515091, 6394105)	mid-south of the survey area with average depths
L3	3,600	(396685, 6393331)	west of the survey area towards deeper water environment

Figure 11 The selected three source locations (L1, L2, & L3) indicated as orange dots. The white polygon shows the proposed 3D seismic survey area.

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4.2.3 Cumulative SEL Modelling

The cumulative SEL accounts for the total acoustic energy received from all seismic impulses within a specific period of exposure (i.e., 24 hours). There will be thousands of survey shots during a typical survey operation within a 24-hour period, and it is not practical to perform sound modelling for every survey shot in an efficient manner. However, the propagation environments for a set of consecutive survey shots are similar, and therefore one propagation model could be performed as representative for the set group. The sound field for the representative survey shot then could be adjusted to represent the rest of the survey shots within the set group accounting for their source positions.

The cumulative SELs (frequency unweighted and weighted) are modelled based on the steps as below:

1. The received SELs at individual grid locations (a 100-m grid size for this study) from individual representative survey shot considered (one in every ten shots for this study) is modelled based on the long range modelling methodology and procedure as detailed in Section 4.2.2 and then the results are adjusted for the rest of survey shots based on their shot locations;
2. The SEL_{24hr} at individual receiving grid locations are obtained by summing SEL contribution from all survey shots within a 24-hour period for the survey operation scenario considered;
3. For weighted SEL_{24w} for individual marine mammal hearing groups, the source spectra are adjusted accounting for the frequency weighting functions for individual hearing groups (as in Appendix B), and the weighted SEL_{24} for individual hearing groups to be obtained by repeating the first two steps as above; and
4. For high frequency energy component which is important for marine mammals with high frequency hearing range, the source spectra and propagation modelling are extended up to 10 kHz, with the source spectra being close to $1/f$ attenuation for frequencies above 1 kHz (Landrø et al. 2011), so that the high frequency energy component to be included for the weighted SEL_{24} predictions.

It should be noted that the source level inputs for long range modelling as detailed in Section 4.2.2 are based on the array source noise emissions in the horizontal plane, and this approach may underestimate the actual sound field close to the array source (< 4 km). As such, the sound fields close to the array source predicted by the long-range modelling as described in Step (1) above are benchmarked against short range modelling results to account for the near-field effects.

4.2.3.1 Survey Scenarios

Based on relevant project information provided, the survey schedules for the survey are outlined in Table 9. One survey line section is assumed to be acquired within the 24-hour period for each scenario.

Table 9 Survey Schedule

Survey	Shot spacing (m)	Vessel Speed (knots)	Survey Orientation
3D	12.5	4.5	NW-SE

The survey line details for the modelling scenario is detailed in Table 10 and indicated in Figure 12. The rationale of the selected cumulative modelling scenarios is on the basis that the scenarios are representative with regards to the adjacent EBSAs (i.e., Childs Bank and Cape Canyon) and MPAs. The modelling is representative of the noise propagation within the proposed 3D seismic area.

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Table 10 Details of the selected survey lines for the cumulative SEL modelling scenarios

Scenario	Survey Lines	[Easting, Northing], m	Length, km	Locality
Line1	1	[421150, 6653270]	80	near to EBSAs and MPAs
Line 2	1	[462322, 6591680]	80	near to EBSAs and MPAs
Line 3	1	[341354, 6605670]	80	northwest of the survey area towards deeper water environment

Figure 12 Representation of the selected three (3) Cumulative SEL 24-hour survey scenarios

4.2.4 Pk SPLs and RMS SPLs – Estimate Methodology from Modelled SELs

For received individual signals emitted from impulsive sources such as seismic airguns, the differences between the SEL and other sound parameters, such as the Pk SPL/RMS SPL, are expected to be greatest at the source location, and then gradually decrease with receiving locations further away from the source location. This is due to the following effects:

- Theoretically, the airgun pulse goes through increasing waveguide distortion effects (e.g., dispersion, interference effects, seafloor and surface reflections, differences of time arrivals, etc.) with increasing range from the source, which impact predominantly on temporal characteristics of the pulse (e.g., lower peak level, extended pulse duration, etc.) rather than the energy based metric levels.
- The above statement is reliably supported by numerous theoretical and empirical research studies, e.g., the relevant seismic survey signal modelling and measurement studies (e.g., Austin et al. 2013, Matthews and MacGillivray 2013, Galindo-Romero et al. 2015, McCauley et al. 2000,

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2016) show that the differences between the three temporal parameters (i.e., Pk SPL, and RMS SPL) and SEL are increasingly higher at the receiver closer to the source location.

4.2.4.1 SEL and Pk SPL

As presented in Section 3.3.2, the difference between the Pk SPL and SEL of the far-field signature of the source arrays (at a reference distance of 1 m from the centre of the array) is 24.0 dB for the 3D array. This value is taken as the conversion factor applied to the SELs for calculating the received Pk SPLs over the receiving range close to the source location. This approach is regarded as conservative for estimating relevant near-field acoustic parameters based on SEL predictions.

4.2.4.2 SEL and RMS SPL

Previous empirical studies demonstrate that at relatively close distances from the airgun sources (within 1.0 km), the difference between SELs and RMS SPLs could be between 10 dB to 15 dB (Austin et al. 2013; McCauley et al. 2000). The differences could drop to under 5 dB when the distances are close to 10 km (Austin et al. 2013). The differences are expected to drop further with the increasing distances beyond 10 km (Simon et al. 2018).

For this project, the RMS SPLs were estimated using the following conversion factors to be applied to the modelled SELs within different distance ranges.

These conversion factors are conservatively estimated based on the source array modelling results and above previous measurement results:

- 0 – 100 m, a conversion factor of 11 dB. This is the difference between RMS SPL and SEL of the far-field signature of the 3 370 cubic inch (CUI) G-Gun II array as modelled in Section 3.3.2;
- 100 – 1,000 m, conversion factors 11 dB to 10.0 dB, following a logarithmic trend with distance;
- 1,000 – 10,000 m, conversion factors 10.0 dB to 5.0 dB, following a logarithmic trend with distance;
- 10,000 – 100,000 m, conversion factors 5.0 dB to 0.0 dB, following a logarithmic trend with distance; and
- > 100,000 m, a conversion factor of 0.0 dB.

The SEL to RMS SPL conversion factors as a function of horizontal ranges from source array are demonstrated in Figure 13.

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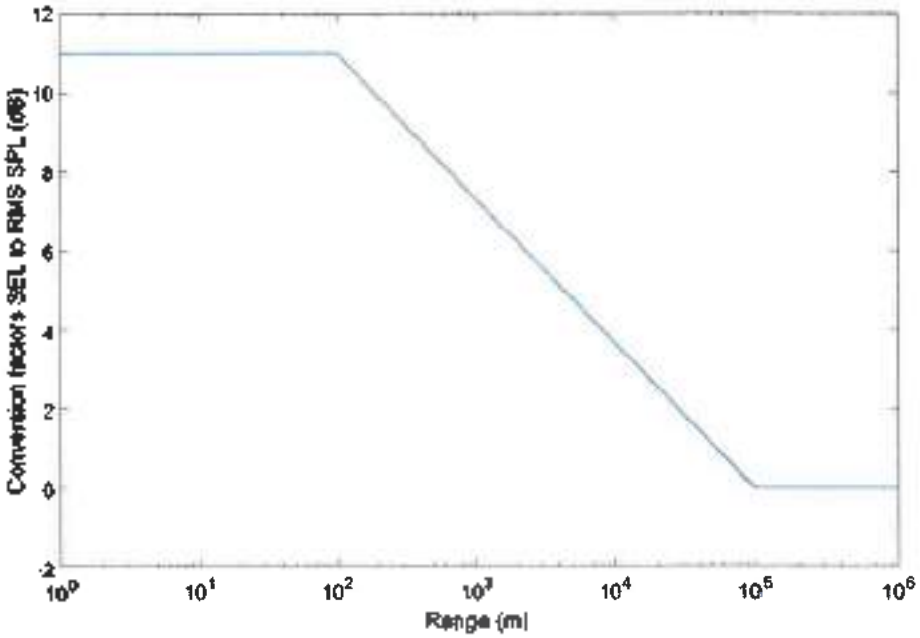
Figure 13 SEL to RMS SPL conversion factors as a function of horizontal range from source array



4.2.5 Model Validation – Airgun Seismic Survey Noise Modelling

The accuracy of airgun array sound field modelling depends on the suitability and accuracy of the airgun array source model and the transmission loss model, as well as the realism of the parameters defining the sound propagation environment, including the bathymetry, seafloor geo-acoustics and sound speed profiles (DOC 2016).

The following model validation exercises have been undertaken previously in regards to the airgun array source model, short range model and long range model that have been used in this modelling study:

- The source modelling software Gundalf has been calibrated against various datasets of near-field recorded signatures, and has been verified against other airgun array source signature models (Ainslie et al. 2016); and
- The short range model and long range model have been validated from a few underwater acoustic measurement programs undertaken by independent third parties, with good agreements between modelled and measured results being reported (e.g., Simon et al. 2018; Li et al. 2021).

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5.0 Modelling Results

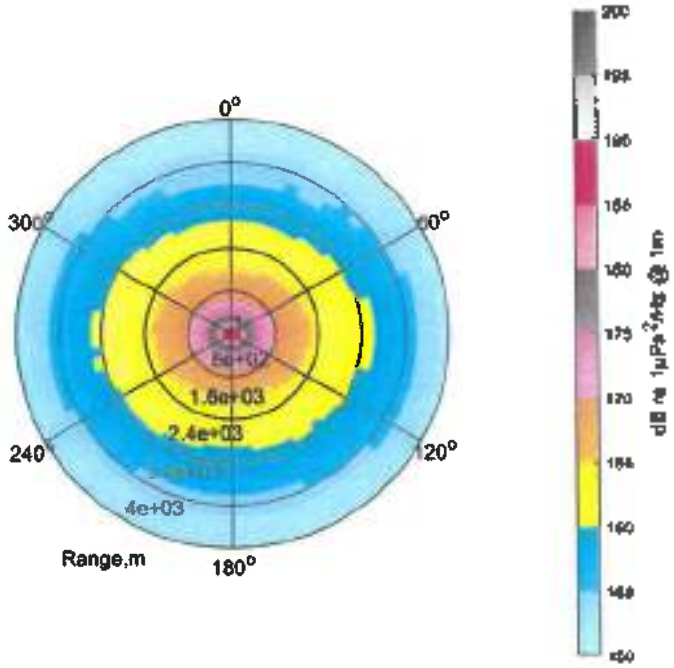
This section presents the modelling results for seismic surveys which include three modelling components (i.e., short range modelling, long range modelling and cumulative noise exposure modelling).

5.1 Short Range Modelling

The received SELs have been modelled for four (4) water depth cases for the 3D survey area (i.e., 1,900 m, 2,500 m, 3,100 m, and 3,700 m) from the G-Gun II 3 370 CUI source array.

Taking the 2,200 m water depth case as an example, Figure 14 shows the maximum received SELs across the water column for a single survey shot as a function of azimuth (0 – 360°) and near-field horizontal range (0 – 4 km) from the centre of the array. The figure illustrates slightly higher SEL levels in the cross-line directions as a result of the directionality of the source array.

Figure 14 **The predicted maximum SELs across the water column as a function of azimuth and horizontal range from the centre of the array. The 0-degree azimuth corresponds to the in-line direction. Water depth: 1,900 m**



The scatter plots of the predicted maximum SELs across the water column for all azimuths as a function of horizontal range (0 – 4 km) from the source array are displayed in Figure 15 for all relevant water depth cases. It is noted from the figure:

(a) For the proposed 3D seismic survey, the maximum received SELs for the four depth cases are nearly identical, as the water depths are all much higher than the deep water Sound Fixing and Ranging (SOFAR) channel (~1,000 m), and the maximum SELs are expected to be dominated by direct arrival acoustic energy from the array source.

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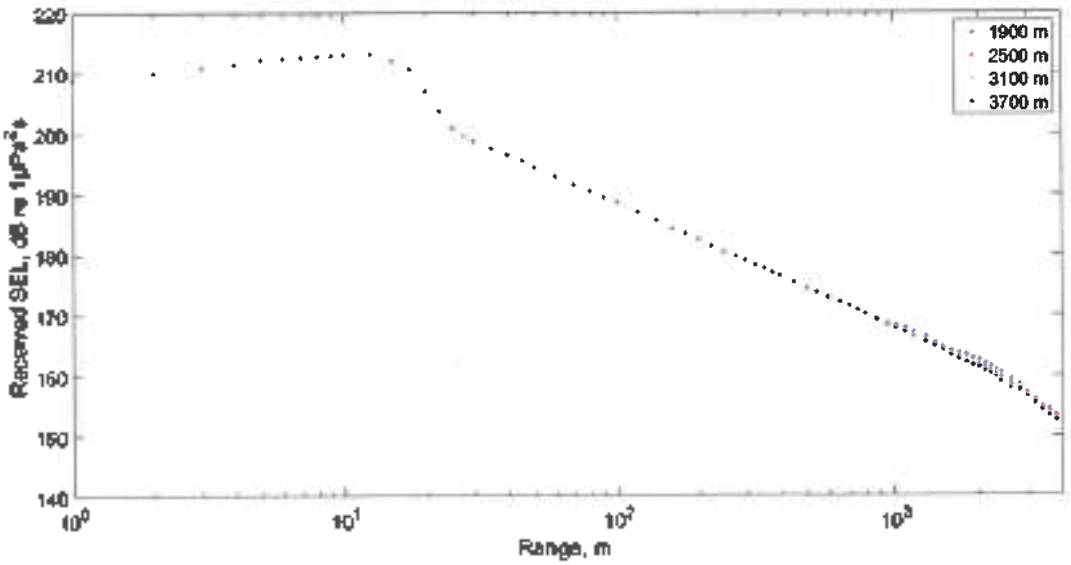
(b) At horizontal distances further away from the array centre (> 1 000 m), the maximum received SELs are predicted to be slightly higher for 1 900 m and 2 500 m water depths. This is because the sound field of a shallower water depth has the highest acoustic energy reflected from the seabed among the water depth cases.

Figure 15 The predicted maximum SELs across the water column for all azimuths as a function of range (0 – 4 km) from the source locations for the 3D source array



5.2 Long Range Modelling

Figure 16 shows the horizontal contour image of the predicted maximum SELs received at locations up to 200 km from source location L1, overlaying the local bathymetry contours. Figure 17 shows the vertical contour images of predicted SELs across the water column along the propagation paths to the west, east, north and south of the modelled location.

Both horizontal and vertical contour images for all other long range modelling locations are attached in Appendix D.

As can be seen from the horizontal and vertical contour figures, the received noise levels at far-field locations vary at different angles and distances from the source locations. This directivity of received levels is due to a combination of the directivity of the source array, and propagation effects caused by bathymetry and sound speed profile variations.

In general, the bathymetry profiles with significant upslope section across the continental slope region have the sound propagations experiencing significant attenuation due to the strong interaction between the sound signal and the seabed. The bathymetry profiles with downslope section have much less sound attenuation. These effects are evident in all locations for propagation paths towards shoreline directions.

For all source locations and except for downslope sections, the seabed depth variations are not significant along the propagation paths within the deep-water region. Therefore, the directivity of received noise is dominated by the directionality of the source array.

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Figure 16 **Modelled maximum SEL (unweighted and maximum level across water column) contours for source location L1 to a maximum range of 200 km, overlayed with bathymetry contour lines. Coordinates in WGS 84/UTM Zone 33S.**

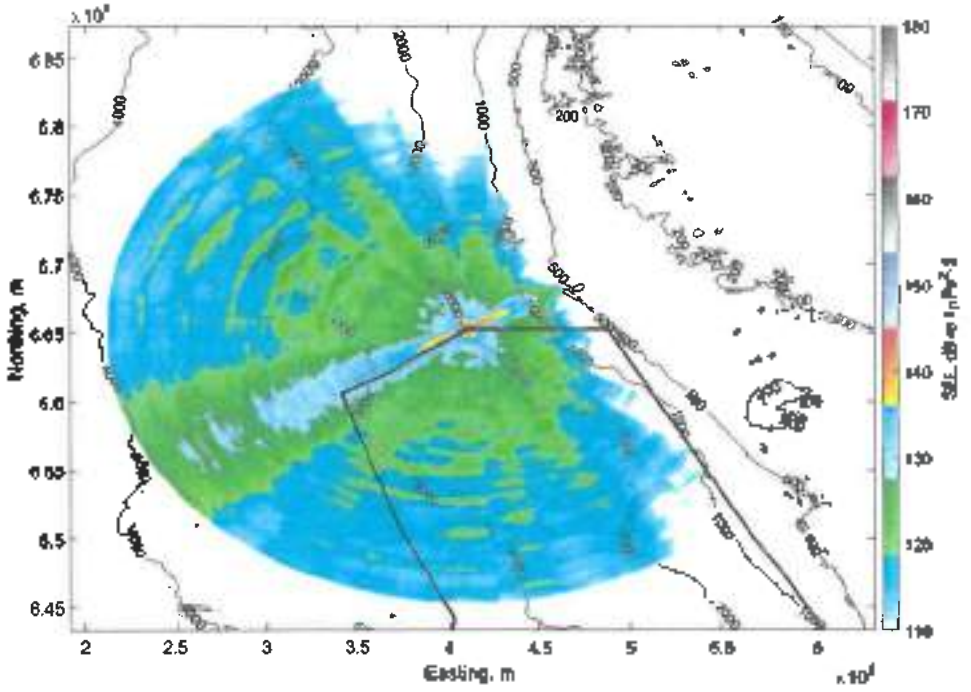
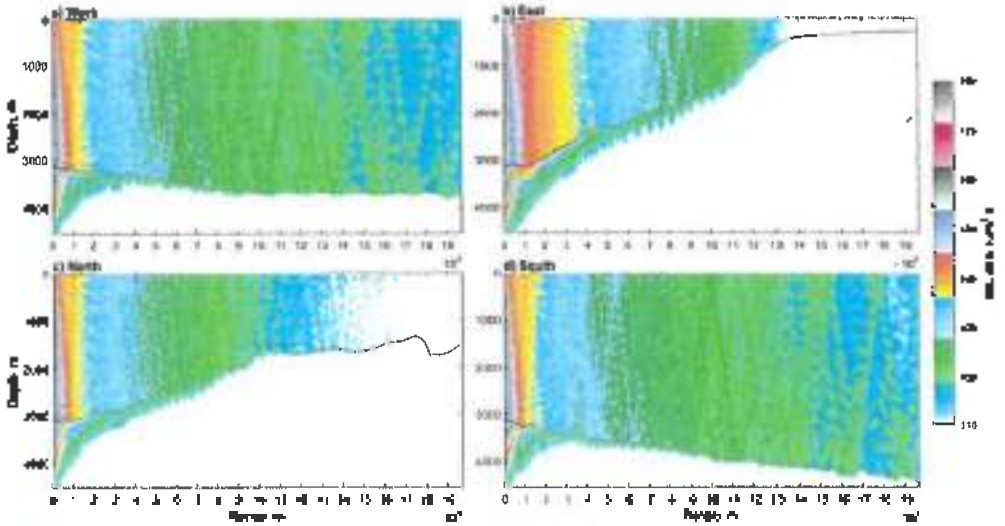


Figure 17 **Modelled SELs (unweighted) vs range and depth along the propagation path towards a) west b) east c) north and d) south direction from the source location L1. Black line shows the seabed depth.**



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5.3 Cumulative SEL Modelling

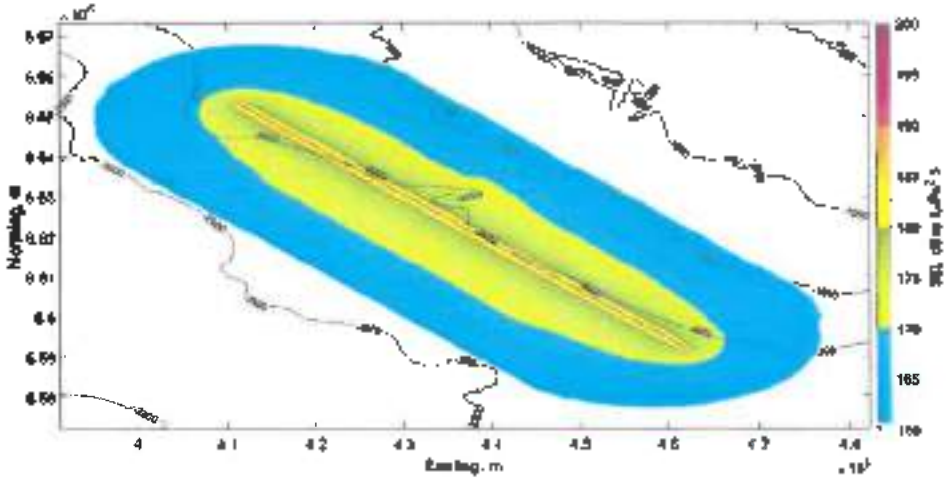
The sound exposure contributions from adjacent survey shots vary with the distances from the receiving locations to the survey line. From the short range modelling results as presented in Section 5.1, sound exposure level from a survey shot received at a receiving location with a distance of 1.0 km is predicted to be up to 30 dB lower than the level from a survey shot at a close distance of 30 m.

With the receiving location perpendicularly further away from the survey lines, the distance differences between the survey location and adjacent survey shots become smaller, and the sound exposure contributions from adjacent multiple shots along the survey lines become more significant proportionally compared with the survey shots closer to the survey lines. Based on this consideration, cumulative modelling is carried out for a modelling area within a 60 km zone around the survey lines and with a 100 metre grid size, so that the modelling area is sufficiently large to include all potential zones of impact for assessed marine fauna species.

The cumulative SEL modelling has been carried out for the 24-hour survey operation scenarios as described in Section 4.2.3.1, based on the modelling methodology and procedure as laid out in Section 4.2.3, for unweighted SEL_{24} case and weighted SEL_{24} cases with frequency weighting functions of different marine mammal hearing groups applied.

The modelled unweighted SEL_{24h} contour map for survey scenario S1 of the 3D seismic survey is presented in Figure 18. All other survey scenarios are attached in Noise Modelling Figures

Figure 18 The predicted maximum unweighted SEL_{24h} across the water column for assessed survey scenario S1 (Line 1) for the 3D survey



5.4 Zones of Impact - Immediate Exposure from Single Pulses

Based on the noise modelling prediction results presented above, the single pulses immediate exposure zones of impact (i.e., maximum horizontal threshold distance from array source location/survey lines) for marine fauna species of interest are summarized as follows.

Table 11 below outlines the predicted maximum SELs and the estimated Pk SPLs and RMS SPL across the water column for all azimuths as a function of horizontal distance from the seismic airgun source array.

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for water depth range within the survey area, based on the short range SEL modelling results as in Section 5.1 and relevant estimate approach as in Section 4.2.4.

Table 11 The maximum SELs, Pk SPLs and RMS SPL across the water column for all azimuths as a function of distance from the source array for water depth range within the 3D survey area

Horizontal distance from the source array, m	The predicted maximum levels across the water column for all azimuths, for water depth range within the survey area		
	SEL, dB re 1 μPa²·s	Pk SPL, dB re 1μPa	RMS SPL, dB re 1μPa
10	213	237	224
20	207	231	218
50	194	218	205
80	191	214.5	201.5
100	189	213	200
200	182	206	193
500	174	198	185
800	170	194	180
1 000	168	192	178
2 000	162	185	170
4 000	156	180	163

The zones of impact from seismic surveys based on per-pulse SEL, Pk SPL and RMS SPL metrics are estimated and presented in Table 12 for PTS and TTS effects for marine mammals, Table 13 for fish, Table 14 for sea turtles, and Table 15 for behavioural disturbance for marine mammals and sea turtles.

5.4.1 Marine Mammal Physiological Effects

Due to the high level of impulsive signal emissions from the array source, marine mammals are predicted to experience a permanent auditory threshold shift (PTS) at close proximity to the source arrays due to the immediate exposure to individual pulses. Based on zones of impact estimated Pk-SPL metric criteria as in Table 12 marine mammals of all hearing groups except very-high-frequency cetaceans are predicted to experience PTS effect within approximately 50 m from the 3D source array at all assessed water depth scenarios. The maximum zones of PTS effect for very-high-frequency cetaceans are predicted to be within 325 m from the 3D array source.

The zones of a temporary auditory threshold shift (TTS) due to a single pulse exposure for marine mammals of all hearing groups except very-high-frequency cetaceans are predicted to be within approximately 100 m from the source array. The maximum zones of TTS effect for very-high-frequency cetaceans are predicted to be within 650 m from the array source as presented in Table 12.

It should be noted that the zones of immediate impact assessed are for the airgun array source under the full-power operation condition (with an operating pressure of 2,000 psi). During the soft start process,

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the airgun array source is under reduced operating pressure conditions, and consequently has lower noise emissions.

As such, the zones of impact during the soft start process are predicted to be less than the full-power operation condition. As an example, under a reduced operating pressure of 1,000 psi, the noise emissions from the airgun array source is approximately 6 dB lower than from the full-power operation, and the resulted zones of impact are estimated to be approximately half of those zones assessed under the full-power operation condition.

Table 12 Zones of immediate impact from single seismic airgun array pulses for PTS and TTS – marine mammals

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to impact threshold levels			
	Injury (PTS) onset		TTS onset	
	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m
Low-frequency cetaceans (LF)	219	45	213	90
High-frequency cetaceans (HF)	230	21	224	27
Very-high-frequency cetaceans (VHF)	202	325	196	650
Sirenians (SI)	226	25	220	40
Phocid carnivores in water (PCW)	218	50	212	100
Other marine carnivores in water (OCW)	232	19	226	24

5.4.2 Fish Physiological Effects

For seismic surveys, as presented in **Table 13**, the zones of potential injuries for fish species with a swim bladder, fish eggs and fish larvae are predicted to be within 180 m from the airgun array source.

However, fish species without swim bladders have higher injury impact thresholds, and therefore have smaller zones of potential injuries within 90 m from the airgun array source.

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Table 13 Zones of immediate impact from single airgun array pulses for mortality and recovery injury– fish, turtles, fish eggs and fish larvae

Type of animal	Zones of impact – maximum horizontal distances from source to impact threshold levels			
	Mortality and potential mortal injury		Recovery injury	
	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m
Fish: no swim bladder (particle motion detection)	>213	90	>213	90
Fish: swim bladder is not involved in hearing (particle motion detection)	>207	180	>207	180
Fish- swim bladder involved in hearing (primarily pressure detection)	>207	180	>207	180
Fish eggs and fish larvae	>207	180	-	-
Note: A dash indicates the threshold is not applicable.				

5.4.3 Sea Turtle Physiological Effects

The sea turtles are predicted to experience PTS effect in the close proximity to the source array due to the immediate exposure to individual pulses within approximately 19 m. The maximum zones of TTS due to a single pulse exposure for sea turtles are predicted to be within approximately 24 m from the array source as presented in Table 14.

Table 14 Zones of immediate impact from single seismic airgun array pulses for PTS and TTS – sea turtles

Type of animal	Zones of impact – maximum horizontal distances from source to impact threshold levels			
	Injury (PTS) onset		TTS onset	
	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m
Sea turtles	232	19	226	24
Note: A dash indicates the threshold is not applicable.				

5.4.4 Marine Mammal, Fish and Sea Turtle Behavioural Responses

The zones of behavioural disturbance for marine mammals and turtles caused by the immediate exposure to individual seismic airgun array pulses for seismic surveys are presented in Table 15 below.

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The results show that behavioural disturbance caused by the immediate exposure to individual pulses are predicted to be within 3.8 km from the array source for marine mammals of all hearing groups, and within 1.3 km from the array source for sea turtles.

Based on the noise exposure criteria provided by Popper et al. (2014), relatively high to moderate behavioural risks are expected for fish species at near to intermediate distances (tens to hundreds of meters) from the source location. Relatively low behavioural risks are expected for fish species at far field distances (thousands of meters) from the source location.

Table 15 Zones of immediate impact from single seismic airgun array pulses for behavioural disturbance – marine mammals and sea turtles

Type of animal	Zones of impact – maximum horizontal distances from source to impact threshold levels	
	Behavioural disturbance	
	Criteria - RMS SPL, dB re 1µPa	Maximum threshold distance, m
Marine mammals	160	3,800
Sea turtles	175	1,300

5.5 Zones of Impact – Cumulative Exposure from Multiple Pulses

As described in Section 5.3, for seismic surveys, the cumulative sound fields in unweighted SEL_{24h} and weighted SEL_{24h} with relevant frequency weighting functions applied are modelled based on an assumed survey scenario for the 3D survey.

The zones of cumulative impact for seismic surveys (i.e., the maximum horizontal perpendicular distances from assessed survey lines to cumulative impact threshold levels) are estimated based on the above modelling results. Table 16 presents the cumulative PTS and TTS effects for marine mammals, and Table 17 the cumulative mortality, injury and TTS effects for fish; and Table 18 the cumulative PTS and TTS effects for sea turtles.

5.5.1 Cumulative Impacts for Marine Mammals

For seismic surveys, among marine mammals of all six hearing groups, low-frequency cetaceans have the highest zones of PTS and TTS impact, as can be seen in Table 16. The zones of PTS impact are predicted to range up to 340 m from the source location, from the adjacent survey lines for the relevant typical 24-hour survey operation scenarios considered, and the maximum zone of TTS impact is predicted to be around 5 km from their relevant adjacent survey lines.

The cumulative PTS and TTS criteria SEL_{24h} are predicted not to be exceeded for high-frequency cetaceans, sirenians and other marine carnivores in water.

The cumulative PTS criteria SEL_{24h} are predicted to be exceeded for both very-high-frequency cetaceans and phocid carnivores in water, with zones of impact within 40 m from the adjacent survey lines. For very-high frequency cetaceans the zones of TTS impact are predicted to range around 1,200 m from the source location, and for phocid carnivores in water around 500 m from the source location, from the relevant adjacent survey lines for the 24-hour survey operation scenario considered.

It should be noted that the cumulative zones of impact presented above are conservative, and since cetaceans are highly mobile, they are likely to have moved considerable distances away from the source over the cumulative survey period. Thus, cumulative effects would only be expected where the animals do not move away from the area, e.g., from specific coastal areas used as calving sites of from feeding focal points such as Tripp Seamount. As Tripp Seamount is approximately 70 km from the north point of the survey area, cumulative effects would not be expected.

Table 16 Zones of cumulative impact from multiple airgun array pulses of the 3D survey for PTS and TTS – marine mammals

Marine mammal hearing group	Zones of impact – maximum horizontal perpendicular distances from assessed survey lines to cumulative impact threshold levels			
	Injury (PTS) onset		TTS onset	
	Criteria – Weighted SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m	Criteria – Weighted SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m
Low-frequency cetaceans (LF)	183	340	168	5,050
High-frequency cetaceans (HF)	185	-	170	-
Very-high-frequency cetaceans (VHF)	155	40	140	1,200
Sirenians (SI)	203	-	175	-
Phocid carnivores in water (PCW)	185	10	170	500
Other marine carnivores in water (OCW)	203	-	188	-

Note: A dash indicates the threshold is not reached.

5.5.2 Cumulative impacts for fish

As presented in Table 17, the zones of potential mortal injuries for fish species with a swim bladder, fish eggs and fish larvae are predicted to be within 30 m from the adjacent survey lines for all the 24-hour survey operation scenarios considered. For recoverable injury, the zones of impact are predicted to be within 80 m from the adjacent survey lines for fish with a swim bladder for all the operation scenarios considered. Fish without swim bladder are not expected to suffer or any potential injury. The zones of TTS effect for fish species with and without swim bladders are predicted to be within 2.9 km, from the adjacent survey lines for the 24-hour survey operation scenario considered.

Existing experimental data regarding recoverable injury and TTS impacts for fish eggs and larvae is sparse and no guideline recommendations have been provided. However, based on a subjective approach as indicated in Table 3, noise impacts related to recoverable injury and TTS on fish eggs and larvae are expected to be moderate at the near field from the source location. Impact is expected to be low for all of them at intermediate and far field from the source location.

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Table 17 Zones of cumulative impact from multiple airgun array pulses of 3D surveys for mortality and recovery injury – fish, fish eggs and fish larvae

Type of animal	Zones of impact – maximum horizontal perpendicular distances from assessed survey lines to cumulative impact threshold levels					
	Mortality and potential mortal injury		Recoverable injury		TTS	
	Criteria - SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m	Criteria - SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m	Criteria - SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m
Fish: no swim bladder (particle motion detection)	219	-	216	-	186	2,900
Fish: swim bladder is not involved in hearing (particle motion detection)	210	10	203	80	186	2,900
Fish: swim bladder involved in hearing (primarily pressure detection)	207	30	203	80	186	2,900
Fish eggs and fish larvae	210	10	-	-	-	-

Note: A dash indicates the threshold is not applicable.

5.5.3 Cumulative impacts for sea turtles

Noise impacts related to recoverable injury and TTS on sea turtles are expected to be high at the near field from the source location as shown in Table 18 maximum zones of PTS impact are predicted to range within 10 m from the source location, from the adjacent survey line for the relevant typical 24-hour survey operation scenario considered. The maximum zones of TTS impact are predicted to be around 500 m.

Table 18 Zones of cumulative impact from multiple airgun array pulses of the survey for PTS and TTS – sea turtles

Type of animal	Zones of impact – maximum horizontal perpendicular distances from assessed survey lines to cumulative impact threshold levels			
	Injury (PTS) onset		TTS onset	
	Criteria – Weighted SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m	Criteria – Weighted SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m
Sea turtles	204	10	189	500

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6.0 Discussion

As detailed in **Section 2.0**, dual metric criteria (i.e., per-pulse impact criteria Pk SPL and cumulative exposure impact criteria SEL_{24hr}) are applied to assess PTS and TTS impact for marine mammals, and mortality and recovery injury for fish and sea turtles. The combined threshold distance for each impact effect is considered as the maximum threshold distances (i.e., the worst-case scenario) estimated from either metric criteria being applied.

For marine mammals, the combined zones of impact from seismic surveys for all six hearing groups based on estimated results in **Table 12** and **Table 16** are presented in **Table 19**. As can be seen, the cumulative noise exposure results in extended zones of PTS and TTS impact for low-frequency cetaceans, and extended zones of TTS impact for very-high-frequency cetaceans and phocid carnivores in water.

Table 19 Combined zones of impact from airgun array pulses for PTS and TTS – marine mammals

Marine mammal hearing group	Combined zones of impact – maximum horizontal distances to either Pk SPL or cumulative SEL threshold levels			
	Injury (PTS) onset		TTS onset	
	Criteria applied - Pk SPL, dB re 1 µPa / Weighted SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m	Criteria applied - Pk SPL, dB re 1 µPa / Weighted SEL_{24hr} dB re 1 $\mu Pa^2 \cdot s$	Maximum threshold distance, m
Low-frequency cetaceans (LF)	183 Weighted SEL_{24hr}	340	168 Weighted SEL_{24hr}	5,050
High-frequency cetaceans (HF)	230 Pk SPL	21	224 Pk SPL	27
Very-high-frequency cetaceans (VHF)	202' Pk SPL	325	140 Weighted SEL_{24hr}	1,200
Sirenians (SI)	226 Pk SPL	25	220 Pk SPL	40
Phocid carnivores in water (PCW)	218 Pk SPL	50	170 Weighted SEL_{24hr}	500
Other marine carnivores in water (OCW)	232 Pk SPL	19	226 Pk SPL	24

The combined zones of mortal and recoverable injury impact from seismic surveys for fish species are the zones of impact estimated based on immediate impact criteria Pk SPL as in **Table 13** and the zones of TTS impact from seismic surveys for fish species based on cumulative impact criteria SEL as in **Table 17**

For sea turtles, the combined zones of impact from seismic surveys based on the noise criteria for PTS and TTS are presented in **Table 14** and **Table 18**.

For marine seismic surveys, the cumulative exposure level at certain locations is modelled based on the assumption that the animals are constantly exposed to the survey airgun noise at a fixed location over the entire 24-hour period.

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However, in reality marine fauna species, such as marine mammals, fish species and sea turtles, would not stay in the same location for the entire period unless individuals are attached to a specific feeding or breeding area or those species that cannot move away (e.g., plankton and fish eggs/larvae).

Therefore, the zones of impact assessed for marine mammals, fish species and sea turtles represent the worst-case consideration.

6.1 Recommended Management Measures

This section includes recommended management measures from seismic survey activities related to zones of impact and implementation of a noise monitoring programme and soft-starts.

- Noise Monitoring Programme – a best practice to minimize the potential for deliberate injury to marine mammal by monitoring a defined area (safety zone) before a noise source is activated and delaying operations in the event a marine mammal is observed.
- Safety zones – these are observation and shut-down zones sized based on the likely noise levels produced by the seismic activity.
- Soft-starts – these procedures are recommended for all seismic activities, irrespective of location and time of year, when marine mammal species may potentially be present within the noise footprint of the seismic activity.

6.1.1 Noise Monitoring Programme

Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented which would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior to the commencement of the survey and then operational levels of noise during the survey.

Additionally, monitoring can be further achieved through a combination of visual and passive acoustic methods. No marine mammal detection method is 100% effective for all species, rather it is considered that these methods seek to complement each other.

Visual monitoring is done by a Marine Mammal Observer (MMO). It should be done from the source vessel with the MMO located on a suitable platform that allows the best view of the safety zone and ahead of the vessel.

The use of Passive Acoustic Monitoring (PAM) is a viable monitoring method during operation periods when effective visual monitoring (due to poor visibility conditions or during night) is not possible. Specialist trained PAM operators are needed to set up and deploy the equipment and to interpret detected sounds.

6.1.2 Safety Zones

Recommended safety zones around the survey vessel and seismic array based on the seismic activity to be performed:

- Immediate Exposure from Single Pulses – refer to maximum threshold distances in PTS for marine mammals and sea turtles, and potential mortal injury for fish.

- Cumulative Exposure from Multiple Pulses - refer to maximum threshold distances in PTS for marine mammals and sea turtles, and potential mortal injury for fish.

6.1.3 Soft-Starts

Implement a soft-start procedure if testing multiple seismic sources. The soft-start should be carried out over a time proportional to the number of seismic sources being tested and not exceed 20 minutes; source arrays should be tested in order of increasing volume.

- If testing the seismic source at full operational capacity, a 20-minute soft-start is required.
- If testing a single lowest power source, a soft-start is not required.
- Delay soft-starts if shoaling large pelagic fish, turtles, or marine mammals are observed within the zone of impact.
- A soft-start should not begin until 30 minutes after cetaceans depart the zone of impact or 30 minutes after they are last seen or acoustically detected in the zone of impact.
- Schedule soft-starts to minimise, as far as possible, the interval between reaching full power operation and commencing a survey line. The period between the end of the soft start and commencing with a survey line must not exceed 20 minutes.

6.1.4 Cumulative impacts from multiple simultaneous survey campaigns

In the unlikely event that multiple surveys would take place at the same time within the same survey area, the risk of cumulative noise impact must be considered and is suggested to be managed as follows:

- The maximum number of simultaneous surveys in the entire survey area would be limited to three;
- Each of the additional activities to that described in this report would be modelled or otherwise considered in terms of the cumulative noise level and with reference to the criteria described in this report; and
- During airgun releases, each survey vessel is at least 40 kilometres from any other survey vessel until sufficient objective evidence is obtained to demonstrate that a reduced buffer distance is acceptable

Note: This 40km buffer maintained by any other survey vessels aligns to advice by authorities[4] and is considered sufficient on the basis that it provides a corridor between vessels where airgun noise approaches ambient levels such that animals may pass between, and/or the potential cumulative effect beyond this distance is considered to be negligible. Further modelling is only considered required in the case where a 40 km buffer distance between active survey ships cannot be maintained.

[4] U.S. Department of the Interior Bureau of Ocean Energy Management 2014, Proposed Geological and Geophysical Activities, Mid-Atlantic and South Planning Areas, Final Programmatic Environmental Impact Statement, Gulf of Mexico OCS Region. New Orleans, https://www.boc.gov/Item/20144500290/ Volume 1, Section 2.2.2.3; p2-37.

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7.0 Statement of Limitations

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8.0 Closure

SLR trusts this report meets the requirements to assist ElMS with regulatory approval of the Environmental and Social Impact Assessment. If you have any questions, please do not hesitate to contact Jonathan Vallarta or Justin Eickmeier at the information below:

Sincerely,

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Appendix A Acoustic Terminology

TGS: South Africa Orange Basin 3D Seismic Survey

Sound Transmission Loss Modelling

Environmental Impact Management Services Pty Ltd.

SLR Project No. 675.30163.00000

October 10, 2022

Acoustic Terminology

1/3 Octave Band Levels	The energy of a sound split into a series of adjacent frequency bands, each being 1/3 of an octave wide
Decibel (dB)	The decibel (abbreviated dB) is the unit used to measure the intensity of a sound on a logarithmic scale.
Peak Sound Pressure Level (Pk SPL)	The peak sound pressure level is the logarithmic ratio of the peak pressure over the impulsive signal event to the reference pressure
Peak-to-Peak Sound Pressure Level (Pk-Pk SPL)	The peak-to-peak sound pressure level is the logarithmic ratio of the difference between the maximum and minimum pressure over the impulsive signal event to the reference pressure
Power Spectral Density (PSD)	PSD describes how the power of a signal is distributed with frequency
Root-Mean-Square Sound Pressure Level (RMS SPL)	The mean-square sound pressure is the average of the squared pressure over the pulse duration. The root-mean-square sound pressure level is the logarithmic ratio of the root of the mean-square pressure to the reference pressure. Pulse duration is taken as the duration between the 5% and the 95% points on the cumulative energy curve
Sound Exposure Level (SEL)	SEL is a measure of energy. Specifically, it is the dB level of the time integral of the squared instantaneous sound pressure normalised to a 1-s period
Sound Pressure	A deviation from the ambient hydrostatic pressure caused by a sound wave
Sound Pressure Level (SPL)	The logarithmic ratio of sound pressure to the reference pressure. The reference pressure underwater is P_{ref} = 1 µPa
Sound Speed Profile	A graph of the speed of sound in the water column as a function of depth
Source Level (SL)	The acoustic source level is the level referenced to a distance of 1 m from a point source

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Appendix B Auditory Weighting Functions

TGS: South Africa Orange Basin 3D Seismic Survey

Sound Transmission Loss Modelling

Environmental Impact Management Services Pty Ltd.

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Auditory Weighting Functions

This appendix provides the recommended frequency-weighting functions for use in assessing the effects of relatively intense sounds on hearing. This information is derived based on all available relevant data and published literature (i.e., the state of current knowledge).

Marine animals do not hear equally well at all frequencies within their functional hearing range. Based on the hearing range and sensitivities, Southall et al. (2019) have categorised marine mammal species (i.e., cetaceans and pinnipeds) into six underwater hearing groups: low-frequency (LF), high-frequency (HF), very high-frequency (VHF) cetaceans, Sirenians (SI), Phocid carnivores in water (PCW) and Other marine carnivores in water (OCW). For each specific marine mammal species, refer to Appendix I – 6 within the reference document (Southall et al. 2019) for their corresponding hearing groups.

The potential noise effects on animals depend on how well the animals can hear the noise. Frequency weighting is a method of quantitatively compensating for the differential frequency response of sensory systems (Southall et al., 2019)

When developing updated scientific recommendations in marine mammal noise exposure criteria, Southall et al. (2019) adopted the auditory weighting functions as expressed in the equation below, which are based on the quantitative method by Finneran (2016) and are consistent with the U.S. National Oceanic and Atmospheric Administration (NOAA) technical guidance (NMFS, 2016 & 2018). Finneran et al. (2017) revised the auditory-weighting functions for sea turtle (TU). Audiogram slopes were calculated across a frequency range of one octave for five species (refer to Appendix C) with composite audiograms based on experimental data.

$$W(f) = C + 10log10\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\} \quad \text{(2.1)}$$

Where:

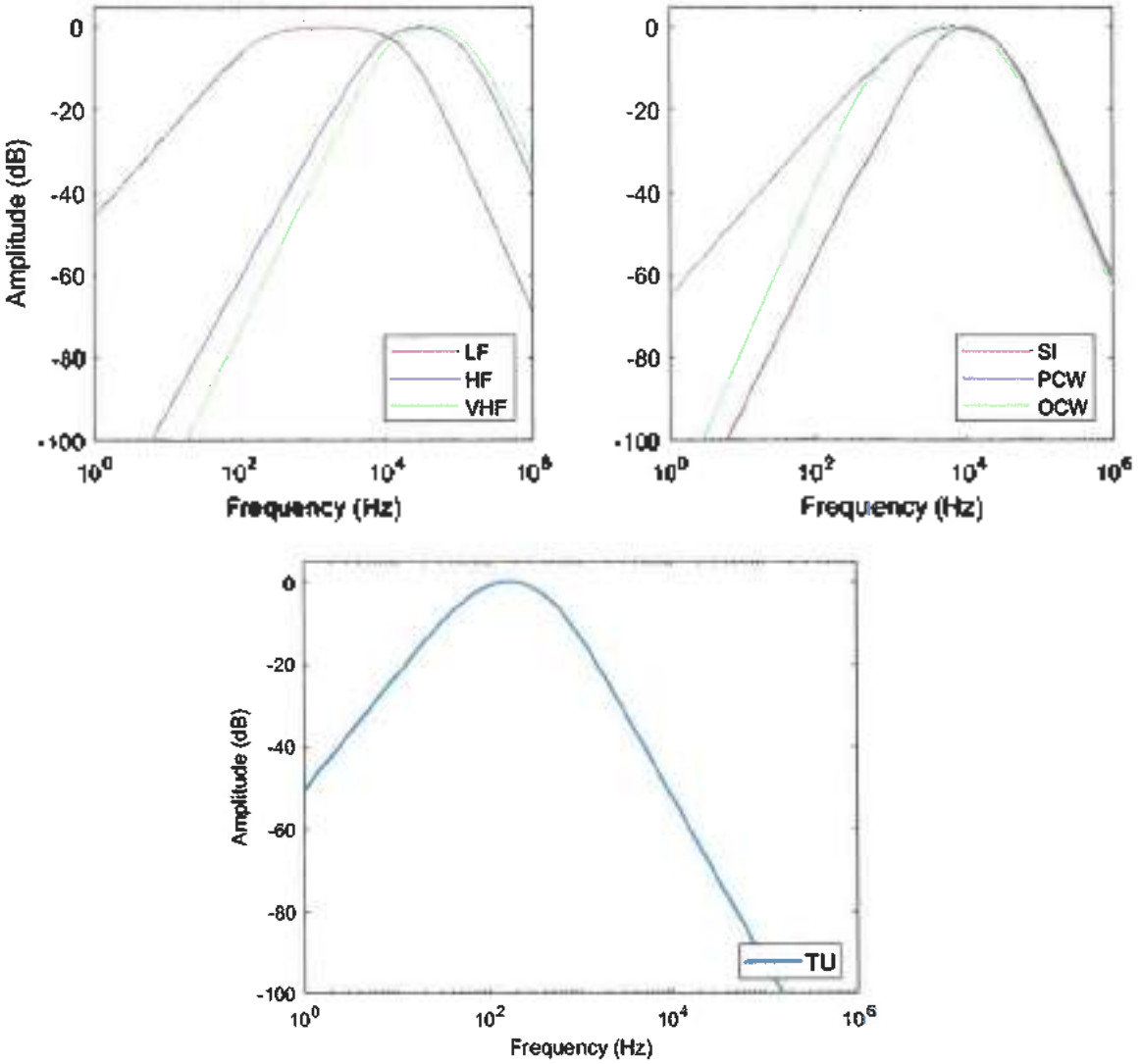
- $W(f)$ is the weighting function amplitude (in dB) at frequency f (in kHz).
- f_1 represents LF transition value (in kHz), i.e., the lower frequency at which the function amplitude begins to change from the flat, central portion of the curve.
- f_2 represents HF transition value (in kHz), i.e., the upper frequency at which the function amplitude begins to change from the flat, central portion of the curve.
- a represents the LF exponent value (dimensionless) which defines the rate of decline of the weighting function amplitude at low frequencies. The change in weighting function amplitude with frequency at low frequencies (the LF slope) is 20a dB/decade.
- b represents the HF exponent value (dimensionless) which defines the rate of decline of weighting function amplitude at high frequencies, becoming linear with the logarithm of frequency. The change in weighting function amplitude with frequency at high frequencies (the HF slope) is -20b dB/decade.
- C is the constant that defines the vertical position of the curve. It is defined so that the maximum amplitude of the weighting function equals 0 dB (with all other values being negative).

Table B.1 lists the auditory weighting parameters as defined above for the seven hearing groups. The corresponding auditory weighting functions for all hearing groups are presented in Figure B.1.

Table B.1 Auditory weighting functions - parameters (Southall et al. 2019; Finneran et al. 2017)

Marine mammal hearing group	*a*	*b*	*f1 (kHz)*	*f2 (kHz)*	*C (dB)*
Low-frequency cetaceans (LF)	1.0	2	0.20	19	0.13
High-frequency cetaceans (HF)	1.6	2	8.8	110	1.20
Very-high-frequency cetaceans (VHF)	1.8	2	12	140	1.36
Sirenians (SI)	1.8	2	4.3	25	2.62
Phocid carnivores in water (PCW)	1.0	2	1.9	30	0.75
Other marine carnivores in water (OCW)	2.0	2	0.94	25	0.64
Sea turtles (TU)	1.4	2	0.077	0.44	2.35

Figure B.1 Auditory weighting functions – spectral plots (Southall et al. 2019; Finneran et al. 2017)



Appendix C Marine Mammal Classification

TGS: South Africa Orange Basin 3D Seismic Survey

Sound Transmission Loss Modelling

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Marine Mammal Classification

The following appendix gives a summary of marine mammal hearing group classification and sea turtles. Not all animals listed in **Table C.1** are expected to be found in the vicinity of the project area.

Table C.1 Summary of marine mammal classification

Classification	Common Name	Scientific Name
Low frequency cetaceans (extracted from Appendix 1 Southall *et al.* (2019))	Bowhead whale	*Balaena mysticetus*
	Southern right whale	*Eubalaena australias*
	North Atlantic right whale	*Eubalaena glacialis*
	North Pacific right whale	*Eubalaena japonica*
	Common minke whale	*Balaenoptera acutorostrata*
	Antarctic minke whale	*Balaenoptera bonaerensis*
	Sei whale	*Balaenoptera borealis*
	Bryde's whale	*Balaenoptera edeni*
	Omura's whale	*Balaenoptera omurai*
	Fin whale	*Balaenoptera physalus*
	Humpback whale	*Megaptera novaeangliae*
	Pygmy right whale	*Caperea marginata*
	Gray whale	*Eschrichtius robustus*
High frequency cetaceans (extracted from Appendix 2 Southall *et al.* (2019))	Sperm whale	*Physeter macrocephalus*
	Arnoux' beaked whale	*Berardius arnuxii*
	Baird's beaked whale	*Berardius bairdii*
	Northern bottlenose whale	*Hyperoodon ampullatus*
	Southern bottlenose whale	*Hyperoodon planifrons*
	Tropical bottlenose whale	*Indopacetus pacificus*
	Sowerby's beaked whale	*Mesoplodon bidens*
	Andrews' beaked whale	*Mesoplodon bowdoini*
	Hubb's beaked whale	*Mesoplodon carlhubbsi*
	Blainville's beaked whale	*Mesoplodon densirostris*
	Gervais' beaked whale	*Mesoplodon europaeus*
	Ginkgo-toothed beaked whale	*Mesoplodon ginkgodens*
	Gray's beaked whale	*Mesoplodon grayi*

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Classification	Common Name	Scientific Name
	Hector's beaked whale	*Mesoplodon hectori*
	Deraniyagala's beaked whale	*Mesoplodon hotaula*
	Layard's beaked whale	*Mesoplodon layardii*
	True's beaked whale	*Mesoplodon mirus*
	Perrin's beaked whale	*Mesoplodon perrini*
	Pygmy beaked whale	*Mesoplodon peruvianus*
	Stejneger's beaked whale	*Mesoplodon stejnegeri*
	Spade-toothed whale	*Mesoplodon traversii*
	Tasman beaked whale	*Tasmacetus shepherdi*
	Cuvier's beaked whale	*Ziphius cavirostris*
	Killer whale	*Orcinus orca*
	Beluga	*Delphinapterus leucas*
	Narwhal	*Monodon monoceros*
	Short- and long-beaked common dolphins	*Delphinus delphis*
	Pygmy killer whale	*Feresa attenuata*
	Short-finned pilot whale	*Globicephala macrorhynchus*
	Long-finned pilot whale	*Globicephala melas*
	Risso's dolphin	*Grampus griseus*
	Fraser's dolphin	*Lagenodelphis hosei*
	Atlantic white-sided dolphin	*Lagenorhynchus acutus*
	White-beaked dolphin	*Lagenorhynchus albirostris*
	Pacific white-sided dolphin	*Lagenorhynchus obliquidens*
	Dusky dolphin	*Lagenorhynchus obscurus*
	Northern right whale dolphin	*Lissodelphis borealis*
	Southern right whale dolphin	*Lissodelphis peronii*
	Irrawaddy dolphin	*Orcaella brevirostris*
	Australian snubfin dolphin	*Orcaella heinsohni*
	Melon-headed whale	*Peponocephala electra*
	False killer whale	*Pseudorca crassidens*
	Indo-Pacific humpback dolphin	*Sousa chinensis*
	Indian Ocean humpback dolphin	*Sousa plumbea*

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Classification	Common Name	Scientific Name
	Australian humpback dolphin	*Sousa sahulensis*
	Atlantic humpback dolphin	*Sousa teuszii*
	Tucuxi	*Sotalia fluviatilis*
	Guiana dolphin	*Sotalia guianensis*
	Pantropical spotted dolphin	*Stenella attenuata*
	Clymene dolphin	*Stenella clymene*
	Striped dolphin	*Stenella coeruleoalba*
	Atlantic spotted dolphin	*Stenella frontalis*
	Spinner dolphin	*Stenella longirostris*
	Rough-toothed dolphin	*Steno bredanensis*
	Indo-Pacific bottlenose dolphin	*Tursiops aduncus*
	Common bottlenose dolphin	*Tursiops truncatus*
	South Asian river dolphin	*Platanista gangetica*
Very high frequency cetaceans (extracted from Appendix 3 Southall *et al.* (2019))	Peale's dolphin	*Lagenorhynchus australis*
	Hourglass dolphin	*Lagenorhynchus cruciger*
	Commerson's dolphin	*Cephalorhynchus commersonii*
	Chilean dolphin	*Cephalorhynchus eutropia*
	Heaviside's dolphin	*Cephalorhynchus heavisidii*
	Hector's dolphin	*Cephalorhynchus hectori*
	Narrow-ridged finless porpoise	*Neophocaena asiaeorientalis*
	Indo-Pacific finless porpoise	*Neophocaena phocaenoides*
	Spectacled porpoise	*Phocoena dioptrica*
	Harbor porpoise	*Phocoena phocoena*
	Vaquita	*Phocoena sinus*
	Burmeister's porpoise	*Phocoena spinipinnis*
	Dall's porpoise	*Phocoenoides dalli*
	Amazon river dolphin	*Inia geoffrensis*
	Yangtze river dolphin	*Lipotes vexillifer*
	Franciscana	*Pontoporia blainvillei*
	Pygmy sperm whale	*Kogia breviceps*
	Dwarf sperm whale	*Kogia sima*

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Classification	Common Name	Scientific Name
Sirenians (extracted from Appendix 4 Southall et al. (2019))	Amazonian manatee	*Trichechus inunguis*
	West Indian manatee	*Trichechus manatus*
	West African manatee	*Trichechus senegalensis*
	Dugong	*Dugong dugon*
Phocid carnivores (extracted from Appendix 5 Southall et al. (2019))	Hooded seal	*Cystophora cristata*
	Bearded seal	*Erignathus barbatus*
	Gray seal	*Halichoerus grypus*
	Ribbon seal	*Histriophoca fasciata*
	Leopard seal	*Hydrurga leptonyx*
	Weddell seal	*Leptonychotes weddellii*
	Crabeater seal	*Lobodon carcinophaga*
	Northern elephant seal	*Mirounga angustirostris*
	Southern elephant seal	*Mirounga leonina*
	Mediterranean monk seal	*Monachus monachus*
	Hawaiian monk seal	*Neomonachus schauinslandi*
	Ross seal	*Ommatophoca rossii*
	Harp seal	*Pagophilus groenlandicus*
	Spotted seal	*Phoca largha*
	Harbor seal	*Phoca vitulina*
	Caspian seal	*Pusa caspica*
	Ringed seal	*Pusa hispida*
	Baikal seal	*Pusa sibirica*

Classification	Common Name	Scientific Name
Other marine carnivores (extracted from Appendix 6 Southall *et al.* (2019))	Walrus	*Odobenus rosmarus*
	South American fur seal	*Arctocephalus australis*
	New Zealand fur seal	*Arctocephalus forsteri*
	Galapagos fur seal	*Arctocephalus galapagoensis*
	Antarctic fur seal	*Arctocephalus gazella*
	Juan Fernandez fur seal	*Arctocephalus philippii*
	Cape fur seal	*Arctocephalus pusillus*
	Subantarctic fur seal	*Arctocephalus tropicalis*
	Northern fur seal	*Callorhinus ursinus*
	Steller sea lion	*Eumetopias jubatus*
	Australian sea lion	*Neophoca cinerea*
	South American sea lion	*Otaria byronia*
	Hooker's sea lion	*Phocarctos hookeri*
	California sea lion	*Zalophus californianus*
	Galapagos sea lion	*Zalophus wollebaeki*
	Polar bear	*Ursus maritimus*
	Sea otter	*Enhydra lutris*
	Marine otter	*Lontra felina*
Sea Turtles (extracted from Finneran *et al.*, 2017)	Green sea turtle	*Chelonia mydas*
	Kemp's ridley sea turtle	*Lepidochelys kempii*
	Loggerhead sea turtle	*Caretta*
	Leatherback sea turtle	*Dermochelys coriacea*
	Hawksbill sea turtle	*Eretmochelys imbricata*

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Appendix D Noise Modelling Figures

TGS: South Africa Orange Basin 3D Seismic Survey

Sound Transmission Loss Modelling

Environmental Impact Management Services Pty Ltd.

SLR Project No. 675.30163.00000

October 10, 2022

Noise Modelling Figures

Figure D-1 **Modelled maximum SEL (unweighted and maximum level across water column) contours for source location L2 to a maximum range of 200 km, overlayed with bathymetry contour lines. Coordinates in WGS 84/UTM Zone 33S.**

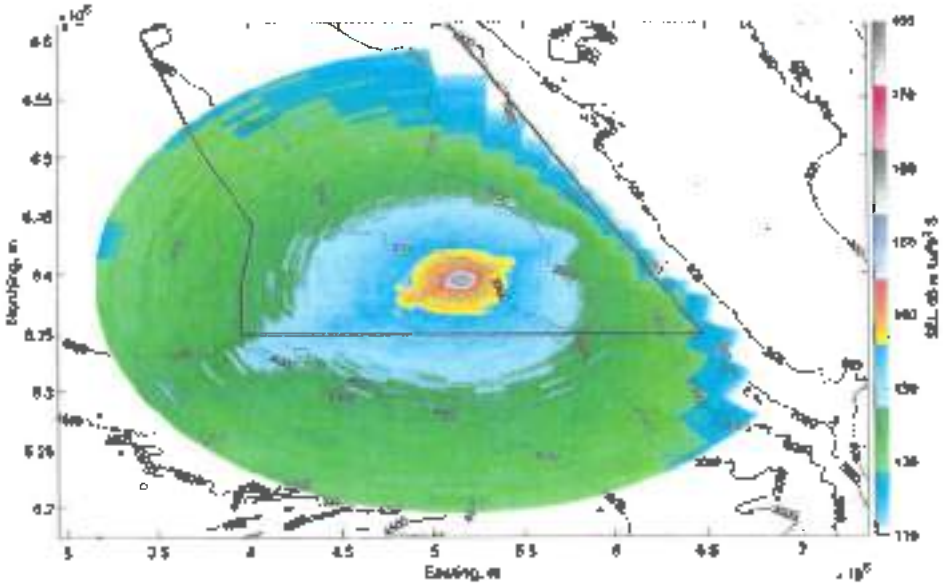


Figure D-2 **Modelled maximum SEL (unweighted and maximum level across water column) contours for source location L3 to a maximum range of 200 km, overlayed with bathymetry contour lines. Coordinates in WGS 84/UTM Zone 33S.**

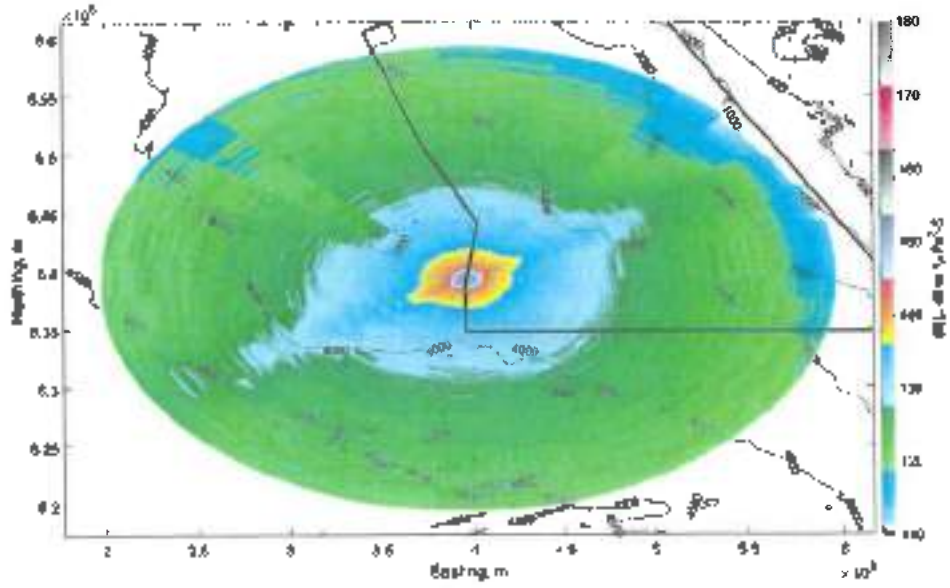


Figure D.3 **Modelled SEL (unweighted) vs range and depth along the propagation path towards a) west b) east c) north and d) south direction from the source location L2. Black line shows the seabed depth.**

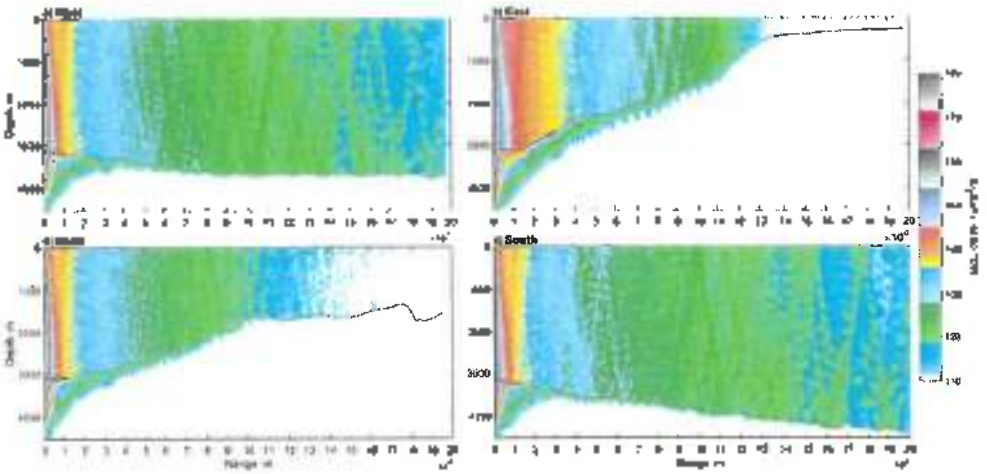


Figure D.4 **Modelled SEL (unweighted) vs range and depth along the propagation path towards a) west b) east c) north and d) south direction from the source location L3. Black line shows the seabed depth.**

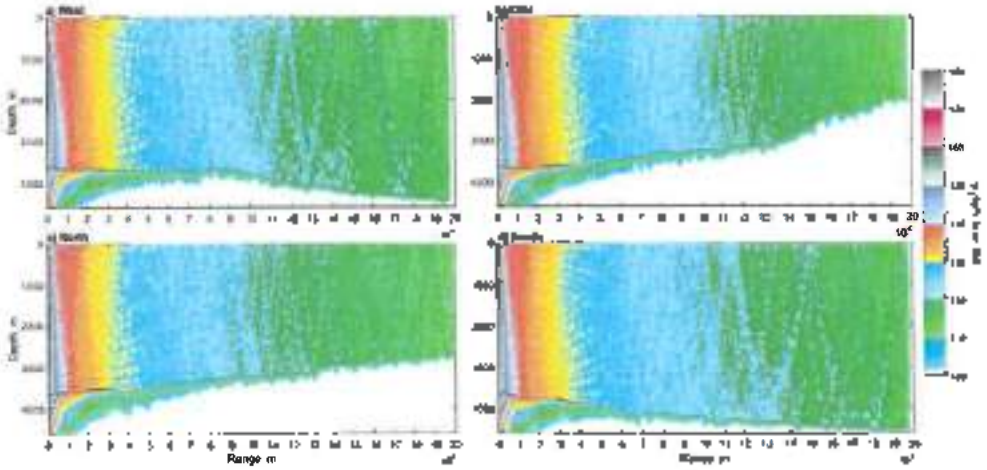


Figure D.5 **The predicted maximum unweighted SEL_{24hr} across the water column for assessed survey scenario S2 for the 3D survey**

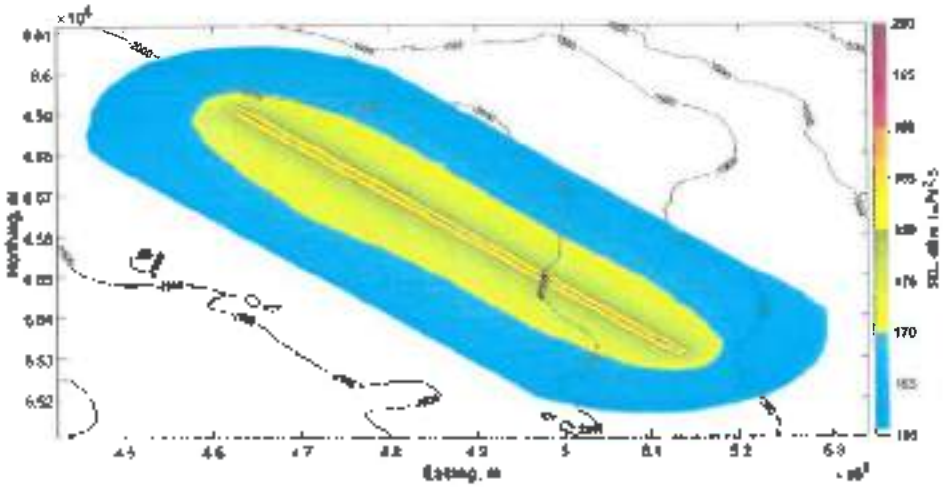
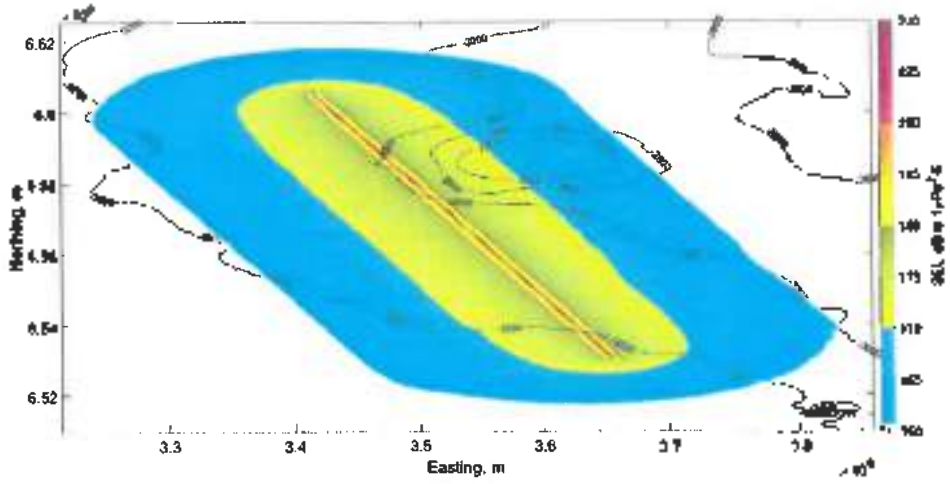


Figure D.6 **The predicted maximum unweighted SEL_{24hr} across the water column for assessed survey scenario S2 for the 3D survey**



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JONATHAN VALLARTA, Ph.D.

Underwater Acoustics Business Lead

EDUCATION

- Ph.D., School of Engineering and Physical Sciences, Heriot-Watt University, UK 2009
- B.Eng., Electronics & Communications (Hons), Ibero-American University Mexico 2001
- B.Sc., Biological Sciences, National Autonomous University of Mexico, 1999

EXPERTISE

- Underwater acoustics
- Passive Acoustic Monitoring
- PAM Localization
- Hydrophone-Arrays: design, implementation, and deployment
- Noise and wildlife
- Noise impact assessments
- Environmental noise monitoring
- Computer noise modeling

CERTIFICATIONS

- Basic Safety Course for Rigs and Mobile Offshore Units
- Mexican Seamans Book
- Medical Fit Certificate
- Master Suba Diving, NAUI

MEMBERSHIPS

- Acoustical Society of America, ASA
- International Association Impact Assessment, IAIA
- Mexican Society of Marine Mammals, SOMEMMA

Dr. Jonathan Vallarta has eighteen years of experience in underwater acoustics in a wide range of positions including teaching, design, project management, acoustic consulting, and collaborative research. His expertise is in the design of new configurations for hydrophone arrays and development of localization algorithms using passive sonar techniques to track the migratory patterns of cetaceans in areas where there is increased anthropogenic activity. He has considerable experience providing training courses in fundamentals of underwater noise and monitoring techniques.

Jonathan joined SLR in January 2020 and is based in Vancouver. His previous experience includes running a passive acoustic monitoring business, while lecturing several university courses and consulting for JASCO Applied Sciences over four years. Jonathan holds a Ph.D. from Heriot-Watt University in Edinburgh, Scotland, awarded for research into the significance of passive acoustic array configuration on sperm whale range estimation.

Jonathan has published numerous papers in academic journals and presented at various international conferences. In June 2018, his expertise was recognized as an invited panellist and as Mexican advisor to the United Nations Informal Consultative Process on Oceans and the Law of the Sea (UNICPOLOS) at the headquarters of the United Nations in New York. He has a particular interest in marine conservation issues, particularly in reference to threatened species, noise pollution and mitigation.

SELECT PROJECT EXPERIENCE

UNDERWATER ACOUSTICS PROJECTS

- **3D Seismic Survey Underwater Noise Modeling, West Coast of South Africa**
  Detailed underwater sound propagation modeling for 3D seismic survey activities were performed to assist with the assessment of a new source array with two high-volume active elements proved to have less impact on marine fauna species of interest (in terms of maximum zones) than the conventional airgun array.
- **Cumulative Effects of Marine Shipping on Esquimalt Nation Territory, Canada**
  The study analyzed numerous automatic identification system transits from 2019 of recreational and commercial vessels in the Salish Sea. Several peer-reviewed papers, and regional reports relevant to the impacts of underwater noise from commercial vessels on marine mammals were reviewed and assembled into a literature review matrix based on topics relevant to Esquimalt Nation.
- **2D Seismic Survey Underwater Noise Modeling, East Coast of South Africa**
  Detailed underwater sound propagation modeling for 2D seismic survey activities were performed to assist with the assessment of potential noise impact on marine fauna species of interest. The noise modelling results were then used to identify zones of impact for marine mammals and other species of concern based on relevant noise impact assessment criteria.
- **Tugboats Towing Drill Rig Underwater Noise Modeling, Cook Inlet, Alaska**
  Technical study on the underwater noise emissions from tugboats in various scenarios in Cook Inlet, Alaska. It included sound propagation modelling, understanding the range of different noise levels produced by tugs, and the distances at which tug noise is predicted to exceed impact assessment thresholds for marine mammals.
- **Offshore Wind Underwater Noise Impact Assessment, Lake Ontario**
  Technical study on underwater noise issues relevant to the project, identifying the relevant regulations and criteria and provided an assessment of potential project

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underwater noise impacts from dredging and tugboat noise specifically for the installation of 66 gravity base structures for turbine generators.

- **TOTAL Mozambique LNG Underwater Noise Analysis**
  Analysis and review of underwater noise impacts due to the construction of the Mozambique LNG project on Tungue Bay. Included an independent review of two modelling reports, analysis and recommendations of available piling noise attenuation options, verification of the impact of sound pressure thresholds on human divers and interpretation of the extent to which underwater noise levels may affect the catch rates for local fishermen, in mitigated and un-mitigated scenarios.
- **Alaska LNG, Cook Inlet, Alaska**
  Detailed frequency and range dependent underwater noise propagation modelling to identify the extent of project construction noise impacts on marine mammals, including the endangered Cook Inlet beluga whale. Included model validation with reference to historical measurements in Cook Inlet, and investigation of the sensitivity of results to variations in environmental parameters used as model inputs to determine realistic areas above defined thresholds.
- **Monitoring the Soundscape of Coral Reef, Cozumel, Mexico**
  A Passive Acoustic Monitoring (PAM) survey was conducted in the Paradise Coral Reef of Cozumel to obtain 1) the first scientific recording of the endangered splendid toadfish vocalizations; 2) record the volume and source of anthropogenic sounds on the coral reef; and 3) estimate possible impacts of anthropogenic noise (masking and exposure) on splendid toadfish. The project involved the deployment of PAM equipment by scientific personnel and scuba divers. Noise mitigation recommendations were provided to local authorities.
- **Sound Characterization of Pile Driving, Virginia, USA**
  Sound characterization of different test piling noise levels during the construction of a harbour terminal in Thimble Shoal, Virginia, USA. Assessment of marine and fish noise impacts and potential for project cumulative impacts.
- **Acoustic Modelling for VSP Offshore Operations, Australia**
  Acoustic modelling for assessing marine fauna sound exposures during Vertical Seismic Profiling (VSP) operations for the CarbonNet Offshore appraisal in Australia. The acoustic modelling included the use of parabolic equation and ray tracing methods.
- **Marine Mammal Acoustic Detections, Chukchi Sea, Artic**
  A five-year project in the northeast of the Chukchi Sea that included passive acoustic detections of bowhead whale and other marine mammals, while seismic exploration activities occurred during summer season every year. A passive acoustic localization algorithm was implemented to assess the impact of anthropogenic noise on the migration patterns of bowhead whale.
- **Modern LNG Carrier Sound Source Characterization, Trinidad**
  Underwater acoustic monitoring at one of the LNG port sites of Trinidad in order to obtain a sound source characterization of modern LNG carriers. The emphasis of this project was due to the lack of data registered and the need to acoustically model the noise levels of a new LNG station in Canada.
- **Acoustic Modelling and Monitoring of the Tappan Zee Bridge, New York**
  Underwater acoustic monitoring during the pile installation project of the new Tappan Zee Bridge. The project included both underwater acoustic modelling and monitoring as a validation method for the different pile driving tests. Assessment of several mitigation techniques, such as different types of bubble curtains, were also modelled and monitored.
- **Underwater Acoustic Monitoring of Power Plant, Dominican Republic**
  Underwater passive acoustic monitoring of an active Power Plant close to offshore in the Dominican Republic. The initiative came along from the need to explore the noise level impacts on manatees and fish. Noise mitigation recommendations were given to local authorities and project managers.

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UNDERWATER ACOUSTICS WORKSHOPS

- **SOMEMMA, La Paz-Baja California 2021.** A one-day virtual acoustic workshop based in La Paz, Baja California to train scientists in PAMGuard software as the preamble to the international meeting for the study of marine mammals "Research, Conservation Foundation".
- **TRITON Environmental Consultants, Vancouver-BC 2020.** A two-day acoustic workshop based in Vancouver to train three scientists in PAMGuard software to engage in acoustic monitoring of offshore dredging in Prince Rupert, BC.
- **Edgewise Environmental, St John's-Newfoundland 2019.** A four-day acoustic workshop based in St. John's to address the need to train new passive acoustic monitoring operators to engage in seismic exploration vessels in the Arctic Sea.
- **TALOS Energy, Villahermosa-Tabasco 2019.** A two-day acoustic workshop based in Villahermosa to train two new passive acoustic monitoring operators to engage in VSP offshore operations in the Gulf of Mexico by TALOS Energy Company.
- **CICESE, Ensenada-Baja California 2018.** A three-day acoustic workshop based in Ensenada to address the specific needs of a Center for Scientific Research and Higher Education, CICESE.
- **PAMOS, Mexico City-Mexico 2015-2017.** A three-day acoustic workshop based in Mexico City to address the need to train new passive acoustic monitoring operators to engage in seismic exploration vessels in the Gulf of Mexico.

AUTHOR OF PUBLICATIONS AND REPORTS

- Vallarta, J. and Croft, B. 2021. *Technical advice on Tugboat Underwater Noise in Cook Inlet*. Confidential. Report prepared by SLR Consulting (Canada) Ltd for Hilcorp Alaska, Llc.
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- Vallarta J. 2010. *Eccentricity discrimination of hyperbolic localizations to minimize positioning uncertainty*. The Journal of the Acoustical Society of America. 2nd Pan-American/Iberian Meeting on Acoustics. Cancun, Mexico. Vol. 128-4, p.2328.
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- Vallarta J. 2007. *3D Passive Acoustic Localization -Homogeneous Vs Non-homogeneous Medium*. 17th Biennial Conference on the Biology of Marine Mammals, Cape Town, South Africa.
- Vallarta J., McHugh B. and Record P. 2007. *The effect of different array-configurations on the accuracy of passive acoustic location of cetaceans*. Proceedings of the Institute of Acoustics, Fourth International Conference on Bio-Acoustics, Loughborough, UK, 29(3):141-148.
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CO-AUTHOR OF PUBLICATIONS AND REPORTS

- Pyć, C. D., Vallarta, J., Rice, A. N., Zeddies, D. G., Maxner, E. E., & Denes, S. L. 2021. *Vocal behavior of the endangered splendid toadfish and potential masking by anthropogenic noise*. Conservation Science and Practice, e352.
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- Martin, B., Vallarta, J. and Burns, R. 2011. *HYWIND Acoustic Measurement Report: Technical report on the acoustic measurement of the HYWIND structure and control site from May to August 2011.* Technical report for Statoil by JASCO Applied Sciences.
- Lumsden E., B. Martin, and J. Vallarta, 2009. *BP Canada's 2009 pokak seismic survey*, Technical report for BP POKAK Canada, and OGGVeritas! by JASCO Applied Sciences.

EDUCATION

- University of Delaware

  Ph.D. Oceanography (Acoustical Oceanography) 2009 - 2016

- Florida Institute of Technology

  MS in Ocean Engineering (Ocean Instrumentation), 2007 – 2009

  BS in Ocean Engineering (Hydrographic Surveying), 2003 - 2007

EXPERTISE

- Underwater acoustics
- Underwater noise modelling
- Target localization using beamforming methods
- Passive acoustic monitoring
- Physical oceanography
- Ocean engineering
- Ocean instrumentation
- Advanced signal processing
- Data analysis
- High-performance computational methods with large data sets

SOFTWARE SKILLS

- Matlab (GPU and Parallel Processing)
- dBSea (underwater sound transmission loss modelling)
- Large (multiple TBs) dataset analysis
- BELLHOP (ray tracing)
- Parabolic Equation & Normal Modes Modelling

Dr. Justin Eickmeier is an experienced researcher and consultant with nine years of graduate studies and three years of post-doctoral work in Acoustical Oceanography at the University of Delaware. He joined SLR's underwater acoustics team in February 2019 and has quickly become involved in managing and delivering underwater noise consulting projects, specifically marine mammal impact assessments. In addition to underwater acoustics projects, he has supported the wider SLR acoustics group in a signal processing/data analyst role. Beginning in June 2019, he was on a 1-year secondment to the Port of Vancouver's ECHO (Enhancing Cetacean Habitat and Observation) program and continues to provide technical support on underwater acoustics. At the start of 2022, Justin took on the role of Underwater Acoustics Team Lead for SLR Canada.

Before joining SLR, Dr. Eickmeier's research focus areas were collecting and analyzing acoustical and ocean environmental data from the Arctic (Beaufort Sea) during the Canadian Basin Acoustic Propagation Experiment (CANAPE). His field research experience followed the completion of BS and MS degrees in Ocean Engineering at the Florida Institute of Technology, specializing in hydrographic surveying and ocean instrumentation, respectively.

Dr. Eickmeier has participated in numerous research cruises in the Arctic and elsewhere in the Atlantic and Pacific. His role on these projects has included working autonomously or in small teams, designing, deploying, and recovering multi-sensor oceanographic moorings, undertaking acoustic monitoring using hydrophone arrays, and analyzing acoustic data, including marine mammal detections, ambient noise, and contributions from anthropogenic noise sources. He specializes in managing large data sets collected during long-term (multi-year) monitoring experiments.

His substantial experience in underwater acoustics complements Dr. Eickmeier's background in oceanography, ocean engineering, and instrumentation. His technical skills include underwater noise propagation modelling and prediction, measurement and monitoring, data processing and analysis, impact assessment, mitigation, and control.

SELECTED PROJECT EXPERIENCE

- **Nilcorp, Tugboat Underwater Noise in Cook Inlet, Alaska 2021**

  Technical study predicting the underwater noise emissions from tugboats in various marine construction scenarios in Cook Inlet, Alaska. This study was prepared to understand the range of different noise levels produced by tugs and the distances at which tug noise is predicted to exceed impact assessment thresholds for marine mammals.

- **Baird, Technical Advice on Underwater Noise for Offshore Wind Project, Ontario 2021**

  The Windstream Wolfe Island Shoals Wind Energy Project is located 5 km off the southwest shore of Wolfe Island, in Lake Ontario. This technical advice report describes underwater noise issues relevant to the project, identifies relevant regulations and criteria, and assesses potential underwater noise impacts via sound transmission loss modelling for wind turbine installation,

including marine construction, dredging, dynamic position systems, and transits of commercial vessels.

- **Hilcorp Cook Inlet Exploration Drilling, Alaska 2019**
  SLR International Corporation prepared an environmental impact analysis of Hilcorp's proposed four-well 2020 outer continental shelf exploration drilling program in the Cook Inlet. As project manager and technical lead for SLR Canada's portion of the assessment, a desktop study identifying the baseline noise environment and the underwater noise impacts of the proposed activities (drill rig tow, impact pile driving, drilling, and vertical seismic profiling) considering marine mammal behavioral disturbance thresholds was undertaken.

- **Vancouver Fraser Port Authority Enhancing Cetacean Research and Observation (ECHO) Program, British Columbia 2019 - 2022 (ongoing)**
  - Technical guidance to program managers within the ECHO Program
  - Salish Sea ambient noise study and best practices report
  - Evaluation of underwater radiated noise from commercial vessels, quieting technology, energy savings devices, and hybrid propulsion systems.

- **Confidential Client Offshore Seismic Survey, Brazil 2019**
  Project manager for a desktop underwater noise impact assessment, predicting extents of various zones of marine mammal impact during a large-scale offshore seismic survey. Project requirements included coordinating SLR team members in Australia and Canada and working on a tight schedule to meet client targets.

- **Lehigh Hanson Materials, British Columbia 2019 & 2021**
  Data analyst supporting ongoing airborne noise monitoring for a quarry in Sechelt, British Columbia (2019). Data collection and analysis for a 2-week overnight airborne noise study (2021).

- **TransLink, British Columbia 2019**
  Data analysis and signal processing support for ongoing SkyTrain noise mitigation studies, including axle box vibration data analysis to infer rail surface conditions).

RESEARCH EXPERIENCE

- **Post-Doctoral Research, University of Delaware, 2016 - 2018**
  Advanced signal processing of broadband acoustic data and water column measurements in shallow water environments. Specialization in managing large data sets (including multi-year experiments) and high-performance computational methods.

  Dr. Eickmeier has extensive experience with beamforming (array localization) from multi-hydrophone arrays and modelling with rough boundary conditions and range-dependent environmental parameters using ray tracers, normal modes, and parabolic equation models.

  A passive acoustic study of soniferous fish and marine mammals in Delaware Bay included the acoustic classification of several species of fish native to Delaware Bay and the acoustic signatures of short-nosed common dolphins during daily feeding cycles.

  The design, fabrication, and deployment of 7 environmental arrays were completed for a year-long study in the Beaufort Sea. Array lengths spanned from 150 to 700 m, including 10 to 30 thermistors, 2 CTDs per mooring, and tandem acoustic release kits. High-frequency sampling rates on thermistors allowed for investigation of the acoustic waveguide, while low pass filtering matched time scales of fluctuations in upwelling and sub-mesoscale eddy formation.

SELECT PUBLICATIONS

- Eickmeier, J., Tollit, D., Trounce, K., Warner, G., Wood, J., MacGillivray, A. and Zizheng Li (2021) Salish Sea Ambient Noise Study: Best Practices (2021). Vancouver, British Columbia, Vancouver Fraser Port Authority, Enhancing Cetacean Habitat and Observation (ECHO) Program, 50pp. DOI: http://dx.doi.org/10.25607/OBP-1068
- Eickmeier, J. and Badiey, M., (2018) Influence of Short Time-Scale Water-Column Temperature Fluctuations on Broadband Signal Angular Beam Spreading. J. Marine Sci. App. DOI: https://doi.org/10.1007/s11804-018-0020-y
- Badiey, M., Eickmeier J., and Song A. (2014) Arrival-time fluctuations of coherent reflections from surface gravity water waves. J Acoust Soc Am 135(5): EL226–EL231. DOI: https://doi.org/10.1121/1.4871577
- Aaslie, M., Martin S., Trounce, K., Hannay, D., Eickmeier, J., Deveau, T., Lucke, K., MacGillivray, A., Noble, V., and P. Borys (2022). International harmonization of procedures for measuring and analyzing of vessel underwater radiated noise. Marine Pollution Bulletin 174: 113124 (2022). DOI: https://doi.org/10.1016/j.marpolbul.2021.113124

UNDERTAKING UNDER OATH/AFFIRMATION

I, Jonathen Vallarta-Hernandez swear under oath/affirm that all the information (of the attached document) for the purposes of this application is true and correct.

Attached document: TGS South Africa Orange Basin 3D Seismic Survey - Sound Transmission Loss Modelling Study (ATTACHED AS EXHIBIT "A")

Prepared for: Environmental Impact Management Services Pty Ltd (Ground Floor, Regus Business Centre, 14 Stewart Drive, Berea, East London, 5241 South Africa).

Signature of the Specialist

Name of Company: SLR Consulting (Canada) Ltd.

Date: DECEMBER 5, 2022

Signature of the Commissioner of Oaths:

Date:

Official Stamp below

Signature of the above specialist attested by the undersigned Notary Public on this 5th day of December, 2022 at the City of Vancouver, Province of British Columbia, Canada. The document has been prepared by the Applicant and no advice was sought or given by the undersigned

DEVIKA MEHTA NOTARY PUBLIC BRITISH COLUMBIA

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"A7.5.2"

DECLARATION OF THE ENVIRONMENTAL SPECIALIST

I, Jonathan Vallarta-Hernandez declare that –

General declaration:

- I act as an independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting undertaking the specialist work as required, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I have not, and will not engage in, conflicting interest in the undertaking of the activity.
- I understand to disclose to the applicant and competent authority all material information in my possession that reasonably has or may have the potential of influencing- any decision to be taken with respect to the application by the competent authority, and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- I have taken into account, to the extent possible, the matters referred to in Regulation 18 when preparing the report, plan or document.
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.
- All the particulars furnished by me this form are true and correct.
- I will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations.
- I am aware of what constitutes an offence in terms of Regulation 48 and that a person convicted of an offence in terms of Regulation 48(1) is liable to the penalties as contemplated in Section 49B of the Act.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remunerative for work performed in terms of the Regulations.

Signed/Sworn/Declared before me, at the City of Vancouver, British Columbia this 5th day of DECEMBER, 2022.

Signature of the Specialist:

Name of Company: SLR Consulting (Canada) Ltd.

Date: DECEMBER 5, 2022

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Vancouver, B.C. V6H 1H6
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ENVIRONMENTAL MANAGEMENT PROGRAMME:

PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT

PASA REFERENCE: 12/1/040

DOCUMENT DETAILS

EIMS REFERENCE:	1520
DOCUMENT TITLE:	Environmental Management Programme: TGS Orange Basin Reconnaissance Permit

DOCUMENT CONTROL

	NAME	SIGNATURE	DATE
COMPILED:	Liam Whitlow / GP Kriel		2022/12/05
CHECKED:	Liam Whitlow		2022/12/05
AUTHORISED:	Liam Whitlow		2022/12/05

REVISION AND AMENDMENTS

REVISION DATE:	REV #	DESCRIPTION
2022/10/06	ORIGINAL DOCUMENT	Environmental Management Programme for public review
2022/12/05	REVISION 1	Environmental Management Programme for adjudication

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Abbreviations

BPEO	:	Best Practicable Environmental Option
DFFE	:	Department of Forestry, Fisheries and Environment
DWS	:	Department of Water and Sanitation
EA	:	Environmental Authorisation
CBA	:	Critical Biodiversity Area
EAP	:	Environmental Assessment Practitioner
ECO	:	Environmental Control Officer
EO	:	Environmental Officer
EIA	:	Environmental Impact Assessment
EIMS	:	Environmental Impact Management Services (Pty) Ltd
EMF	:	Environmental Management Framework
EMPr	:	Environmental Management Programme Report
EPRP	:	Emergency Preparedness and Response Plan
ESA	:	Ecological Support Area
HSE	:	Health, Safety and Environment
I&AP	:	Interested and Affected Party
ISO	:	International Standards Organisation
MPRDA	:	Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)
NFA	:	National Forests Act (Act 84 of 1998)
NEMA	:	National Environmental Management Act (Act No. 107 of 1998)
NEMAQA	:	National Environmental Management: Air Quality Act (Act No. 39 of 2004)
NEMBA	:	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEMWA	:	National Environmental Management: Waste Act (Act No. 59 of 2008)
NWA	:	National Water Act (Act No. 36 of 1998)
OHSA	:	Occupational Health and Safety Act (Act No. 85 of 1993)
SABS	:	South African Bureau of Standards
SANAS	:	South African National Accreditation System
SWMP	:	Storm Water Management Plan

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1 INTRODUCTION

TGS Geophysical Company (UK) (hereafter TGS) has applied for Environmental Authorization for a 3D seismic survey off the West Coast of South Africa. Environmental Impact Management Services (Pty) Ltd (EIMS) has been appointed by TGS to prepare and submit an application for Environmental Authorisation (EA) as per the requirements of the Environmental Impact Assessment (EIA) Regulations, 2014, as amended, promulgated under the National Environmental Management Act (Act No. 107 of 1998- NEMA) and the requirements of the Minerals and Petroleum Resources Development Act (Act No. 28 of 2002 – MPRDA).

The proposed project area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay over a number of petroleum licence blocks.

The area of interest for the proposed 3D seismic survey is approximately 57 400 km^2 in extent. It is proposed that a single survey vessel equipped with seismic sources and streamers be used. The proposed 3D survey would be supported by up to two escort vessels. The 3D survey will take in the order of 70 days including downtime.

The Environmental Management Programme (EMPr) has been compiled to meet the requirements for an EIA and as stipulated in the EIA Regulations, 2014. The competent authority for this application will be the Department of Mineral Resources and Energy (DMRE).

An EMPr is an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts during the applicable phases of a development or activity are prevented, and that the positive benefits of the projects are enhanced. This EMPr has been compiled as a guideline for the mitigation and management measures to be implemented to avoid, reduce and minimise potential environmental impacts arising out of the project.

2 SCOPE OF THIS DOCUMENT

The purpose of the EMPr is to give effect to precautionary and mitigatory measures, which are to be put in place for controlling the activities that take place during the project. The EMPr also provides guidance to assist in ensuring compliance with relevant national legislative and regulatory requirements.

It should be borne in mind, however, that the EMPr is a working document that should be updated on a regular basis, as and when necessary. Formal risk identification forms an integral part of EMPr management and assists with prioritizing and focusing the control of risks. The EMPr thus supports this on-going proactive mitigation and the duty of care to the environment. The EMPr shall therefore allow for risk minimization, rather than just ensuring legal compliance. The purpose of this EMPr is thus also to allow the user to make minor amendments to ensure continual revision and improvement of risk mitigation through the continual re-assessment of risks associated with the activity.

3 DOCUMENT STRUCTURE

Table 1: EMPr Structure

Appendix 4 Reference	Description	Section in EMPr
Appendix 4(1)(1)(a)	Details of – (i) The EAP who prepared the EMPR; and (ii) The expertise of that EAP to prepare an EMPR, including a curriculum vitae;	Section 4
Appendix 4(1)(1)(b)	A detailed description of the aspects of the activity that are covered by the EMPR as identified by the project description.	Section 5
Appendix 4(1)(1)(c)	A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Section 6
Appendix 4(1)(1)(d)	A description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified though the environmental impact assessment process for all phases of the development including – (i) Planning and design; (ii) Pre-construction activities; (iii) Construction activities; (iv) rehabilitation of the environment after construction and in the case of a closure activity, closure; and (v) Where relevant, operation activities;	Section 13
Appendix 4(1)(1)(f)	A description of proposed impact management actions, identifying the manner in which the impact management contemplated in paragraphs (d) will be achieved, and must, where applicable, include actions to – (i) Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) Comply with any prescribed environmental management standards or practices; and (iii) Comply with any applicable provisions of the act regarding closure, where applicable.	Section 13

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Appendix 4 Reference	Description	Section in EMPr
Appendix 4(1)(1)(g)	The method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 13
Appendix 4(1)(1)(h)	The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 13
Appendix 4(1)(1)(i)	An indication of the persons who will be responsible for the implementation of the impact management actions;	Section 13
Appendix 4(1)(1)(j)	The time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 13
Appendix 4(1)(1)(k)	The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Section 13
Appendix 4(1)(1)(l)	A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 13
Appendix 4(1)(1)(m)	An environmental awareness plan describing the manner in which – (i) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 11
Appendix 4(1)(1)(n)	Any specific information that may be required by the competent authority.	N/A

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4 REQUIREMENTS OF AN EAP

In terms of Regulation 13 of the EIA Regulations, 2014, an independent EAP, must be appointed by the applicant to manage the application. EIMS has been appointed by the Applicant as the EAP and is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations and Section 1 of the NEMA. This includes, inter alia, the requirement that EIMS is:

1) Objective and independent;

2) Has expertise in conducting EIA's;

3) Comply with the NEMA, the Regulations and all other applicable legislation;

4) Takes into account all relevant factors relating to the application; and

5) Provides full disclosure to the applicant and the relevant environmental authority.

The Curriculum Vitae (indicating the experience with environmental impact assessment and relevant application processes) of the consultants that were involved in the EMPr process, and the compilation of this report are attached as Appendix 1.

4.1 Details of the EAP

EIMS was appointed by the Applicant as the EAP to compile this report. The contact details of the EIMS consultants who compiled the report are as follows:

Table 2: EAP Details

Name of Practitioner	Mr GP Kriel (Report Compiler) & Mr Liam Whitlow (Reviewer)
Tel No.:	+27 11 789 7170
E-mail:	tgs@eims.co.za

4.2 Expertise of the EAP

EIMS is a private and independent environmental management-consulting firm that was founded in 1993. EIMS has in excess of 29 years' experience in conducting EIA's. Please refer to the EIMS website (www.eims.co.za) for further details of expertise and experience.

GP holds an M.Env.Sci (Water Sciences) Cum Laude from the North-West University (Potchefstroom Campus) and has been employed as an Environmental Consultant since 2007. GP is a Registered Professional Natural Scientist (South African Council for Natural and Scientific Professions) and a Registered Environmental Assessment Practitioner (Environmental Assessment Practitioner). He has delivered presentations locally and internationally concerning the use of bio-indicators for the determination of water quality, and has experience in a wide variety of environmental management projects including: Environmental Impact Assessments, Basic Assessments, Geographic Information Systems (GIS), Environmental Compliance Monitoring, Environmental Awareness Training, Aquatic Ecological Assessments, Drinking and Waste Water Treatment Process Audits, Wetland Delineation and Assessments, ISO 14001 Aspect Registers, Water Use Licence Applications, Waste Management Licence Applications, Integrated Waste and Water Management Plans (IWWMP) and Green House Gas Assessments.

Liam holds a B. Sc. Hons degree in Environmental Management and has completed an additional B. Sc. honours course in applied limnology. In addition, he has completed a higher certificate in Project Management with Damelin Business School and a course on ISO14001 Auditing Principles and Environmental Management Systems Auditor Training. Liam is a registered professional natural scientist with the South African Council for Natural Scientific Professions. Liam's professional experience, gained over more than 21 years, lies mainly with environmental impact assessments including project managing significantly large EIAs in the mining and infrastructure sectors. Liam's other experience includes ISO14001, Site Assessments, Water-use licensing, Environmental monitoring, and

Environmental Management Plans. Liam's experience lies mainly within South Africa, but he has been involved in projects in both Lesotho and Botswana.

The Curriculum Vitae of the EAP responsible for the compilation of this Report is included in Appendix 1.

5 PROJECT DESCRIPTION

This section provides an overview of the proposed activity

Seismic survey programmes comprise of data acquisition in either two-dimensional (2D) and/or three-dimensional (3D) scales, depending on information requirements. 2D surveys are typically applied to obtain regional data from widely spaced survey grids and provide a vertical profile through the subsurface, highlighting geophysical, geological information and features along the seismic line. Infill surveys on closer grids subsequently provide more detail over specific areas of interest. In contrast, 3D seismic surveys are conducted on a very tight survey grid spacing in specific target areas, often identified during 2D applications, providing a cube image of the subsurface geology within the survey volume. The current proposed seismic survey as discussed in this report is a 3D seismic survey and does not include any provision for exploration drilling.

During seismic surveys high-level, low frequency sound pulses are generated by an acoustic instrument towed behind a survey vessel, just below the sea surface. The sounds are directed towards the seabed and the seismic signal is reflected by the geological interfaces below the seafloor. The reflected signals are received by an array of receivers or sets of hydrophones towed behind the vessel in a single streamer (2D) or in multiple streamers (3D) and are fed back to the recording instruments on board. The spacing between the hydrophone groups is commonly 25 m or shorter, depending on the purpose of the seismic survey. Each group contains many hydrophones, spaced less than 1 m apart. The hydrophone streamers must be towed at constant depth (6 – 10 m), with flotation usually achieved by filling the cables with kerosene, gel or flexible polymer foam, so that they are neutrally buoyant. To compensate for minor adjustments, Automatic Cable Levellers, or "birds" are used. The ends of the hydrophone streamers are marked with tail buoys, to warn shipping about the presence of the cable in the water. The tail buoys also act as a platform for surface positioning systems so that the cable locations can be accurately monitored. Refer to Figure 1, Figure 2 and Figure 3 for illustrative examples of typical survey vessel, equipment and activities.

Figure 1: Example of seismic survey vessel and associated equipment (FishSAFE, 2021).

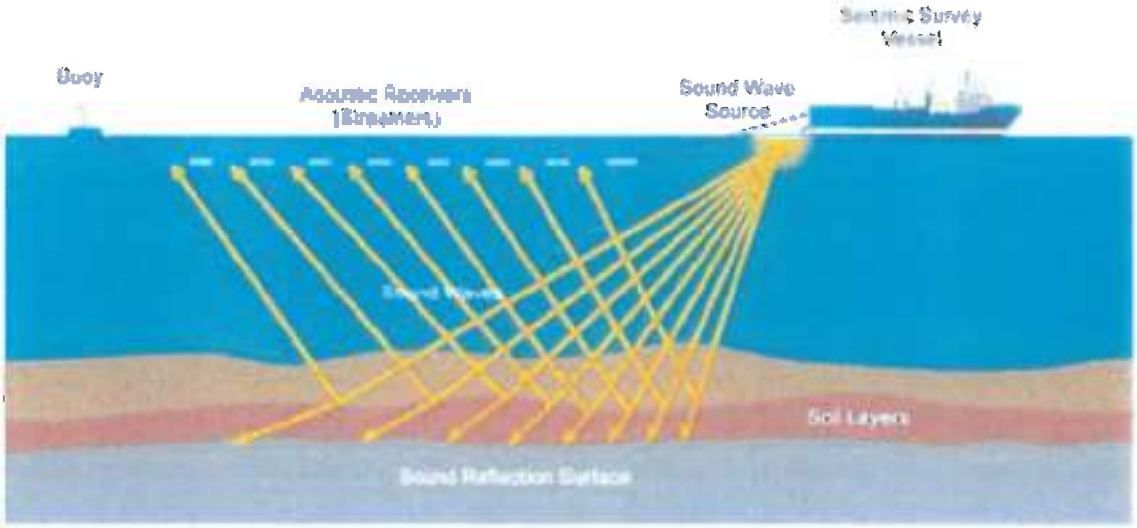

Figure 2: Example demonstration of seismic survey activities (Fish SAFE, 2021).

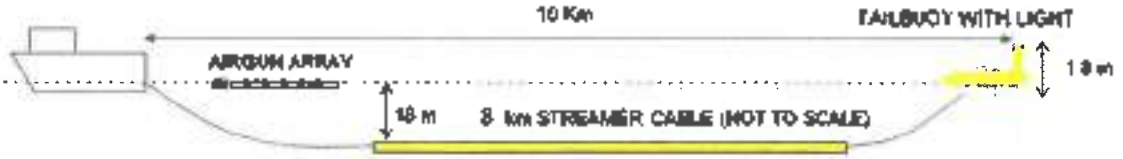

Figure 3: Schematic diagram showing side-view of the seismic source array and hydrophone cable ("streamer")

While acquiring the seismic data, the survey vessel would travel along transects of a prescribed grid within the survey area that have been chosen to cross any known or suspected geological structure in the area. The vessel typically travels at a speed of between four and six knots (i.e. 2 to 3 meters per second / 7.2 to 10.8 kilometres per hour) while surveying. The survey vessel length is approximately 100 m.

The proposed survey would involve a seismic sound source and multiple hydrophone streamers, which would be approximately 8 000 m long and 2 000 m wide. The streamers would be towed at a depth of 8 m below the surface and would not be visible, except for the tail-buoy at the terminal end of the cable. The array has an operating pressure of 2 000 pounds per square inch. The sound source would be towed behind the vessel at a depth of between 5 – 25 m below the surface. As the survey vessel would be restricted in manoeuvrability, other vessels should remain clear of it and therefore a support vessel usually assists in the operation of keeping other vessels at a safe distance.

Each triggering of a sound source is termed a seismic pulse, and these are discharged at intervals of 6 – 20 seconds (depending on water depth and other environmental characteristics). Each seismic pulse is usually only between 5 and 30 milliseconds in duration, and despite peak levels within each pulse being high, the total energy delivered into the water is low. Seismic sources have most of their energy in the 5-300 Hz frequency range, with the optimal frequency required for deep penetration seismic work being 50-80 Hz.

Sound levels from individual sound sources used today in the seismic industry range from 200 to 255 dB re 1 µPa at 1 m, for small to large individual seismic sources, respectively. For sound source arrays, sound levels range from 235 dB re 1 µPa at 1 m for a small array (500 cubic inches) to 260 dB re 1 µPa at 1 m for large arrays (7 900 cubic inches). The majority of the produced energy is below 250 Hz, with 90% of the energy between 70 to 140 Hz, although pulses do contain some higher frequencies up to 16 kHz. It must be noted, however, that the sound level specifications for sound source arrays refer to sound levels in the vertical direction directly beneath the sound source array, generally near its centre, with nominal sound levels in the horizontal direction being ~10-20 dB lower.

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6 SITE DESCRIPTION AND SENSITIVE AREAS

There are six offshore Marine Protected Areas (MPAs) in the general project area, but none fall within the Survey area. The proposed 3D survey area lies well offshore of these MPAs. Although there is no overlap of the 3D survey area with Ecologically and Biologically Significant Areas (EBSAs), critical biodiversity areas (CBAs) within the Reconnaissance Permit and 3D survey areas include both CBA1: natural and CBA2: natural areas (Figure 4). No no-go areas were identified.

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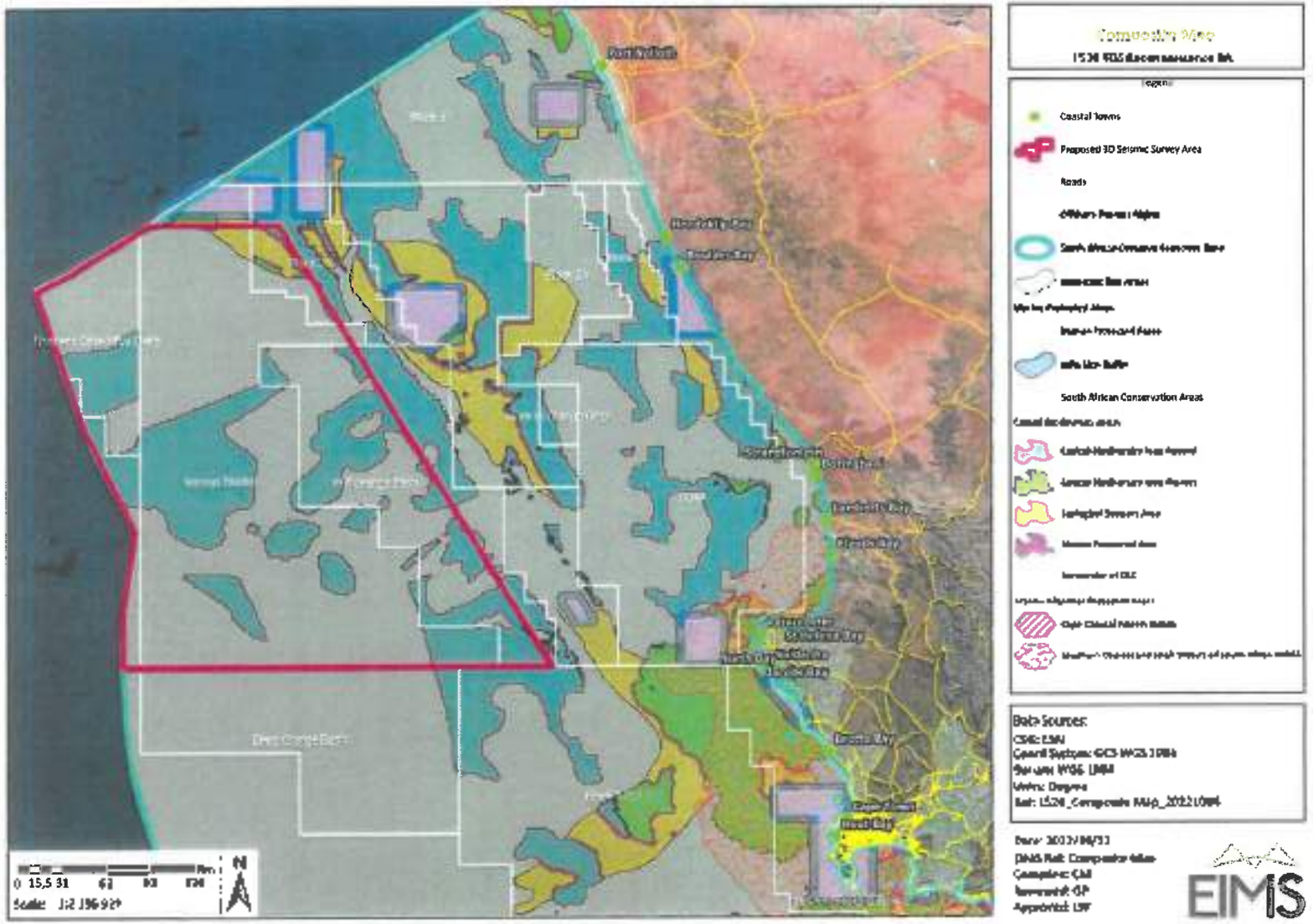

Figure 4: Locality/ sensitivity map showing the preferred site for the 3D Survey.

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Potential impacts associated with the proposed activity at the selected site have been identified and addressed in the EMPr and are summarised in the table below:

Table 3: Potential impacts identified in BA report

#	Impact	Phase
1	Impacts of seismic noise on mysticetes and odontocetes	Operation
2	Impacts of seismic noise on seals	Operation
3	Impacts of seismic noise on turtles	Operation
4	Impacts of seismic noise on diving seabirds	Operation
5	Impacts of seismic noise to pelagic fish	Operation
6	Impacts of seismic noise to marine invertebrates	Operation
7	Impacts of seismic noise to plankton and ichthyoplankton	Operation
8	Disturbance and behavioural changes in seabirds, seals, turtles and cetaceans due to vessel noise	Operation
9	Disturbance and behavioural changes in seabirds, seals, turtles and cetaceans due to noise of support aircraft	Operation
10	Disturbance and behavioural changes in pelagic fauna due to vessel lighting	Operation
11	Impacts of marine biodiversity through the introduction of non-native species in ballast water and on ship hulls	Operation
12	Impacts of normal vessel discharges on marine fauna	Operation
13	Impacts on turtles and cetaceans due to ship strikes, collision and entanglement with towed equipment	Operation
14	Impacts on benthic and pelagic fauna due to accidental loss of equipment to the seabed or the water column	Operation
15	Impacts of an operational spill or collision on marine fauna	Operation
16	Impacts of exclusion from fishing ground on the large pelagic longline sector due to the safety zone around the survey vessel	Operation
17	Impact of Exclusion of the Tuna Pole-Line Sector from access to Fishing Ground	Operation
18	Impact of Underwater Sound on the Large Pelagic Longline Sector	Operation
19	Impact of Underwater Sound on the Tuna Pole-Line Sector	Operation
20	Impacts of an operational spill on the large pelagic longline sector	Operation
21	Impacts of the unplanned loss of equipment to sea from the survey vessel	Operation

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#	Impact	Phase
22	Impacts on Cultural Heritage	Operation
23	Impacts of an operational spill or collision on marine fauna	Operation
24	Impacts on Cultural Heritage	Operation
25	Uncertainty	Planning
26	Concerns about cumulative impacts	Planning
27	Further marginalisation of vulnerable groups	Planning
28	Stakeholder fatigue and disillusionment	Planning
29	Perceived impact on livelihoods	Operation
30	Impacts on sense and spirit of place	Operation
31	Impacts on social licence to operate	Operation
32	Community expectations	Operation
33	Social unrest	Operation

7 ENVIRONMENTAL MANAGEMENT APPROACH

The compilation of an EMPr for an activity which is likely to result in significant environmental impacts is typically compiled at the culmination of a thorough investigation into the receiving environment and the identification and assessment of likely environmental impacts (i.e. EIA). This EMPr forms part of an EA application process. This EMPr aims to comply with the requirement of Appendix 4 of the EIA Regulations, 2014. These requirements are systematically addressed in the subsequent sections of this report. The primary objectives of the EMPr are as follows:

- To promote sustainability and describe an action programme to mitigate negative impacts as far as possible;
- To be a practical document that sets out both the goals and actions required in mitigation. Though the term "mitigation" can be broad in definition, it means in this context to "allay, moderate, palliate, temper or intensify." Mitigation of a negative impact means that its effect is reduced. Mitigation of a positive impact means that its effect is increased or optimised; and
- To indicate responsibilities for the implementation of these action items within the EMPr.

This EMPr shall be deemed to have contractual standing on the basis that its contents and specifically objectives are a detailed expansion of the environmental risks and consequent requirements of the EA (if, and when issued). Where relevant the Applicant is responsible for delegating responsibility for compliance to designated parties (internal or external). Such delegation must be legally binding to the extent relevant.

The objectives and targets in this EMPr are further guided by the NEMA, and specifically by the EIA Regulations, 2014. Thus, the underlying principles of sustainable development are the ultimate objectives and target of this report. The EMPr has included measures to ensure the development activity complies with the following principles, as instilled in the NEMA, amongst others:

i. That the disturbance of ecosystems and loss of biological diversity are minimised and remedied;

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ii. That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;

iii. That waste is avoided, minimised and reused or recycled where possible and otherwise disposed of in a responsible manner;

iv. That a risk-averse and cautious approach is applied, which considers the limits of current knowledge about the consequences of decisions and actions; and

v. That negative impacts on the environment and on people's environmental rights be anticipated, prevented and remedied.

7.1 Environmental Management Principles

NEMA establishes a general framework for environmental law, in part by prescribing national environmental management principles that must be applied when making decisions that may have a significant impact on the environment. These principles are briefly summarised below:

7.1.1 Holistic Principle

The Holistic principle, as defined by NEMA (Section 2(4) (b)) requires that environmental management must be integrated, acknowledging that all elements of the environment are linked and inter-related and it must take into account the effect of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option (defined below in Section 7.1.2). Holistic evaluation does not mean that a project must be looked at as a whole. It rather means that it must be accepted that there is an all-inclusive whole into which a project is introduced. If the indications are that the project could have major adverse effects, the project must be reconsidered and where appropriate, re-planned or relocated to avoid an adverse impact or to ensure a beneficial impact.

7.1.2 Best Practicable Environmental Option

When it is necessary to undertake any action with environmental impacts, the different options that could be considered for the purpose must be identified and defined. The Best Practicable Environmental Option (BPEO) is defined in NEMA as "the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term." Other guidelines typically used for environmental management in terms of other legislation include: BPM which is the Best Practicable Means and BAT which is the Best Available Technology.

7.1.3 Sustainable Development

The concept of sustainable development was introduced in the 1980's with the aim to ensure that the use of natural resources is such that our present needs are provided without compromising the ability of future generations to meet their own needs. The constitution of South Africa is built around the fact that everyone has the right to have the environment protected through reasonable legislative and other measures that secure ecologically sustainable development. The National Environmental Principles included in the NEMA require development to be socially, environmentally and economically sustainable.

7.1.4 Preventative Principles

The preventative principle is fundamental to sustainable development and requires that the disturbance to ecosystems and the pollution, degradation of the environment and negative impacts on the environment be avoided, or, where they cannot be altogether avoided, are minimised and remedied.

7.1.5 The Precautionary Principle

The precautionary principle requires that where there is uncertainty, based on available information, that an impact will be harmful to the environment, it is assumed, as a matter of precaution, that the said impact will be harmful to the environment until such time that it can be proven otherwise. The precautionary principle requires that decisions by the private sector, governments, institutions and individuals need to allow for and recognise conditions of uncertainty, particularly with respect to the possible environmental consequences of those

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decisions. In South Africa, the DWS (then DWAF) adopted a BPEO guideline in 1991 for water quality management and in 1994 in the Minimum Requirements document for waste management.

In terms of DWAF Minimum Requirements for the Handling and Disposal of Hazardous Waste, 1994, the precautionary principle is defined as, "Where a risk is unknown; the assumption of the worst-case situation and the making of provision for such a situation." Here the precautionary principle assumes that a waste or an identified contaminant of a waste is "both highly hazardous and toxic until proven otherwise."

In the context of the EIA process in South Africa, the precautionary principle also translates to a requirement to provide sound, scientifically based, information that is sufficient to provide the decision-making authority with reasonable grounds to understand the potential impacts on the environment, the extent thereof and how impacts could be mitigated. If such information is not adequate for this purpose, the relevant authority cannot be satisfied as is required and then the authority should require that further information be collected and provided.

7.1.6 Duty of Care and Cradle to Grave Principle

In terms of the NEMA Section 28, "Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment."

By way of example, the principle of "duty of care" in terms of waste management emphasises the responsibility to make sure that waste is correctly stored and correctly transported, as it passes through the chain of custody to final point of disposal. This means that waste must always be stored safely and securely. The company removing and disposing of waste also holds the responsibility to hold the relevant licenses, and that waste is transported alongside the necessary paperwork.

"Cradle to Grave" refers to the responsibility a company takes for the entire life cycle of a product, service or program, from design to disposal or termination. In terms of the DWAF Minimum Requirements for the Handling and Disposal of Hazardous Waste, 1994, "any person who generates, transports, treats or disposes of waste must ensure that there is no unauthorised transfer or escape of waste from his control. Such a person must retain documentation describing both the waste and any related transactions. In this way, he retains responsibility for the waste generated or handled." This places responsibility for a waste on the Generator and is supported by the "Cradle to Grave" principle, according to which a "manifest" accompanies each load of Hazardous Waste until it is responsibly and legally disposed. This manifest is transferred from one transporter to the next along with the load, should more than one transporter be involved. Once the waste is properly disposed of at a suitable, permitted facility, a copy of the manifest must be returned to the point of origin." Duty of Care offers one strategy to implement sustainable development.

7.1.7 Polluter Pays Principle

The "polluter pays principle" holds that the person or organisation causing pollution is liable for any costs involved in cleaning it up or rehabilitating its effects. It is noted that the polluter will not always necessarily be the generator, as it is possible for responsibility for the safe handling, treatment or disposal of waste to pass from one competent contracting party to another. The polluter may therefore not be the generator but could be a disposal site operator or a transporter. Through the 'duty of care' principle, however, the generator will always be one of the parties held accountable for the pollution caused by the waste. Accordingly, the generator must be able to prove that the transferral of management of the waste was a responsible action. The polluter pays principle according to NEMA dictates that "the cost of remedying pollution, environmental degradation and consequent adverse effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment."

7.2 Duty of Care Responsibilities

Section 28 of the NEMA makes provision for duty of care, and remediation of environmental damage. The binding principles are described below:

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1. Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

   (1A) Subsection (1) also applies to a significant pollution or degradation that-

   a) occurred before the commencement of this Act;

   b) arises or is likely to arise at a different time from the actual activity that caused the contamination; or

   c) arises through an act or activity of a person that results in a change to pre-existing contamination.

2. Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-

   a) any activity or process is or was performed or undertaken; or

   b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.

3. The measures required in terms of subsection (1) may include measures to-

   a) investigate, assess and evaluate the impact on the environment;

   b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;

   c) cease, modify or control any act, activity or process causing the pollution or degradation;

   d) contain or prevent the movement of pollutants or the cause of degradation;

   e) eliminate any source of the pollution or degradation; or

   f) remedy the effects of the pollution or degradation.

7.3 Failure to Comply with Environmental Considerations

Within the provisions of the relevant environmental legislation, there are a number of penalties for non-compliance or offences. Below a few extracts are presented for information purposes, however these must not be read in isolation and the reader is reminded that there are other Acts, or sections of Acts, that may be applicable to the relevant project:

- NEMA Section 49B(1): A person convicted of an offence in terms of section 49A(1)(a), (b), (c), (d), (e), (f) or (g) is liable to a fine not exceeding R10 million or to imprisonment for a period not exceeding 10 years, or to both such fine or such imprisonment- this includes commencing with a listed activity without an EA or the non-compliance with conditions of any EA and associated EMPr;
- NEMA Section 49B(2): A person convicted of an offence in terms of section 49A(1)(i), (j) or (k) is liable to a fine not exceeding R5 million or to imprisonment for a period not exceeding 5 years, and in the case of a second or subsequent conviction to a fine not exceeding R10 million or to imprisonment for a period not exceeding 10 years, and in both instances to both such fine and such imprisonment;
- NEMA Section 49B(3): A person convicted of an offence in terms of section 49A(1)(h), (l), (m), (n), (o) or (p) is liable to a fine or to imprisonment for a period not exceeding one year, or to both a fine and such imprisonment;
- NWA Section 151 (1c): No person may fail to comply with any condition attached to a permitted water use under this Act;

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- NWA Section 151 (2): Any person who contravenes any provision of subsection (1) is guilty of an offence and liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment;
- NEM:BA Section 102 (1): A person convicted of an offence in terms of section 101 is liable to a fine not exceeding R10 million, or an imprisonment for a period not exceeding ten years, or to both such a fine and such imprisonment;
- NEM:WA Section 68 (1): A person convicted of an offence referred to in section 67(1)(b), (c), (d), (e), (f), (i), (j), (k) or (l) or section 67(2)(a), (b), (c), (d) or (e) is liable to a fine not exceeding R5 000 000 or to imprisonment for a period not exceeding five years, or to both a fine and such imprisonment, in addition to any other penalty or award that may be imposed or made in terms of the National Environmental Management Act;
- NEM:WA Section 68 (2): A person convicted of an offence referred to in section 67(1)(b), (c), (d), (e), (f), (i), (j), (k) or (l) or section 67(2)(a), (b), (c), (d) or (e) is liable to a fine not exceeding R5 000 000 or to imprisonment for a period not exceeding five years, or to both a fine and such imprisonment, in addition to any other penalty or award that may be imposed or made in terms of the National Environmental Management Act;
- NEM:WA Section 68 (3): Any person convicted of an offence referred to in section 67(1)(m) is liable to a fine or to imprisonment for a period not exceeding six months or to both a fine and such imprisonment;
- NEM:WA Section 68 (4): A person who is convicted of an offence in terms of this Act and who persists after conviction in the act or omission that constituted the offence commits a continuing offence and is liable on conviction to a fine not exceeding R1 000 or to imprisonment for a period not exceeding 20 days, or to both such fine and such imprisonment, in respect of each day that person persists with that act or omission;

It is recommended that a procedure for non-compliances (i.e. incentives or disincentives for conformance and non-conformance with the EMPr requirements) must be employed to ensure that the EMPr is adequately implemented. The system to be used must be determined before the project commences, included in the tender documents and contracts, and made clear to all project workers. The system may include that the independent Environmental Control Officer (ECO) can be authorized to impose spot fines on the Contractor and/or his subcontractors for any of the defined transgressions. Such fines should be issued in addition to any remedial costs incurred as a result of non-compliance with the environmental specifications and or legal obligations.

8 ROLES AND RESPONSIBILITIES

The applicant will be responsible for ensuring overall compliance with the provisions of the EMPr. Implementation is the key to the success of the EMPr. In order to ensure that the EMPr and its mitigation measures are implemented, roles and responsibilities need to be clearly defined and documented prior to commencement. This section serves as a guide on which party is normally responsible for certain tasks. Specific roles are designated in the specific environmental management and mitigation requirements in this EMPr.

8.1 The Project Applicant/Proponent

The applicant is the principal party (Proponent) of the project. For the purposes of this project, it is understood that the Applicant role is fulfilled by the TGS. The legal accountability for correct implementation of the relevant requirements of the EA and EMPr falls primarily upon the applicant and must therefore be built into all contractor's contractual agreements. The applicant's role typically includes:

- Provide for all necessary supervision during the execution of the project including appointment of key personnel to act on his/her behalf during the project (e.g.: Project Manager). The key personnel will be tasked with ensuring that the various contractors/developers comply with the necessary provisions of the EA and EMPr;

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- Ensure that the various contractors and applicable sub-contractors appoint a suitably qualified, competent Environmental Officer (EO) that will be responsible for among others, ensuring daily compliance with the EMPr and EA throughout the execution of the relevant project components;
- Appoint a suitably qualified, competent independent Environmental Control Officer (ECO) who will undertake periodic audits on the various contractors works;
- Appoint an independent and suitably qualified MMO to monitor marine fauna for the duration of the survey;
- Appoint an independent and suitably qualified PAM operator to monitor marine fauna for the duration of the survey;
- Appoint a suitably qualified FLO to facilitate communications between the seismic and fishing vessels for the duration of the survey;
- Notify the relevant competent authority of changes in the development resulting in significant environmental impacts;
- Assess the various contractor's environmental performance during the survey, in consultation with the ECO;
- Ensure compliance with regulations;
- To implement the projects as per the approved project plan;
- To ensure that implementation is conducted in an environmentally acceptable manner;
- To inform and educate all employees about the environmental risks associated with the different activities that should be avoided during the survey process and lessen significant impacts to the environment;
- Ensure MMOs and PAM operators are briefed on the area-specific sensitivities and on the seismic survey planning (including roles and responsibilities, and lines of communication); and
- Seabird, turtle and marine mammal incidence data and seismic source output data arising from surveys should be made available on request to the Marine Mammal Institute, DFFE, and the Petroleum Agency South Africa for analyses of survey impacts in local waters. Therefore, ultimately, the Applicant is responsible for the development and implementation of the EMPr and, where relevant, ensuring that the conditions in the EA are satisfied. Where survey activities are contracted out (e.g. to Contractors and Subcontractors), the liability associated with non-compliance still rests with the Applicant (unless otherwise agreed upon between the authorities, the Applicant and the contracting parties). The Applicant (and not the Contractor) is therefore responsible for liaising directly with the relevant authorities with respect to the preparation and implementation of the EMPr and meeting authorisation conditions.

8.2 The Project Manager

During the development, it is envisaged that there may be a number of contractors and sub-contractors undertaking various activities on the project. The Project Manager would oversee all contractors and sub-contractors from a project management point of view. The roles of the Project Manager typically include the following:

- The Project Manager acts on behalf of the Applicant regarding the administration of contracts to sub-contractors, etc.;
- Provides and/or approves scheduling, aspects of co-ordination and estimating,
- Ensures implementation of the project plan within cost, time and quality constraints;
- Ensures that implementation of EMPr is executed as planned; and
- Keeps the asset owner informed of progress made during the life cycle of the project.

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8.3 The Environmental Control Officer

The ECO is appointed by the Applicant and should be independent from the Applicant and the Contractors. The ECO should have appropriate training and/or experience in the implementation of environmental management specifications. The ECO must preferably have a tertiary qualification in an Environmental Management or appropriate field. The ECO provides feedback to the Project Manager regarding all environmental matters. The ECO's key role is auditing the implementation of the EMPr. For the purposes of implementing the conditions contained herein, the Applicant should appoint the ECO well before the start of survey activities. The ECO is responsible for the auditing function as well as the clarification of environmental conditions contained in this EMPr to anyone working on the site. For the purposes of this project, the role of ECO and MMO can be fulfilled by the same person.

The ECO roles include:

- Recommendations for review and update of the EMPr;
- Liaison between the Applicant, Contractors, authorities and other lead stakeholders on high importance environmental concerns;
- Ensures that correct shape files have been uploaded into the vessel navigation systems to support effective implementation of spatial controls
- Review the site induction training to ensure environmental issues receive adequate attention and important site-specific issues are included;
- Conduct environmental audits of the site/contractors including relevant documentation on a monthly basis;
- Validating the regular site inspection reports, which are to be prepared by the relevant contractor ECO's;
- Maintain a record of all non-conformances and incidents to ensure that measures are put in place to remedy such;
- Maintain a public consultation register in which all complaints are recorded, as well as action taken; and
- Verification that all environmental monitoring programmes (sampling, measuring, recording etc. when specified) are carried out according to protocols and schedules.

It is important to note that where opportunity for interpretation occurs within the conditions of this EMPr, the interpretation of the ECO will take preference.

8.4 Marine Mammal Observer

Independent Marine Mammal Observer (MMO) is required on board at all times; as a minimum sufficient MMOs must be on watch to cover all hours for the pre-acquisition observations and while the acoustic source is active. The duties of the MMO would be to:

- Give effective briefings to crew members, and establish clear lines of communication and procedures for onboard operations;
- Record seismic source activities, including sound levels, "soft-start" procedures and pre-start regimes;
- Observe and record responses of marine fauna to seismic source from optimum vantage points, including seabird, turtle, seal and cetacean incidence and behaviour and any mortality or injuries of marine fauna as a result of the seismic survey. Data captured should include species identification, position (latitude/longitude), distance/bearing from the vessel, swimming speed and direction (if applicable) and any obvious changes in behaviour (e.g. startle responses or changes in surfacing/diving frequencies, breathing patterns) as a result of the seismic activities. Both the identification and the behaviour of the animals must be recorded accurately along with current seismic sound levels. Any attraction of predatory seabirds, large pelagic fish or cetaceans (by mass disorientation or stunning of fish as a result of seismic survey activities) and incidents of feeding behaviour among the hydrophone streamers should also be recorded;

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- Record sightings of any injured or dead protected species (marine mammals, large pelagic fish (e.g. sharks), seabirds and sea turtles) should be recorded, regardless of whether the injury or death was caused by the seismic vessel itself. If the injury or death was caused by a collision with the seismic vessel, the date and location (latitude/longitude) of the strike, and the species identification or a description of the animal should be recorded and included as part of the daily report;
- Record meteorological conditions at the beginning and end of the observation period, and whenever the weather conditions change significantly;
- Request the delay of start-up or temporary termination of the seismic survey or adjusting of seismic source, as appropriate. It is important that MMO decisions on the termination of seismic source is made confidently and expediently and following dialogue between the observers on duty at the time. A log of all termination decisions must be kept (for inclusion in both daily and "close-out" reports);
- Use a recording spreadsheet in order to record all the above observations and decisions; and
- Prepare daily reports of all observations, to be forwarded to the necessary authorities as required, in order to ensure compliance with the mitigation measures.

8.5 Passive Acoustic Monitoring Operator

An independent Passive Acoustic Monitoring (PAM) Operator is required on board at all times, as a minimum at least one must be on watch at all times while the acoustic source is active. The duties of the PAM operator would be to:

- Provide effective regular briefings to crew members, and establish clear lines of communication and procedures for onboard operations;
- Ensure that the hydrophone cable is optimally placed, deployed and tested for acoustic detections of marine mammals;
- ; Confirm that there is no marine mammal activity within 500 m of the seismic source array prior to commencing with the "soft-start" procedures;
- Record species identification, position (latitude/longitude), distance and bearing from the vessel and acoustic source, where possible;
- Record general environmental conditions;
- Record seismic source activities, including sound levels, "soft-start" procedures and pre-start regimes;
- Request the delay of start-up and temporary termination of the seismic survey, as appropriate;

8.6 Fisheries Liaison Officer

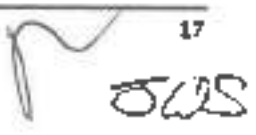
An independent Fisheries Liaison Officer (FLO) must be appointed to undertake the following:

- Facilitate communication with maritime vessels;
- Report daily on vessel activity;
- Respond and advise on action to be taken in the event of encountering fishing gear; and
- Report daily on the survey vessel's potential impacts on marine fauna.

8.7 The Contractor/ Operator

The contractor is usually a third party appointed by the applicant/project manager to undertake the actual survey acquisition. For the purposes of this section, any contractor (regardless of who appointed them) is referred to as the "contractor".

The relevant contractors are answerable to the Project Manager and ECO for all environmental issues associated with the project. Contractor performance will, amongst others, be assessed on health, safety and environmental management criteria. The principal contractor/s, any other contractors and sub-contractors will be required to comply with the provisions contained herein, and accordingly, the EMPr and its provisions must form part of any



contractual arrangements between the applicant and contractors, and contractors and their sub-contractors, etc. The contractor must comply with EMPr and ensure that all his employees and sub-contractors appointed by him/her are familiar with the EMPr. The legal accountability for correct implementation of the relevant requirements of the EA and EMPr must be contractually bound to the appointed contractor.

The Contractors roles include (but not limited to):

- Provide all necessary supervision during the execution of the project;
- Appoint a suitably qualified, competent EO that will be responsible for amongst others, ensuring daily compliance with the EMPr, EA during the acquisition phase;
- Adhere to the instructions of the MMO and PAM operators with regards to seismic source soft start procedures and possible temporary termination of activities if indicated by marine fauna observations;
- To implement the project as per the approved project plan;
- To ensure that implementation is conducted in an environmentally acceptable manner;
- To fulfil all obligations as per the agreed contract; and
- Ensure that the Contractors staff and employees have received the appropriate environmental awareness training prior to commencing survey activities.

8.8 The Contractor/ Operator Environmental Officer

The principal contractor shall appoint an Environmental Officer (EO), who is responsible for implementation of the EMPr. The Contractor must ensure that the Contractor's EO is suitably qualified and competent to perform the necessary tasks and is appointed at a level such that she/he can interact effectively with other Contractors, labourers, the ECO and the public (if necessary). The Contractor's EO ensures that all sub-contractors working under the Contractor and sub-contractors abide by the requirements of the EMPr. The appointment of additional EO's and/or sub-contractors EO's is at the ECO's discretion. The costs related to the implementation of the EMPr will be the responsibility of the relevant Contractor/ sub-contractor.

The Contractor's EO roles will include:

- Preparing activity based Environmental Method Statements where applicable and where required by the ECO;
- Review the contractors safe work procedures/risk assessments/induction training/DSTI's (daily safe task instruction) during the survey and include information relating to the relevant environmental risks and appropriate mitigation measures;
- Support the ECO in monitoring by maintaining a permanent presence on board the survey vessel;
- Establishing and maintaining an environmental incident register;
- Taking required corrective action within specified time frame in respect of non-conformances and environmental incidents;
- Assist in finding environmentally acceptable solutions to problems;
- Attendance at HSE meetings, toolbox talks and induction programmes (where relevant);
- Complete a daily diary with the purpose of recording environmental issues and corrective measures on a daily basis;
- Report any complaints to the ECO to be captured in the Consultation register;
- Liaise with the project teams on issues related to implementation of, and compliance with the EMPr; and
- Ensure adequate and compliant waste management.

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8.9 The Authorities

The authorities that should be involved include the Competent Authorities, i.e. PASA and the OMRE. The authorities may be required to perform the following roles:

- Review Monitoring and Audit reports, if required;
- Review whether there is compliance by the Applicant and Contractor with the terms of the EMPr and permit/license conditions. Whenever necessary, the authorities should assist the Applicant in understanding and meeting the specified requirements; and
- The authorities may perform random controls to check compliance. In case of persistent non-compliance, the Applicant will be required to provide an action plan with corrective measures, and have it approved by the authorities.

9 ENVIRONMENTAL MANAGEMENT SYSTEM

The purpose of this EMPr is to ensure that the environment is properly considered during the design, mobilisation, operations, and completion of the survey activities, and that negative impacts are minimised or prevented, and positive impacts enhanced. At the same time the EMPr should provide a logical extension of the EIA, specialist studies, or any other technical planning and assessment documentation, to ensure that recommendations are implemented, and that the project does not deviate from the environmental profile that formed the basis of the assessment.

9.1 Document Control

A formal document control system should be established. The document control system must provide for the following requirements;

- Documents are approved for adequacy prior to use;
- Review and update documents as necessary and re-approve documents;
- Ensure that changes and the current version status of documents are identified;
- Ensure that relevant versions of applicable documents are available at points of use;
- Ensure that documents remain legible and readily identifiable;
- Ensure that documents of external origin necessary for the EMPr are identified and their distribution controlled; and
- Prevent unintended use of obsolete documents and apply suitable identification to them if they are retained for any purpose.

The responsibility for establishing a suitable document control system rests with the Project Manager.

9.2 Record Keeping

It is essential that an official procedure for control of records be developed to ensure records required to demonstrate conformity to environmental standards are maintained. The Applicant, or the Project Manager (if assigned) is therefore required to develop and maintain a procedure for the identification, storage, protection, retrieval, retention and disposal of records as part of the EMPr. Records must be legible, identifiable and traceable.

9.3 Auditing and Reporting Procedures

Reporting procedures must be developed at the start of the project, for conveying information from the compliance monitoring activities and to ensure that management is able to take rapid corrective action should certain thresholds be exceeded. Different reporting procedures may include:

- Inspections;

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- Accidents and emergencies;
- Measuring performance indicators and interpreting and acting on the indicators;
- Records of monitoring activities to test the effectiveness of mitigation measures and impact controls, as well as for compliance auditing purposes; and
- Training programmes and evidence of appropriate levels/amount of skills/capacities created.

All monitoring and auditing must be accompanied by applicable records and evidence (e.g. delivery slips, photographic records, etc.). All reports must be retained and made available for inspection by the ECO, the Applicant and /or the Relevant Competent Authorities. All reports shall be signed by the relevant parties to ensure accountability. The Applicant must use the audit report findings to continually ensure that environmental protection measures are working effectively through a system of self-checking. The EMPr should be viewed as a dynamic document aimed at continual environmental performance improvement.

The following auditing and reporting shall be required throughout the survey:

- Daily Environmental Diary: These reports must be prepared by the contractors' EO and must aim to monitor and report on day-to-day activities so as to ensure compliance with the relevant authorisations, licences and permits, the approved EMPr, and environmental method statements;
- Monthly Compliance Reports (EO): These reports must be prepared by the contractors' EO and must aim to provide a concise monthly performance report, including copies of relevant documents (e.g. waste manifests, incident registers, consultation registers, etc);
- Monthly Audit Reports: The ECO must compile monthly compliance reports (audits) which are to be submitted to the Applicant for review and correction of non-compliance issues. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified. Depending on the outcome of the authorisation processes it may be a requirement to submit these to the relevant authorities.

9.4 Responding to Non-Compliances

Non-compliance will be identified and managed through the following four key activities including:

- Inspections of the survey vessel and activities related to the survey;
- Monitoring of selected environmental quality variables (where relevant);
- Audits of the survey activities and relevant documentation; and
- Reporting on a monthly basis.

An environmental non-conformance and incident register must be prepared and maintained by the ECO throughout the 3D seismic survey in order to track and monitor environmental concerns, incidents, and non-conformances. The register must include details of date, location (coordinates), description of the NC or incident, applicable environmental commitment/standard, corrective action taken, adequacy of corrective action, date rectified, etc.

Non-compliance with the EMPr or any other environmental legislation, specifications or standards shall be recorded by the ECO in the non-conformance register. This register shall be maintained by the ECO and will be sent to the Applicant and Contractor on a regular basis (monthly), and the Applicant shall ensure that the responsible party takes the necessary corrective actions. Non-conformances may only be closed out in the register by the ECO upon confirmation that adequate corrective action has been taken and/or documented proof provided. The register should be utilised to measure overall environmental performance.

9.5 Environmental Incidences

For the purposes of this project, an environmental incident can be divided into three levels, i.e. major, medium and minor. All Major and Medium environmental incidents shall be recorded in the ECO's non-conformance and incident register. Minor incidents shall be recorded by the contractor, and by the Applicant in their own incident register. Definitions of environmental incidents are provided in Table 4.

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Table 4: Description of incidents and non-conformances for the purpose of the project

Non-Conformance	Any deviation from work standards, practices, procedures, regulations, management system performance etc. that could either directly or indirectly lead to injury or illness, damage to the workplace or oceanic environment, legal transgression or a combination of these.
Major Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread, long-term, irreversible significant negative impact on the oceanic environment and/or has a high risk of legal liability. A major environmental incident usually results in a significant pollution and may entail risk of public danger. Major environmental incidents usually remain an irreversible impact even with the involvement of long-term external intervention i.e. expertise, best available technology, remedial actions, excessive financial cost etc. Major environmental incidents must be reported to the authorities. The ECO shall make the final decision as to whether a particular incident should be classified as a Major incident.
Medium Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread or localised, short term, reversible significant negative impact on the oceanic environment and/or has a risk of legal liability. A medium environmental incident may be reported to the authorities, can result in significant pollution or may entail risk of public danger. The impact of medium environmental incidents should be reversible within a short to medium term with or without intervention. The ECO shall make the final decision as to whether a particular incident should be classified as a Medium incident.
Minor Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, where the oceanic environmental impact is negligible immediately after occurrence and/or once-off intervention on the day of occurrence.

The following incident reporting procedures shall apply to this project:

- All environmental incidents shall be reported to Contractor's EO, and the ECO, and shall be recorded in the contractors' respective incident registers;
- The ECO shall record the incident in the non-conformance and incident register and advise on the appropriate measures and timeframes for corrective action;
- An incident report shall be completed by the relevant party responsible for the incident for all medium and major incidents and the report shall be submitted to the Project Manager and ECO within 5 calendar days of the incident;
- The EO shall investigate all incidents and identify any required actions to prevent a recurrence of such incidents; and
- In the event of an emergency incident (unexpected sudden occurrence), including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed, the Applicant shall notify the relevant authorities in accordance with Section 30(3) of the NEMA. The Applicant shall engage the ECO who shall assess all major incidents and shall advise the Applicant when any such incident must be reported to the authorities as per the above requirement.

9.6 Application of the Mitigation Hierarchy

A key component of the EIA process is to explore practical ways of avoiding and where not possible to reducing potentially significant impacts of the proposed seismic acquisition activities. The mitigation measures put forward are aimed at preventing, minimising or managing significant negative impacts to as low as reasonably practicable (ALARP). The mitigation measures are established through the consideration of legal requirements, project standards, best practice industry standards and specialist inputs.

The mitigation hierarchy, as specified in International Finance Corporation (IFC) Performance Standard 1, is based on a hierarchy of decisions and measures aimed at ensuring that wherever possible potential impacts are mitigated at source rather than mitigated through restoration after the impact has occurred. Any remaining significant residual impacts are then highlighted, and additional actions are proposed. With few exceptions, however, identified impacts were of low significance with very low or zero potential for further mitigation. In such cases the appropriate project Standards will be used and additional best management practices are proposed.

The operator will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and Best Available Techniques (BAT), and in compliance with the applicable requirements in the MPRDA regulations.

The operator will ensure that the proposed seismic survey is undertaken in a manner consistent with good international industry practice and in compliance with the applicable requirements in MARPOL 73/78 and industry best practices with regard to waste management

Detailed mitigation measures for seismic surveys in other parts of the world are provided by Weir et al. (2006), Compton et al. (2007) and US Department of Interior (2007). Many of the international guidelines presented in these documents are extremely conservative as they are designed for areas experiencing repeated, high intensity surveys and harbouring particularly sensitive species, or species with high conservation status. A number of countries have more recently updated their guidelines, most of which are based on the JNCC (2010, 2017) recommendations but adapted for specific areas of operation. A review and comparison of these is provided in MaMaCoCo SEA (2015). The guidelines currently applied to seismic surveying in South African waters are those proposed in the Generic EMPR (CCA & CMS 2001). These have been updated as necessary to include salient points from recognised international guidelines, particularly the JNCC (2010, 2017) Guidelines and the 2013 New Zealand Code of Conduct for seismic operations.

10 REVIEW AND REVISION OF THE EMPR

It is important to note that this EMPr is made legally binding on the Applicant through the EA and the approval of the EMPr by the decision-making authority. It is important to consider that the EMPr is a dynamic document which may require such alteration and /or amendment as the project evolves. Conditions under which the EMPr would require revision include:

- Changes in legislation;
- Occurrence of unanticipated impacts or impacts of greater intensity, extent and significance than predicted;
- Inadequate mitigation measures (i.e. where environmental performance does not meet the required level despite the implementation of the mitigation measure);
- Secondary impacts occur as a result of the mitigation measures; and
- Instances where the implementation of the specified management, as a result of changes in circumstances, may become impractical or unreasonable to implement.

The Applicant in consultation with the ECO should be responsible for ensuring that the registration and updating of all relevant EMPr documentation is carried out. It shall be the responsibility of the Applicant, in consultation with the ECO, to ensure that all personnel are performing according to the requirements of the document

control procedure, and to initiate the revision of controlled documents, when required by changes in process or operations.

The ECO must undertake a risk assessment of any proposed changes to the EMPr. This risk assessment must be included in the applicable monthly audit report, and where applicable supported by the necessary proof of public consultation. It is important to note that if alterations and/or amendments are required these may only be affected with written approval from the competent authority and in accordance with the relevant legal processes.

11 ENVIRONMENTAL AWARENESS PLAN AND TRAINING

Training and environmental awareness is an integral part of a complete EMPr. The overall aim of the training will be to ensure that all site staff are informed of their relevant requirements and obligations pertaining to the relevant authorisations, licences, permits and the approved EMPr and protection of the environment.

The applicant and contractor must ensure that all relevant employees are trained and capable of carrying out their duties in an environmentally responsible and compliant manner and are capable of complying with the relevant environmental requirements. To obtain buy-in from staff, individual employees need to be involved in:

- Identifying the relevant risk;
- Understanding the nature of risks;
- Devising risk controls; and
- Given incentive to implement the controls in terms of legal obligations.

The Applicant shall ensure that adequate environmental training takes place. All employees shall have been given an induction presentation on environmental awareness. Where possible, the presentation needs to be conducted in the language of the employees. All training must be formally recorded, and attendance registers retained. The environmental training should, as a minimum, include the following:

- General background and definition of the oceanic environment;
- The importance of compliance with all environmental policies;
- The environmental impacts, actual or potential, of their work activities;
- Compliance with mitigation measures proposed for sensitive marine fauna;
- Their roles and responsibilities in achieving compliance with the environmental policy and procedures and with the requirement of the applicant's environmental management systems, including emergency preparedness and response requirements;
- The potential consequences (legal and/or other) of departure from specified operating procedures including fines (where applicable);
- The mitigation measures required to be implemented when carrying out their work activities; and
- All operational risks must be identified, and processes established to mitigate such risk, proactively. Thus, the applicant needs to inform the employees of any environmental risks that may result from their work, and how these risks must be dealt with in order to avoid pollution and/or degradation of the oceanic environment.

The specific requirements for environmental training during the survey include:

- Environmental Induction Training: All workers must receive induction training which shall be presented by the Contractors HSE Manager Representatives. The induction training must include an environmental management component which will be prepared by the Contractor's EO and presented where possible by the Contractor's EO. The training material must include general environmental awareness with an overview of the approved EMPr and applicable authorisations, licences and permits. Health and safety expectations including communication and reporting to key personnel, including incidents and during emergencies, should also be outlined. The Induction Training Material must be reviewed and approved by the ECO;

- Weekly Environmental Toolbox Talks will be prepared by the Contractor's EO to cover a range of environmental topics and must be presented to relevant staff during applicable times during the seismic survey process (e.g. at the start of a day or activity). The aim of these toolbox talks will be to inform employees of general environmental requirements pertaining to specific activities, as well as specific EMPr and EA requirements and obligations. The ECO shall review environmental toolbox talks on a periodic basis to ensure the material is relevant and appropriate;
- Informal training of all seismic survey staff is also required on an on-going basis through informal discussions, on-site supervision and through facilitation of day-to-day activities. Such training must be given or otherwise facilitated by the Contractor's EO; and
- The Contractor's EO must review all safe work procedures/risk assessments/DSTI's (daily safe task instruction) from the safety department and include the relevant environmental risks and appropriate mitigation measures where necessary. Since the above procedures are specific to the applicable activity being undertaken, the inclusion of environmental measures aims to ensure each activity is undertaken in an environmentally responsible manner.

12 EMERGENCY RESPONSE PLAN

The Applicant must identify potential emergencies and develop procedures for preventing and responding to them. There are several options for dealing with high priority impacts and risks, as the paradigm has two components, probability and consequence. The design of control measures rests on understanding the cause and effect. Best practise is to intervene with the ultimate factors where feasible, rather than treat the outcomes. Emergency response therefore has the option of reducing probability or reducing the consequence while reducing the probability is the preferred option. Below are some common emergency preparedness approaches:

- Threat consequence if a risk eventuates, when the risk becomes an issue;
- Combine reducing the probability and treating the consequence;
- Offset environmental losses by investing in other assets;
- Not manage some of the risks because there are too many; and
- Make provision to manage residual impacts or issues that arise because of shortcomings in risk identification and rating, avoidance and mitigation or because a rare event has occurred.

Residual impacts are those impacts that despite reducing the probability and consequence might still occur. In these cases, parties will have to be compensated, pollution cleaned up and damage to the environment remediated.

The Applicant shall be required to develop and implement an Emergency Preparedness and Response Plan prior to commencing work. The Applicant must ensure that the Emergency Preparedness and Response Plan makes provision for environmental emergencies, including, but not limited to:

- Fire Prevention;
- Fire Emergency Response;
- Spill prevention;
- Spill Response;
- Accidents to employees; and
- Use of hazardous substances and materials, etc.

The Applicant and Contractor must ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant locations throughout the seismic survey phase.

12.1 Spill Response Procedure

The Contractor must ensure that all employees, staff and labourers are informed and instructed regarding implementation of spill prevention measures and spill response procedures. In the event of a spill, the following general requirements shall apply, and the detailed spill procedure must cater for these requirements:

- Immediately reporting of spills by all employees and/or visitors to the relevant supervisor and EO (this requirement must be including in induction training);
- Take immediate action to contain or stop the spill where it is safe to do so;
- Contain the spill and prevent its further spread;
- Dispose of any contaminated materials according to appropriate waste disposal procedure. Note. Waste from spills of hazardous materials shall be disposed of as hazardous waste at a suitably licensed onshore waste disposal facility;
- The Contractor's EO shall record details of the spill in their respective incident registers;
- Photographic evidence shall be obtained of the spill clean-up.

In the case of large spills, the services of a specialist spill response agency shall be required, who shall advise on appropriate clean-up procedures and follow-up monitoring (if required). The incident procedures as defined in Section 9.5 shall also apply.

The Applicant must also, (as per Section 30 of the NEMA) notify the Director-General (DWS, Competent Authority, DEFF), South African Police Services, Provincial Environmental Authority, the Local Municipality, and any persons whose health may be affected of the nature of an incident including:

- Any risks posed to public health, safety and property;
- Toxicity of the substance or by products released by the incident; and
- Any step taken to avoid or minimise the effects of the incident on public health and the environment.

12.2 Measures to Control or Remedy any Causes of Pollution or Degradation

The broad measures to control or remedy any causes of pollution or environmental degradation as a result of the proposed activities taking place on the project are provided below:

- Ensure that the environmentally sensitive areas are adequately understood by the ship's Captain throughout the survey;
- Contain potential pollutants and contaminants (where possible) at source;
- Handling of potential pollutants and contaminants (where possible) must be conducted in controlled areas;
- Ensure the timeous clean-up of any spills;
- Implement a waste management system for all waste streams present; and
- Investigate any third-party claims of pollution or contamination as a result of the project activities.

13 MANAGEMENT AND MITIGATION

Table 5: Technical or Management Options

Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
13.1	**Legal Compliance**						
A	• The Applicant shall identify and comply with all relevant national, provincial and local legislation, including associated regulations and bylaws and shall establish and maintain procedures to keep track of, document and ensure compliance with environmental legislative changes.	Planning Operation	Prior to operation and ongoing	Applicant	ECO (Monthly)	Ensure compliance with relevant legislation.	Up to date legal register. (Legal register) (ECO Monthly Audit)
B	• Should there be changes in legislation and/or regulations the Applicant shall take the necessary actions to incorporate such changes and to pass these requirements on to the Contractors.	Planning Operation	Prior to operation and ongoing	Applicant ECO	ECO (Monthly)	Ensure compliance with relevant legislation / Confirmation that requirements in terms of updated legislation are passed onto the contractors.	(Contractor contractual agreements) (ECO Monthly Audit)
C	• Should surveys run simultaneously, it would be required to amend the EMPr, which would be subject to further assessment and consultation.						
13.2	**Scheduling**						
A	Based on the findings of the Acoustics, Marine Ecology and Fisheries recommendations, it is recommended that the survey window of January – May be utilized in order to: • Avoid sensitive areas and periods for some marine fauna: Movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (June/July and late October/November), and their aggregation on the summer feeding grounds between St Helena Bay and Dassen Island from late October to late December and ensure that migration paths are not blocked by seismic operations; • Avoid periods of peak fishing activity during June and July in order to reduce the probability of disruption to the large pelagic longline fishing sector and tuna pole line fishing sector.	Planning Operation	Prior to operation and ongoing	Applicant ECO	ECO (ongoing)	Limit survey to January – May.	Survey logs and ECO Reports.

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Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
13.3. Appointment of ECO/MMO/PAM/FLO							
A	• The Applicant shall appoint a suitably qualified ECO who shall be independent from the Applicant and the Contractor. The ECO must preferably have a tertiary qualification in Environmental Management or appropriate environmental science field. The ECO should have appropriate qualification and experience in the implementation of environmental management specifications. For the purposes of implementing the conditions contained in this EMPr. The Applicant shall provide the ECO with the necessary support to ensure that the environmental aspects relating to the development is adhered to. The appointment of the ECO shall remain in force until all obligations of this EMPr have been met (e.g. including any relevant rehabilitation phase)	Planning Operation	Prior to operation	Applicant	Applicant (once off prior to operations)	Appoint ECO to ensure monitoring of successful implementation of the EMPr.	Confirmation that ECO has been appointed and is suitably qualified to perform the duties contained in this EMPr. (ECO appointment and CV)
B	• Qualified, independent MMOs are required on board at all times; as a minimum sufficient MMOs must be on watch to cover all hours while the acoustic source is active.	Planning Operation	Prior to operation	Applicant	Applicant (once off prior to operations)	Appoint MMO to ensure monitoring of successful implementation of the EMPr.	Confirmation that MMO has been appointed and is suitably qualified to perform the duties contained in this EMPr. (MMO appointment and CV)
C	• Qualified, independent PAM Operators are required on board at all times, as a minimum one must be on watch while the acoustic source is active.	Planning Operation	Prior to operation	Applicant	Applicant (once off prior to operations)	Appoint PAM to ensure monitoring of successful implementation of the EMPr.	Confirmation that PAM has been appointed and is suitably qualified to perform the duties contained in this EMPr. (PAM appointment and CV)
D	• The Applicant shall appoint an independent FLO who must have experience in the liaising with the fishing operations and communities.	Planning Operation	Prior to operation	Applicant	Applicant (once off prior to operations)	Appoint FLO to ensure monitoring of successful implementation of the EMPr.	Confirmation that FLO has been appointed and is suitably qualified to perform the duties contained in this EMPr. (FLO appointment and CV)
E	• The Applicant is responsible for the maintenance, update and review of the EMPr. The ECO shall include any recommendations for proposed amendments/alterations of the EMPr to the Applicant who shall engage the competent authority, to the extent required, with regards to such changes.	Planning Operation	As required	Applicant ECO	ECO (Monthly) Applicant (as and when necessary)	Ensure EMPr is reviewed and updated where necessary to ensure adequate mitigation for all impacts associated with the project.	Audit results and recommendations (ECO Monthly Audit)

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Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
13.4 . Appointment of Contractors							
A	• The EMPr must be made binding on the contractor/s and should be included in tender documentation and contracts. The costs related to the implementation of the EMPr during survey activities must be provided for in the contract.	Planning Operation	Prior to operation	Applicant Contractors	ECO (Once-off at the start of individual contractor's work)	Ensure that the contractor is in possession of the EMPr and that they understand their obligations thereto.	Confirmation that contractor has received EMPr, and that EMPr has been made contractually binding. (Contractual agreements) (ECO Monthly Audit)
B	• All contractors and sub-contractors must have a copy of this EMPr on site and should be briefed by the EO with regards to the use and implementation of the EMPr.	Planning - Operation	Prior to Operation and Ongoing	Contractor	ECO (Monthly) Applicant (once off per contractor)	Ensure all contractors are aware of EMPr requirements.	Confirmation that contractors have received training relating to EMPr implementation. (Training records) (ECO Monthly Audit)
C	• The Contractor shall appoint a dedicated Contractor's EO who is suitably qualified to perform the necessary tasks and is appointed at a level such that she/he can interact effectively with other site Contractors, labourers, the ECO and the public. The Contractor's EO shall be appointed prior to the onset of the seismic survey.	Planning	Prior to Operation and Ongoing	Contractor	ECO (Once-off)	Ensure a suitably qualified EO is present on site to oversee day to day activities and ensure successful implementation of EMPr during the seismic survey.	Confirmation that EO has been appointed and is suitably qualified to perform the necessary duties contained in the EMPr. (ECO Monthly Audit)
D	• The Contractor shall ensure that all sub-contractors working under them abide by the requirements of the EMPr through the inclusion of the EMPr and applicable environmental requirements in contractual agreements for all sub-contractors.	Operation	Ongoing	Contractor	EO (Weekly) ECO (Monthly)	Ensure that the contractor implements all the mitigation measures as described in the EMPr.	Signed declaration of understanding by contractors (EO weekly checklist) (ECO Monthly Audit Report)
13.5 Health and Safety							
A	The Applicant through the Project Manager shall ensure: • That reasonable measures are taken to ensure the safety of all site staff; • Provide appropriate Personal Protective Equipment (PPE) where required. • Compliance with the Occupational Health and Safety Act (Act No. 85 of 1993) and associated regulations; • That all accidents and incidents are recorded and reported to the Project Manager and EO/ECO; and • The Applicant and Contractor must ensure that he/she has the contact details of the nearest emergency rooms (hospitals) of both private and public hospitals.	Operation	Ongoing	Project Manager Contractor	Safety Department	Ensure compliance with legal provisions of OHSA.	(safety reports) (safety audits)

1603

Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
13.6 Emergency Response / Disaster Management Planning							
A	• Develop and implement an Emergency Preparedness and Response Plan (EPRP) for implementation during the seismic survey. This should be revised periodically as the various phases of the seismic survey work takes place.	Planning Operation	Prior to Operation and Ongoing	Contractor	ECO (Once-off)	Ensure emergency preparedness and response systems in place.	Verification that EPRP is in place. (ECO Audit) (EPRP) (Incident Reports)
13.7 Socio-Economic Considerations							
A	• TGS should develop a community engagement protocol that is based on the Sea Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism.	Planning Operation	Prior to Operation and Ongoing	Applicant/ Project manager	ECO (Monthly)	Ensure that socio-economic considerations are considered and implemented where necessary	Preparation and maintenance of a community engagement protocol. (ECO Monthly Audit), (Consultation register)
	• TGS should contribute to assisting with collaboration on independent research on bear fish species on the West Coast such as snoek respond to seismic surveying. TGS will further contact relevant scientific research institutions to offer the potential of collaborating in independent on-water research during the survey. It is recommended that the Department of Agriculture, Forestry and Fisheries, Oceans & Coasts, Research component be contacted for possible collaboration on further research on the impact of seismic surveys on the marine ecosystem.	Planning Operation	Prior to Operation and Ongoing	Applicant/ Project manager	ECO (Monthly)	Ensure that socio-economic considerations are considered and implemented where necessary	Proof of consultation and attempts at collaboration
C	• Consult with communities on potential ways in which to make a positive contribution to the communities. • TGS should investigate opportunities for the employment of people from local communities and skills development.	Planning Operation	Prior to Operation and Ongoing	Applicant/ Project manager	ECO (Monthly)	Ensure that socio-economic considerations are considered and implemented where necessary	Consultation Register (ECO Monthly Audit)
D	• A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with adjusting the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful	Planning Operation	Prior to Operation and Ongoing	Applicant/ Project manager	ECO (Monthly)	Ensure that socio-economic considerations are considered and implemented where necessary	Consultation Register and workshops (ECO Monthly Audit)

1604

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	engagement with the leadership and communities are critical from a social perspective. • TGS should also initiate discussions in their industry. The seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.						
F	• TGS should approach the authorities and enter into conversation regarding a strategic impact assessment for the area that should be contributed to by all the prospecting/ exploration companies involved.	Planning Operation	Prior to Operation and Ongoing	Applicant/ Project manager	ECO (Monthly)	Ensure that socio-economic considerations are considered and implemented where necessary	Proof of consultation with authorities
	13.8 Heritage/ Palaeontological Features						
A	• Re-assess post-project the potential effects on the identified communities and their intangible cultural heritage. This will require consideration of the socio-economic baseline developed during the environmental impact process against quantified economic damage and losses and human development impacts in a follow-up socio-economic assessment. It will enable the heritage specialist to evaluate the link between the socio-economic changes induced by the proposed project as it relates to changes in the intangible cultural heritage practices of the communities. • Based on the outcomes, provide resources and support for communities to develop and undertake safeguarding measures or plans to enhance the mitigation capacity of their intangible cultural heritage by fostering dialogue, mutual understanding and reconciliation between and within communities. • 3D seismic survey have the potential to locate wrecks on the surface, and sometimes below sediments on the ocean	Planning Closure	During Operation	Applicant/ Project manager in consultation with specialist	ECO – once off	Re-assess post project, the effects on the identified communities and their intangible cultural heritage Enhance mitigation capacity of intangible cultural heritage	Safeguarding measures or plans in place post survey.

1605

Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	floor. Any shipwrecks or pieces thereof noted during the survey must be shared with the SAHRA MPOH Unit for inclusion into the national database. These could then be identified and be incorporated into the EMPr.						
	13.9 Air Quality						
A	• Maintain all diesel motors and generators in good working order. Properly tune and maintain all engines, motors, generators and all auxiliary power to contain the minimum of soot and unburned diesel.	Operation	Ongoing	Applicant & Contractor	ECO (Weekly)	Ensure that no excessive air quality impacts are perceived	Visual confirmation of compliance with EMPr conditions. (EO weekly checklist) (ECO Monthly Audit)
	13.10 Noise Nuisance						
A	In the unlikely event that aircraft are utilised for crew changes or medivac: • Plan support aircraft flight path to avoid sensitive and protected areas and ensure no flying occurs over coastal seal colonies and seabird nesting areas • Avoid excessive low-altitude coastal flights by ensuring that the flight path is perpendicular to the coast, as far as possible. • Brief all pilots on the ecological risks associated with flying at a low level along the coast or above marine mammals.	Planning Operation	Prior to Operation and Ongoing	Applicant Contractor	EO (Weekly) ECO (Monthly)	Ensure that noise levels are controlled within acceptable limits. No complaints relating to noise.	Confirmation that noise levels are within acceptable limits and relevant notifications undertaken. (EO weekly checklist) (ECO Monthly Audit) (Consultation register)
	13.11 Acoustic Impacts of Seismic Surveys on Marine Fauna						
A	• All initiation of seismic source acquisition be carried out as "soft-starts" of at least 20 minutes duration.	Operation	During Operation	Contractor	EO (Weekly) ECO (Monthly)	Utilisation of soft starts at initiation.	Confirmation soft starts at initiation. (EO weekly checklist) (ECO Monthly Audit)
B	• Implement a dedicated MMO and PAM pre-acquisition watch of at least 60 minutes (to accommodate deep-diving species in water depths greater than 200 m).	Operation	During Operation	Contractor	EO (Weekly) ECO (Monthly)	Utilisation of soft starts at initiation.	Confirmation soft starts at initiation. (EO weekly checklist) (ECO Monthly Audit)
C	• Implement a "soft-start" procedure of a minimum of 20 minutes' duration on initiation of the seismic source if: o During all hours it is confirmed visually by the MMO during the pre-acquisition watch (60 minutes) that there are no penguins or feeding aggregations of diving seabirds, shoaling large pelagic fish, turtles, seals or cetaceans within 500 m of the seismic	Operation	During Operation	Contractor	EO (Weekly) ECO (Monthly)	Utilisation of soft starts at initiation.	Confirmation soft starts at initiation. (EO weekly checklist) (ECO Monthly Audit)

1606

Item No.	Potential Environmental Impact	Mitigation or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
		source, and by PAM technology that there are no vocalising cetaceans detected in the 500 m mitigation zone. o During times of poor visibility or darkness it is confirmed by PAM technology that no vocalising cetaceans are present in the 500 m mitigation zone during the pre-acquisition watch (60 minutes).						
D		+ Delay "soft-starts" if penguins or feeding aggregations of diving seabirds, shoaling large pelagic fish, turtles, seals or cetaceans are observed within the mitigation zone. o A "soft-start" should not begin until 30 minutes after cetaceans depart the 500 m mitigation zone or 30 minutes after they are last seen or acoustically detected by PAM in the mitigation zone. o In the case of penguins, diving seabirds, shoaling large pelagic fish and turtles, delay the "soft-start" until animals are outside the 500 m mitigation zone. o In the case of fur seals, which may occur commonly around the vessel, delay "soft-starts" for at least 10 minutes until it has been confirmed that the mitigation zone is clear of all seal activity. However, if after a period of 20 mins seals are still observed within 500 m of the seismic source, the normal "soft-start" procedure should be allowed to commence for at least a 20-minute duration. Seal activity should be carefully monitored during "soft-starts" to determine if they display any obvious negative responses to the seismic source and gear or if there are any signs of injury or mortality as a direct result of the seismic activities. o In the case of shoaling large pelagic fish being observed within the mitigation zone, delay the "soft-start" until animals are outside the 500 m mitigation zone.	Operation	During Operation	Contractor MMO	MMO (ongoing) ECO (Monthly)	Visual scanning of seabirds	Confirmation recording of diving seabirds, turtles, seals and cetaceans visual scanning. (MMO Reports) (ECO Monthly Audit)
E		+ When arriving at the survey area for the first time, survey activities should, as far as possible, only commence during daylight hours with good visibility. However, if this is not possible due to prolonged periods of poor visibility (e.g. thick fog) or unforeseen technical issues which results in a night-time start, the initial acoustic source activation (including seismic source tests) may only be undertaken if:	Operation	During Operation	Contractor	EO (Weekly) ECO (Monthly)	Utilization of soft starts at initiation.	Confirmation soft - starts at initiation. (EO weekly checklist) (ECO Monthly Audit)

1607

Item No.	Technical & Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	the normal 60-minute PAM pre-watch and "soft-start" procedures have been followed.						
F	• Schedule "soft-starts" so as to minimise, as far as possible, the interval between reaching full power operation and commencing a survey line. The period between the end of the soft start and commencing with a survey line must not exceed 20 minutes. If it does exceed 20 minutes, refer to breaks in acquisition below.	Operation	During Operation	Contractor	EO (Weekly) ECO (Monthly)	Utilization of soft starts after breaks.	Confirmation soft starts after breaks. (EO weekly checklist) (ECO Monthly Audit)
G	• An area of radius of 500 m from the centre of the seismic source array be scanned (visually during the day) by an independent observer for the presence of seals prior to the commencement of "soft starts" and that these be delayed until such time as this area is clear of seals for a period of 10 minutes. If after a period of 10 minutes seals are still within 500 m of the seismic sources, the normal "soft start" procedure should be allowed to commence for at least a 20-minutes duration. Their activity should be carefully monitored during "soft-starts" to determine if they display any obvious negative responses to the seismic sources and gear or if there are any signs of injury or mortality as a direct result of the seismic activities.	Operation	During Operation	Contractor MMO	MMO (ongoing) ECO (Monthly)	Visual scanning of seabirds.	Confirmation recording of seabird visual scanning. (MMO Reports) (ECO Monthly Audit)
H	• Terminate seismic source on observation of any obvious mortality or injuries to seals when estimated by the MMO to be as a direct result of the survey.	Operation	During Operation	Contractor MMO	MMO (ongoing) ECO (Monthly)	Recording of mass mortality as a result of survey activities. Ceasing of survey activities.	Confirmation recording of mortality as a result of survey activities. (MMO Reports) (ECO Monthly Audit)
I	• Plan seismic surveys to avoid sensitive areas and periods for some marine fauna: Within 200 m of critical turtle foraging habitats (e.g. seamounts or convergence zones); Movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (June/July and late October/November) and their aggregation on the summer feeding grounds between St Helena Bay and Dassen Island from late October to late December and ensure that migration paths are not blocked by seismic operations. If possible the survey should be undertaken from North to South to avoid these feeding aggregations.	Planning Mobilisation	Pre-Survey Planning	Contractor	MMO (ongoing) ECO (Monthly)	Surveys planned according to the movement of mammals.	Confirmation recording of surveys in line with the movement of mammals. (MMO Reports) (ECO Monthly Audit)
J	• Plan survey, as far as possible, so that the first commencement of seismic source sounding in a new area (including seismic source tests) are undertaken during daylight hours.	Planning Mobilisation	Pre-Survey Planning	Contractor	MMO (ongoing) ECO (Monthly)	Surveys commence during daylight hours.	Confirmation recording of surveys commencement during daylight hours. (MMO Reports)

1608

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
							(ECO Monthly Audit)
K	• Prohibit seismic source use (including seismic source tests) outside of the Reconnaissance Permit Area. Although a seismic vessel and its gear may pass through a declared Marine Protected Area, acoustic sources (seismic sources) must not be operational during this transit.	Planning Mobilisation	Pre-Survey Planning	Contractor	MMO (ongoing) ECO (Monthly)	No seismic source operational during transit.	Confirmation no survey equipment in use during transit. Survey logs. (MMO Reports) (ECO Monthly Audit)
L	• A buffer of at least 5 km is recommended around MPAs.	Planning Mobilisation	Pre-Survey Planning	Contractor	MMO (ongoing) ECO (Monthly)	No surveys undertaken in MPAs or within 5 km from MPAs.	Confirmation no survey equipment in use within MPAs. Survey logs. (MMO Reports) (ECO Monthly Audit)
M	• When arriving at the survey area for the first time, survey activities should, as far as possible, only commence during daylight hours with good visibility. However, if this is not possible due to prolonged periods of poor visibility (e.g. thick fog) or unforeseen technical issue which results in a night-time start, the initial acoustic source activation (including seismic source tests) may only be undertaken if the normal 60-minute PAM pre-watch and "soft-start" procedures have been followed.	Operation: Pre-Start Observations	During Operation	Contractor MMO PAM Operator	MMO (ongoing) PAM Operator (ongoing) ECO (Monthly)	New location / arrival procedure followed.	Confirmation of following of new location arrival procedure. Survey logs. (MMO Reports) (PAM Reports) (ECO Monthly Audit)
N	• In the unlikely event that multiple surveys would take place at the same time within the same survey area then during seismic source pulses, each survey vessel must be at least 40 kilometres from any other survey vessel until sufficient objective evidence is obtained that a reduced buffer distance is acceptable.	Operation	During Operation	Contractor	EO (Weekly) ECO (Monthly	Negligible cumulative noise impacts	Confirmation: 40 km distance maintained between any other survey vessels while seismic source is active.
O	• Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented that would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior to the commencement of the survey and then operational levels of noise during the survey.	Planning Mobilisation	Pre-Survey Planning	Applicant/ Contractor	ECO (Once-off) MMO (ongoing)	Baseline (pre-commencement) and operational underwater noise measurements	Baseline and Operational Monitoring (Noise Monitoring Programme, Noise Monitoring Reports for Baseline and Operations)
P	• Consideration is to be given to the practicality (considering the weather conditions and costs) of aerial surveys to locate feeding aggregations. The use of drones could be considered (considering the weather conditions and costs) to supplement the observations of the MMO prior to soft starts	Planning Mobilisation	Pre-Survey Planning	Applicant/ Contractor	ECO (Once-off) MMO (ongoing)	Consideration given to use of aerial surveys or drones for feeding aggregations	Consideration given to use of aerial surveys or drones for feeding aggregations.

1609

Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	13.12 Line Turns and Breaks in Acquisition						
A	• If line changes are expected to take less than 40 minutes, seismic acquisition can continue during the line change if: ○ The power is reduced to 200 cubic inches (or as close as is practically feasible) at standard pressure. Seismic source volumes of less than 200 cubic inches can continue to discharge at their operational volume and pressure; ○ The Seismic Pulse Interval (SPI) is increased to provide a longer duration between pulses, with the SPI not to exceed 5 minutes; and ○ The power is increased, and the SPI is decreased in uniform stages during the final 20 minutes of the line change (or geophone repositioning), prior to data collection re-commencing (i.e. a form of mini soft start). ○ Normal MMO and PAM observations continue during this period when reduced power seismic source is active.	Operation	During Operation	Contractor	EO (Weekly) ECO (Monthly)	Utilisation of soft starts.	Confirmation soft starts (EO weekly checklist) (ECO Monthly Audit)
B	• If after breaks in seismic acquisition, the seismic source can be restarted within 5 minutes, no soft-start is required, and acquisition can recommence at the same power level provided no marine mammals have been observed or detected in the mitigation zone during the break-down period. • For all breaks in seismic source of longer than 5 minutes, but less than 20 minutes, implement a "soft-start" of similar duration, assuming there is continuous observation by the MMO and PAM operator during the break. • For all breaks in seismic source of 20 minutes or longer, implement a 60-minute pre-acquisition watch and 20-minute "soft-start" procedure prior to the survey operation continuing. • For planned breaks, ensure that there is good communication between the seismic contractor and MMO and PAM operators in order for all parties to be aware of these breaks and that early commencement of pre-watch periods can be implemented to limit delays.	Operation	During Operation	Contractor	EO (Weekly) ECO (Monthly)	Utilisation of soft starts.	Confirmation soft starts (EO weekly checklist) (ECO Monthly Audit)
C	• If line changes are expected to take longer than 40 minutes:	Operation	During Operation	Contractor	EO (Weekly)	Utilisation of soft starts.	Confirmation soft starts (EO weekly checklist)

1610

Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	• Terminate seismic source at the end of the survey line and implement a pre-acquisition search (40 minutes) and "soft-start" procedure (20 minutes) when approaching the next survey line. • If line turn is shorter than 60 minutes (i.e. shorter than a 40-minute pre-acquisition watch and 20-minute "soft-start" combined), the pre-acquisition watch can commence before the end of the previous survey line.				ECO (Monthly)		(ECO Monthly Audit)
13.13 Shut-downs							
A	• Seismic source should be terminated on observation of penguins or feeding aggregations of diving seabirds, turtles, slow swimming large pelagic fish (including whale sharks, basking sharks, and manta rays), seals and cetaceans within the 500 m mitigation zone. If PAM detects the presence of very high frequency cetaceans (Heaviside's dolphins, pygmy sperm whale and dwarf sperm whale) within 1 000 m of the sound source, seismic source should be terminated. • Terminate source for cetaceans until such time as there has been a 30-minute delay from the time the animal was last sighted within the mitigation zone before the commencement of the normal soft start procedure. For specific species of turtles, penguins diving seabirds and slow swimming large pelagic fish, diving seabirds, terminate source until such time as the animals are outside of the 500 m mitigation zone (seismic "pause", no soft-start required)	Operation	During Operation	Contractor MMO PAM Operator	MMO (ongoing) ECO (Monthly)	Visual scanning and termination of activities.	Confirmation recording of visual scanning, Termination of activities. (MMO Reports) (ECO Monthly Audit)
B	• Seismic source should be terminated on observation of any obvious mortality or injuries to cetaceans, turtles, seals or mass mortalities of invertebrate and fish species (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and roackerel) as a direct result of the survey. Such mortalities would be of particular concern where a) commercially important species are involved, or b) mortality events attract higher order predator and scavenger species into the seismic area during the survey, that subjecting them to acoustic impulses.	Operation	During Operation	Contractor MMO PAM Operator	MMO (ongoing) ECO (Monthly)	Visual scanning and termination of activities.	Confirmation recording of visual scanning, Termination of activities. (MMO Reports) (ECO Monthly Audit)

1611

Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Targets	Performance Indicators (Monitoring Tool)
C	• Seismic source should also be terminated when observer changes to turtle, seal or cetacean behaviours are observed from the survey vessel, or turtles and cetaceans (not seals) are observed within 500 m of operating seismic sources or appear to be approaching active seismic sources (particularly if the MMO has lost sight of the approaching animal prior to it entering the mitigation zone). The rationale for this is that animals at close distances (i.e. where physiological injury may occur) may be suffering from reduced hearing as a result of seismic sounds, that frequencies of seismic sound energy lies below best hearing frequencies (certain toothed cetaceans and seals), or that animals have become trapped within the area filled with sound through diving behaviour.	Operation	During Operation	Contractor MMO PAM Operator	MMO (ongoing) ECO (Monthly)	Visual scanning and termination of activities.	Confirmation recording of visual scanning, Termination of activities. (MMO Reports) (ECO Monthly Audit)
D	• Although a seismic vessel and its gear may pass through a declared Marine Protected Area, acoustic sources (seismic sources) must not be operational during this transit.	Planning Mobilization	Pre-Survey Planning	Contractor	MMO (ongoing) ECO (Monthly)	No surveys seismic source operational during transit	Confirmation on survey equipment in use during transit. Survey logs. (MMO Reports) (ECO Monthly Audit)
13.14 Key Equipment							
A	Key Equipment to be used: • All seismic vessels must be fitted with Passive Acoustic Monitoring (PAM) technology, which detects animals through their vocalizations. • The use of PAM 24-hrs a day must be implemented to detect deep diving species. • Ensure the PAM streamer is fitted with at least four hydrophones, of which two are HF and two LF, to allow directional detection of cetaceans. • Ensure the PAM hydrophone streamer is towed in such a way that the interference of vessel noise is minimized. • Ensure spare PAM hydrophone streamers are readily available in the event that PAM breaks down, in order to ensure timeous redeployment. • Define and enforce the use of the lowest practicable seismic source volume for production. Design arrays to maximize downward propagation, minimize horizontal propagation and minimize high frequencies in seismic source pulses.	Planning Mobilization Operation	Mobilization and Operation	Contractor PAM Operator	PAM Operator (ongoing) ECO (Monthly)	Adequate equipment is in place and used as per the requirements and specifications.	Confirmation of PAM Operations (PAM Operator Reports, ECO Reports). Use of lowest volume seismic sources, turtle friendly buoys, operation within approved area, use of solid streamers.

1612

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Plan (Frequency)	Target	Performance Indicator (Monitoring Tool)
	• Ensure the ramp-up airgun volumes do not exceed the production volume. • Prevent seismic source use (including seismic source tests) outside of the area of operation (which includes line turns undertaken outside the licence area). • The operator must provide a display screen for the acoustic source operations. 'All' information relating to the activation of the acoustic source and the power output levels must be readily available to support the observers in real time via the display screen and to ensure that operational capacity is not exceeded. • MMOs are to be equipped with night-vod cameras in order to observe mammals at night. • Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'. • Ensure that 'solid' streamers rather than fluid-filled streamers are used to avoid leaks. • Ensure that 'turtle-friendly' tail buoys are used by the survey contractor or that existing tail buoys are fitted with either exclusion or deflector 'turtle guards'. • Ensuring that leads are lifted using the correct lifting procedure and within the maximum lifting capacity of crane system. • Minimize the lifting path between vessels. • Undertake frequent checks to ensure leads and equipment are stored and secured safely on board each vessel. • In the event that equipment is lost during the operational stage, assess safety and metocean conditions before performing any retrieval operations. Establishing a hazards database listing the type of gear left on the seabed and/or in the Reconnaissance Permit Area with the dates of abandonment/loss and locations, and where applicable, the dates of retrieval. Notify SAN Hydrographer of any hazards left on the seabed or floating in the water column, and request that they send out a Notice to Mariners with this information. • Use low toxicity dispersants cautiously and only with the permission of DFFE. • Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station.						

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Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
13.15 PAM Malfunctions							
A	• If the PAM system malfunctions or becomes damaged during night-time operations or periods of low visibility, continue operations for 30 minutes without PAM if no marine mammals were detected by PAM in the mitigation zones in the previous 2 hours, while the PAM operator diagnoses the issue. If after 30 minutes the diagnosis indicates that the PAM gear must be repaired to solve the problem, reduce power to 180 cubic inches. The reduced seismic source may continue for 30 minutes while PAM is being repaired, the last 10-minutes of which is a 20-minute ramp-up to full power (also "soft-start"). If the PAM repair will take longer than 60 minutes, stop surveying until such time as a functional PAM system can be redeployed and tested. • If the PAM system breaks down during daylight hours operations may continue for 20 minutes without PAM while the PAM operator diagnoses the issue. If the diagnosis indicates that the PAM gear could be repaired to solve the problem, operations may continue for an additional 2 hours without PAM monitoring as long as: o No marine mammals were detected solely by PAM in the mitigation zones in the previous 2 hours; o Two MMOs maintain watch at all times during operations when PAM is not operational; o The time and location in which operations began without an active PAM system is recorded.	Operation	Operation	Contractor PAM Operator MMO	PAM Operator (ongoing) ECO (Monthly)	Ceasing activities during PAM Malfunctions. PAM equipment investigation and repair.	Ceasing activities during PAM Malfunctions. PAM equipment investigation and repair. (PAM Operator Reports, ECO Reports).
13.16 Seismic source Testing							
A	For seismic source testing the following should apply: • Maintain a pre-acquisition watch of 60-minutes before any instances of seismic source testing. If only a single lowest power seismic source is tested, the pre-acquisition watch period can be reduced to 30 minutes.	Operation	Operation	Contractor	PAM Operator (ongoing) ECO (Monthly)	Adequate testing is in place and conducted as per the requirements and specifications.	Testing in line with the requirements (PAM Operator Reports, ECO Reports)
B	• Implement a "soft-start" procedure if testing multiple seismic sources. ◇ The "soft-start" should be carried out over a time period proportional to the number of seismic	Operation	Operation	Contractor	PAM Operator (ongoing) ECO	Adequate testing is in place and conducted as per the requirements and specifications.	Testing in line with the requirements (PAM Operator Reports, ECO Reports)

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Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	sources being tested and not exceed 20 minutes; seismic sources should be tested in order of increasing volume; o If testing all seismic sources at the same time, a 20 minute "soft-start" is required; o If testing a single lowest power seismic source a "soft-start" is not required.				(Monthly)		
	13.17 Waste Management						
A	• The discharge of biodegradable wastes from vessels is regulated by MARPOL 73/78 Annex V, which stipulates that: o No disposal to occur within 3 nautical miles (± 5.5 km) of the coast. o Disposal between 3 nautical miles (± 5.5 km) and 12 nautical miles (± 22 km) needs to be comminuted to particle sizes smaller than 25 mm. o Disposal overboard without macerating can occur greater than 12 nautical miles from the coast when the vessel is sailing.	Operation	During Operation	Contractor ECO	ECO (ongoing)	Proper waste management in line with the required EMPr and regulations.	Recording of waste types and quantities (waste register and records)
B	• Discharges of oily water (deck drainage, bilge and mud pit wash residue) to the marine environment are regulated by MARPOL 73/78 Annex I, which stipulates that vessels must have: o A Shipboard Oil Pollution Emergency Plan (SOPEP). o A valid International Oil Pollution Prevention Certificate, as required by vessel size. o Equipment for the control of oil discharge from machinery space bilges and oil fuel tanks, e.g. oil separating/filtering equipment and oil content meter. Oil in water concentration must be less than 15 ppm prior to discharge overboard. o Oil residue holding tanks. o Oil discharge monitoring and control system.	Operation	During Operation	Contractor ECO	ECO (ongoing)	Proper waste management in line with the required EMPr and regulations.	Recording of waste types and quantities (waste register and records)
C	• Sewage and grey water discharges from vessels are regulated by MARPOL 73/78 Annex IV, which specifies the following: o Vessels must have a valid International Sewage Pollution Prevention Certificate.	Operation	During Operation	Contractor ECO	ECO (ongoing)	Proper waste management in line with the required EMPr and regulations.	Recording of waste types and quantities (waste register and records)

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Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	◇ Vessels must have an onboard sewage treatment plant providing primary settling, chlorination and dechlorination before discharge of treated effluent. ◇ The discharge depth is variable, depending upon the draught of the seismic vessel / support vessel at the time, but will be in accordance with MARPOL 73/78 Annex IV. ○ Discharge of sewage beyond 12 nm requires no treatment. However, sewage effluent must not produce visible floating solids in, nor cause the discolouration of, the surrounding water. ○ Sewage must be comminuted and disinfected for discharges between 3 nautical miles (± 6 km) and 12 nautical miles (± 22 km) from the coast. This will require an onboard sewage treatment plant or a sewage comminuting and disinfecting system. ○ Disposal of sewage originating from holding tanks must be discharged at a moderate rate while the ship is proceeding on route at a speed not less than 4 knots.						
D	• Sewage will be treated using a marine sanitation device to produce an effluent with: ◇ A biological oxygen demand (BOD) of <25 mg/l (if the treatment plant was installed after 1/1/2010) or <50 mg/l (if installed before that date). ◇ Minimal residual chlorine concentration of 1.0 mg/l. ◇ No visible floating solids or oil and grease.	Operation	During Operation	Contractor ECO	ECO (ongoing)	Proper waste management in line with the required EMPr and regulations.	Recording of waste types and quantities (waste register and records)
E	• The project will also comply with industry best practices with regard to waste management, including the completion of a waste management plan that includes the following: ○ Waste management will follow key principles: Avoidance of Waste Generation, adopting the Waste Management Hierarchy (reduce, reuse, recycle, recover, residue disposal), and use of Best Available Technology (BAT). ○ An inventory will be established of all the potential waste generated, clarifying its classification (hazardous, non-hazardous or inert) and quantity, as well as identifying the adequate treatment and disposal methods.	Operation	During Operation	Contractor ECO	ECO (ongoing)	Proper waste management in line with the required EMPr and regulations.	Recording of waste types and quantities (waste register and records)

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Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	○ Waste collection and temporary storage shall be designed to minimise the risk of escape to the environment (for example by particulates, obliteration, runoff or odours). ○ On-site waste storage should be limited in time and volume. ○ Dedicated, clearly labelled, containers (bins, skips, etc.) will be provided in quantities adapted to anticipated waste streams and removal frequency.						
F	• Avoid the unnecessary discharge of ballast water. • Use filtration procedures during loading in order to avoid the uptake of potentially harmful aquatic organisms, pathogens and sediment that may contain such organisms. • Ensure that routine cleaning of ballast tanks to remove sediments is carried out, where practicable, in mid-ocean or under controlled arrangements in port or dry dock, in accordance with the provisions of the ship's Ballast Water Management Plan. • Ensure all infrastructure (e.g. airguns, streamers, tail buoys etc) that has been used in other regions is thoroughly cleaned prior to deployment.	Operation	During Operation	Contractor ECO	ECO (ongoing)	Proper waste management in line with the required EMPr and regulations.	Recording of waste types and quantities (waste register and records)
	13.18 Vessel and Aircraft Operations						
	• Ensure vessel transit speed between the survey area and port is a maximum of 12 knots (22 km/hr), except in the MPAs where it is reduced further to 10 knots (18 km/hr) as well as when they are present in the vicinity.	Operation	During Operation	Contractor ECO	ECO (ongoing)	Ensure vessel speed limits are adhered to	Confirmation of flights undertaken in accordance with the requirements (ECO Reports, ship logs)
A	In the unlikely event that aircraft are utilised for crew changes or medevac: • Pre-plan flight paths to ensure that no flying occurs over seabird and seal colonies and offshore islands by at least 1 852 m (i.e. 1 nm); • Avoid extensive low-altitude coastal flights by ensuring that the flight path is perpendicular to the coast, as far as possible • The flight path between the onshore logistics base and seismic vessel should be perpendicular to the coast; • Brief all pilots on the ecological risks associated with flying at a low level along the coast or above marine mammals.	Operation	During Operation	Contractor ECO	ECO (ongoing)	Adequate flight planning in line with the requirements of the EMPr and legislation.	Confirmation of flights undertaken in accordance with the requirements (ECO Reports, Flight plans).
B	• The lighting on the seismic vessel and support vessels should be reduced to a minimum compatible with safe	Operation	During Operation	Contractor ECO	ECO (ongoing)	Adequate lighting and vessel planning,	Confirmation of lighting and vessel planning, operation and

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Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)

	operations whenever and wherever possible. Light sources should, if possible and consistent with safe working practices, be positioned in places where attraction to the surrounding environment can be minimized.
	• Keep disorientated, but otherwise unharmed, seabirds in dark containers for subsequent release during daylight hours. Ringed/banded birds should be reported to the appropriate ringing/banding scheme (details are provided on the ring).
	• Avoid the unnecessary discharge of ballast water.
	• Use filtration procedures during loading in order to avoid the uptake of potentially harmful aquatic organisms, pathogens and sediment that may contain such organisms.
	• Ensure all infrastructure (e.g. arrays, streamers, tail buoys etc.) that has been used in other regions is thoroughly cleaned prior to deployment.
	• Implement a waste management system that addresses all wastes generated at the various sites, shore-based and marine. This should include:
	  ○ Separation of wastes at source.
	  ○ Recycling and re-use of wastes where possible.
	• Treatment of wastes at source (maceration of food wastes, compaction, incineration, treatment of sewage and oily water separation).
	• Implement leak detection and repair programmes for valves, flanges, fittings, stairs, etc.
	• Use a low-toxicity biodegradable detergent for the cleaning of all deck spillages.
	• The vessel operators should keep a constant watch for marine mammals and turtles in the path of the vessel. Keep watch for marine mammals behind the vessel when tension is lost on the towed equipment and either retrieve or regain tension on towed gear as rapidly as possible.
	• In the event that equipment is lost during the operational stage, assess safety and metocean conditions before performing any retrieval operations.
	• Ensure that routine cleaning of ballast tanks to remove sediments is carried out, where practicable, in mid-ocean or under controlled arrangements in port or dry dock, in accordance with the provisions of the ship's Ballast Water Management Plan.
						operation and maintenance in line with the requirements of the EMP and legislation.	maintenance undertaken in accordance with the requirements (ECO Reports, maintenance plans, O&M Manuals).

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Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	• Prepare and implement a Shipboard Oil Pollution Emergency Plan and an Oil Spill Contingency Plan, in doing so take cognisance of the South African Marine Pollution Contingency Plan, which sets out national policies, principles and arrangements for the management of emergencies including oil pollution in the marine environment • As far as possible, and whenever the sea state permits, attempt to control and contain the spill at sea with suitable recovery techniques to reduce the spatial and temporal impact of the spill. • Ensure offshore bunkering is not undertake in the following circumstances: o Wind force and sea state conditions of ≥5 on the Beaufort Wind Scale; o During any workboat or mobilisation boat operations; o During helicopter operations; o During the transfer of in-sea equipment; and o At night or times of low visibility.						
	13.19 Fisheries						
A	• At least three weeks prior to the commencement of survey activities the following key stakeholders should be consulted and informed of the proposed survey programme (including navigational co-ordinates of location, timing and duration of proposed activities) and the likely implications thereof (specifically the exclusion and safety zone around the survey vessels): o Fishing industry associations: SA Tuna Association; SA Tuna Longline Association; Fresh Tuna Exporters Association, South African Deepsea Trawling Industry Association (SADSTIA); South African Hake Longline Association (SAHLLA), SA Commercial Linefish Association and West Coast Rock Lobster Association. o Other key stakeholders: SAMSA, South African Maritime Safety Association, Ports Authority and the Department of Agriculture, Forestry and Fisheries Vessel Monitoring, Control and Surveillance Unit in Cape Town.	Planning Operation	Three weeks prior to operation	Contractor FLO	FLO (pre- and post operations) ECO	Notification of stakeholders.	Confirmation of notification of stakeholders.

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	• These stakeholders should again be notified at the completion of the project when the survey and support vessels are off location.						
B	• Request, in writing, the SAHHO to broadcast a navigational warning via Navigational Telex (Navtex) and Cape Town radio for the duration of the activity. • For the duration of the survey, circulate a daily survey schedule (look-ahead), via email, to key fishing associations.	Planning Operation	During Operation	Contractor FLO	FLO (pre- and post operations) ECO	Navigational Telex (Navtex) and Cape Town radio broadcast	Navigational Telex (Navtex) and Cape Town radio broadcast.
C	• Timing: Timing of the seismic survey to avoid periods of peak fishing activity during May, June and July is recommended in order to reduce the probability of disruption to the large pelagic longline fishing sector.	Planning; Operation	March-July	Contractor	ECO (monthly)	Time the survey to avoid peak fishing activity.	Confirmation that survey timed to avoid peak fishing activity.
D	• Ensure project vessels fly standard flags and lights to indicate that they are engaged in towing surveys and are restricted in manoeuvrability.	Operation	During operation	Contractor	ECO (monthly)	Vessel's indication in place.	Adequate indication in place
E	• The lighting on the survey and support vessels should be managed to ensure that they are sufficiently illuminated to be visible to fishing vessels, as well as ensure that it is reduced to a minimum compatible with safe operations whenever and wherever possible.	Operation	During Operation	Contractor FLO	FLO (pre- and post operations) ECO	Adequate lighting in place	Adequate lighting in place
GE	• Notify any fishing vessels at a radar range of 12 nm from the vessel via radio regarding the safety requirements around the survey vessel.	Operation	During Operation	Contractor FLO	FLO (pre- and post operations) ECO	Notification of fishing vessels.	Notification of fishing vessels.
G	• Implement a grievance mechanism in case of disruption to fishing or navigation. The grievance mechanism should allow stakeholders to register specific grievances related to operations, by ensuring they are informed about the process and that resources are mobilized to manage the resolution of all grievances, in accordance with the Grievance Management procedure	Operation	During Operation	Contractor FLO	FLO (pre- and post operations) ECO	Grievance mechanism	Grievance mechanism. (Complaints register)

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14 APPENDICES

Appendix 1: EAP Curriculum Vitae

EIMS ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

CURRICULUM VITAE

Name:	Liam Michael Whitlow
Nationality:	South African
Date of Birth:	22 August 1978
Profession:	Environmental Scientist
Professional Qualification/ Training:	BSc Honours Environmental Management; Rand Afrikaans University (now University of Johannesburg), 2000
	Higher Certificate in Project Management; Damelin Business School, 2001.
	ISO 14001 Auditor Training; BVQI, 2003.
	Environmental Monitoring- Fallout Dust Training; Dustwatch, 2014.
	Aquifer Hydraulics and Groundwater Monitoring Certificate Course; North West University, 2014.
	Carbon Footprint Analyst Course; Terra Firma Academy, 2017.
Professional Membership/ Registrations:	Registered Environmental Assessment Practitioner: Number 2019/222 Registered Professional Natural Scientist (SACNASP- #400148/08). Member of Land Rehabilitation Society of Southern Africa (LaRSSA).
Current Employer:	Environmental Impact Management Services (Pty) Ltd.

KEY EXPERIENCE

Liam holds a B. Sc. Hons degree in Environmental Management and has completed an additional B. Sc. honours course in applied limnology. In addition he has completed a higher certificate in Project Management with Damelin Business School and a course on ISO14001 Auditing Principles and Environmental Management Systems Auditor Training. Liam is a registered professional natural scientist with the South African Council for Natural Scientific Professions. Liam's professional experience, gained over more than 17 years, lies mainly with environmental impact assessments including project managing significantly large EIA's in the mining and infrastructure sectors. Liam's other experience includes ISO14001, Site Assessments, Water-use licensing, Environmental monitoring, and Environmental Management Plans. Liam's experience lies mainly within South Africa but he has bene involved in projects in both Lesotho and Botswana.

CAREER SUMMARY

Period: January 2011 - Current	Organisation: EIMS	Position: Director, Senior Environmental Assessment Practitioner

Key Projects/Assignments	Technical Director: Responsible for the technical management of EIMS including the following aspects: • Technical review and direction for complex projects; • Quality control and assurance; • Staff management and performance review; • Client management; and • Marketing and business development. Project Experience: • Transnet Multi-products Pipeline (~650km total length) in Gauteng, Mpumalanga and between Durban and Johannesburg, RSA. Project manager and Environmental Advisor to the New Multiproduct Pipeline (NMPP) Alliance for the monitoring of construction phase. 2009-2017. • Olifants River Water Resources Development Project, Steelpoort, Mpumalanga, RSA. EIMS was appointed to undertake the required environmental monitoring (noise, air quality, and water quality) for the construction of the Phase 1C of the bulk water pipeline. Project manager, 2012-2017. • GSW Dilokong Chrome Mine Due Diligence, Limpopo, RSA. Environmental lead to undertake an environmental due. 2017. • Tshipi é Ntle Manganese Mine Environmental Due Diligence, Kathu, Northern Cape, RSA. Project manager and senior consultant (in association with GSW) for an environmental review to inform a due diligence being undertaken. 2017. • Libra Due Diligence, Mpumalanga and Free State Province, RSA. Project manager and senior consultant to conduct a high level environmental review and due diligence study for the Anglo Libra project (incl various Anglo Coal assets) for Mindset Mining Consultants, 2016. • Sedgman Environmental Training, Pretoria, RSA. Compiled and presented a training workshop to Sedgman Engineers, focusing on the application and interpretation of the South African Environmental Laws, in relation to their operations and client profile. 2017. • EIA and EMP for the Transnet Richards Bay Coal Line: Overvaal Tunnel, Mpumalanga Province. Project manager, responsible for successful completion of the EIA. 2015-2016. • Tetra 4 Virginia Natural Gas Production, Water Monitoring, Free State, RSA. Project manager appointed to undertake surface and groundwater sampling to establish an environmental baseline and to monitor the actual impacts associated with the proposed natural gas production activities. 2015-2017. • Drafted the 2014-2019, 3rd Edition Environmental Management, Plan (compiled in terms of Section 11(2) of the National Environmental

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Management Act 1998 (act 107 of 1998), for the National Department of Energy. Project manager and report writer. 2014-2015.

- Environmental Advisory to the Government Technical Advisory Centre, Public Private Partnership Unit. Environmental lead in a team of consultants providing consulting services to report to the GTAC on the lessons learn from past PPP's and to suggest means of improving the process for future PPP's. 2015.

- Eskom Lambda 400-765kV Sub-station and Associated Transmission Lines, Mpumalanga, RSA. Project manager and Environmental Assessment Practitioner for EIA. 2010-2012.

Mine Closure and Financial Provisioning:

- Determined Financial Provisions in accordance with the 'Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision' provided by a Mine (DMR Guideline): Mooiplaats Colliery 2018; Exxaro Paardeplaats Coal Mine- Update 2018.

- Final Rehabilitation, Decommissioning and Closure Plan (FRDCP) prepared in accordance with the requirements of the NEMA Financial Provisioning Regulations (2015) (NEMA GNR 1147): Tetra 4 Virginia Natural Gas Project, 2017; Motuoane Gas Hennenman Exploration Right-2017; Motuoane Gas Ladysmith Exploration Right- 2017; Sungu Sungu Dannhauser Exploration Right- 2016; Kangala Colliery- Eloff Phase 3 Pit-2020; Anker Coal Elandsfontein Colliery-2021.

- Review of closure plans and financial provisions for closure as a component of Due Diligence and/or Competent Persons Reports: Environmental Review for 5 large Coal mining operations held by Exxaro- 2018; Environmental Review for Dilokong Chrome Mine- 2017; Environmental Review for Tshipi Mine- 2017; Environmental Review on numerous large coal mines held by Anglo Coal-2016.

Environmental Monitoring:

- Project manager and senior environmental scientist for the construction phase environmental monitoring on the Olifants River Water Resources Project Phase 2C (bulk water pipeline). The project included monitoring of water (point and diffuse), air quality (PM10 and fallout dust), and noise to ensure and guide compliance with the environmental specifications of the construction phase EMPR.

- Project manager and senior environmental scientist for the water resource monitoring of the Tetra4 Virginia Natural Gas Production Project. This includes specialist low-flow sampling od dissolved gases in the groundwater as well as general water quality parameters in both regional ground and surface water resources.

- Project Director for the routine water resource (surface and groundwater) monitoring being undertaken for the United Manganese of the Kalahari

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	(UMK), manganese mine in Northern Cape. Responsible for technical and quality review and oversight.	
Period: January 2002-December 2010	Organisation: EIMS	Position: Senior Environmental Assessment Practitioner
Key Projects/Assignments	Project Manager and Environmental Assessment Practitioner for the following: • Environmental applications, including EMs, and mining permit applications, for various (7 Packages including N1, N3, N12, R23, and R24) Gauteng road upgrades as part of the Gauteng Freeway Improvement Project. EIMS was also appointed to undertake the role of independent ECO's for certain GFIP Packages • EIA for OCGT Peaking Power Station within the Conga IDZ. • EIA for spent nuclear fuel storage facility at Pelindaba. • EIA for nuclear waste smelter at Pelindaba. • EIA and water-use licensing for an underground ash disposal facility in Mpumalanga Province. • EIA for the proposed upgrade of the effluent collection and treatment facilities at the South African Nuclear Energy Corporation, Pelindaba. • EIA for proposed Garona to Aries 400KV Transmission line. • EIA for numerous Golf Estates. • EIA for Market Street Underpass as part of the Provincial government Precinct and City Square (Johannesburg) CBD. • EIA's for numerous residential developments. • Scoping report for the Eskom Janus substation in Limpopo Province. • EIA's for low-cost housing developments in the East Rand, Ekurhuleni Metropolitan Council as part of the Regional Professional Team. • Environmental exemption process for a World Summit on Sustainable Development project, Moroka Dam, Gauteng Province. • Numerous environmental exemption applications for housing developments. • Environmental Scoping studies for Sentech telecommunication masts in Eastern Cape Province. • Environmental Studies for telecommunication facilities for Vodacom. • Environmental Studies for 150+ telecommunication facilities for Cell C and Siemens in five provinces. • Environmental Studies for Eskom Telecommunications.	

	Environmental Site Assessment and Remediation: • Participation in several Environmental Site Assessments in Gaborone (Botswana) and Mpumalanga. Strategic Environmental Assessment: • Participation in the compilation of the Strategic Environmental Assessment for the Hartbeespoort Dam area. ISO 14001 Environmental Management Systems and Auditing • Participation in the compilation of the ISO 14001 system (legal register) for Coega Development Corporation, Eastern Cape Province. • Participation in the compilation of the ISO 14001 system (legal register) for Matimba Power Station in Limpopo Province. Mining Related Permits and Rights • Environmental Management Programme and EIA for the Cranemere Gas Exploration Project in the Eastern Cape Province. • EIA and EMPR for the proposed Loopspruit Coal Mine, Mpumalanga Province. • Project Manager for in excess of 40 mining permit applications for the Transnet New Multi-products Pipeline, Inland and Trunkline (between Johannesburg and Durban). Applications submitted in 4 different provinces. • Project Manager for 5 Mining Permit Applications for the South African National Roads Agencies Gauteng Freeway Improvement Project. Numerous NEMA Section 24(G) Rectification applications for a broad spectrum of developments

LANGUAGE CAPABILITY

Language	Speak	Read	Write
English	**Excellent**	**Excellent**	**Excellent**
Afrikaans	**Excellent**	**Excellent**	**Good**

DECLARATION

I confirm that the above information contained in the CV is an accurate description of my experience and qualifications and that, at the time of signature.

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Recoverable Signature

X

Liam Whitlow
Director
Signed by: 6461035b0-585d-4fda-855e-bdf53a161a41

Signature of Staff Member

Date

EIMS ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

CURRICULUM VITAE

Name:	Gideon Petrus Kriel
Nationality:	South African
Date of Birth:	1 September 1983
Profession:	Environmental Scientist
Professional Qualification/ Training:	M.Env.Sci Water Sciences; North West University (Potchefstroom Campus), 2008
	Implementation of Environmental Management Systems (ISO 14001); Centre for Environmental Management, North-West University (Potchefstroom Campus), 2007.
	Bringing Data into GIS (ArcGIS); GIMS (now ESRI SA), 2008.
	Tools for Wetland Assessment; Rhodes University, 2013
Professional Membership/ Registrations:	Registered Professional Natural Scientist (SACNSP- #400202/09) – Environmental Sciences
	Registered Environmental Assessment Practitioner (EAPASA- #2019/1451)
	Water Institute of Southern Africa (WISA) Member (21162)
Current Employer:	Environmental Impact Management Services (Pty) Ltd.

KEY EXPERIENCE

GP holds an M.Env.Sci (Water Sciences) Cum Laude from the North-West University (Potchefstroom Campus) and has been employed as an Environmental Consultant since 2007. GP is a Registered Professional Natural Scientist (South African Council for Natural and Scientific Professions) and a Registered Environmental Assessment Practitioner (Environmental Assessment Practitioner). He has delivered presentations locally and internationally concerning the use of bio-indicators for the determination of water quality, and has experience in a wide variety of environmental management projects including: Environmental Impact Assessments, Basic Assessments, Geographic Information Systems (GIS), Environmental Compliance Monitoring, Environmental Awareness Training, Aquatic Ecological Assessments, Drinking and Waste Water Treatment Process Audits, Wetland Delineation and Assessments, ISO 14001 Aspect Registers, Water Use Licence Applications, Waste Management Licence Applications and Integrated Waste and Water Management Plans (IWWMP).

CAREER SUMMARY

Period: July 2007- Current	Organisation: EIMS	Position: Senior Environmental Assessment Practitioner
Key Projects/Assignments	Senior Consultant: Responsible for the following aspects: • Technical review and direction;	

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- Quality control and assurance;
- Client management; and
- Marketing and business development.

Project Experience:

- Environmental Impact Assessment for the proposed Zonk'Izizwe Mixed Use Development in Midrand, Gauteng.
- Basic Assessments for the road upgrades for the Johannesburg Roads Agency (JRA).
- Environmental Impact Assessment for the proposed Thabeng Eco Reserve and Golf Estate, near Ohrigstad, Limpopo.
- Basic Assessment for the proposed TATA Steel KZN Clean Energy Project, Richards Bay, KwaZulu-Natal.
- Basic Assessment for the proposed IPM Clean Energy Project, Moon Nest, North-West Province.
- Compilation of ISO 14001 Aspect/Impact registers for Clover (Pty) Ltd.
- Basic Assessment for the proposed N17 Phase 2 project: Addition of Auxiliary Lanes Between the Roodebult Road Interchange and the Proposed Trichardts Road Interchange.
- Basic Assessment for the Proposed Early Warning System for the South African Nuclear Energy Corporation of South Africa (NECSA).
- Environmental Impact Assessment for the Proposed Water and Effluent Collection and Treatment Infrastructure Upgrade for the Nuclear Energy Corporation of South Africa (NECSA).
- Basic Assessment for the proposed Residential Development on Portions 16 & 17 of the Farm Wilgespruit 190 IQ, Wilgeheuwel, Roodepoort.
- Independent Environmental Control Officer for the Eye of Africa Golf Estate, Gauteng.
- Independent Environmental Control Officer for the Department of International Relations Head Office Construction, Pretoria.
- Water Use License Application for the Upgrade of the Low Level Bridge on Hyperion Drive, North Riding, Johannesburg.
- Diatom Water Quality Assessments for the Upgrade of the Low Level Bridge on Hyperion Drive, North Riding, Johannesburg.
- Basic Assessment for the Proposed Rand Water 1400mm diameter L17 Bulk Water Pipeline, Brakpan, Gauteng.
- Wetland Delineation for Anglo Platinum Potgietersrus Platinum Limited near Mokopane, Limpopo.

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- Independent Environmental Control Officer for the Knock-down and Rebuild of the Shell Range River Service Station, Gilview, Johannesburg.
- Independent Designated Environmental Officer for the Refurbishment of the South African National Roads Agency Limited (SANRAL) Dalpark Operations Centre, Brakpan.
- Waste Licence Application for the Proposed Water and Effluent Collection and Treatment Infrastructure Upgrade for the Nuclear Energy Corporation of South Africa (NECSA).
- Prospecting Rights Applications on behalf of the African Exploration Mining and Finance Corporation (Pty) Ltd for a variety of projects in Limpopo, Free State and North-West Provinces.
- Environmental Impact Assessment and Waste Management Licence Application for the Lusikisiki Sewer and Sewer Treatment Plant, Lusikisiki, Eastern Cape.
- Diatom Monitoring for the Lusikisiki Sewer and Sewer Treatment Plant, Lusikisiki, Eastern Cape.
- Appointed as a Blue Water Services Inspector for the 2012 Blue Water Services Audits by the Department of Water Affairs.
- Basic Assessment for the formalisation of Masibambane, Masibulele, Ilinge, Dacawa Gwentsha, Velvano, Mathemba Vuso in Mdantsane for the Buffalo City Metropolitan Municipality.
- Environmental Impact Assessment for the Proposed Sunny South Housing Development for the Buffalo City Metropolitan Municipality.
- Basic Assessment and Water Use Licence for the Mqonjwana Access Road for the Mbizana Local Municipality.
- Independent Environmental Control Officer for the East London Industrial Development Zone (ELIDZ): Infrastructure Services for the Zone 1B West Residential Development.
- Heritage Impact Assessment and Public Participation for the Proposed Reconstruction of Fleet Street, East London for the Buffalo City Metropolitan Municipality.
- Environmental Monitoring (Water Quality) for Phase 2 OD of the Olifants River Water Resources Development Project for Basil Read.
- Basic Assessment and Water Use Licence Application for the Proposed Sidwadeni River Access Road near Mthatha, Eastern Cape on behalf of the South African National Roads Agency (SOC) Limited.
- Basic Assessment and Water Use Licence Application for the Proposed Mngazi River Access Road near Port St Johns, Eastern Cape on behalf of the South African National Roads Agency (SOC) Limited.

- Independent Environmental Control Officer for the East London Industrial Development Zone (ELIDZ): Proposed MMOEM Facilities.
- Amalinda Fairlands Feasibility Study for the Buffalo City Metropolitan Municipality (CS Consulting).
- Independent Environmental Control Officer for the Lusikisiki Sewer and Sewer Treatment Plant, Lusikisiki, Eastern Cape.
- Independent Environmental Control Officer for the Noblesfontein Wind Energy Facility near Victoria West, Northern Cape Province.
- Independent Environmental Control Officer for the Reconstruction of Fleet Street, East London, Buffalo City Metropolitan Municipality, Eastern Cape Province.
- Transnet Freight Rail NEMA Section 24G Rectification Application – Coega Station to Tankatara Level Crossing, Coega, Eastern Cape.
- Independent Environmental Control Officer for the Sunny South Housing Development for the Buffalo City Metropolitan Municipality.
- Vincent-Berea Local Spatial Development Framework, CS Consulting (Buffalo City Metropolitan Municipality), East London, Eastern Cape.
- Participatory Based Planning Support to Informal Settlements Upgrading Projects in Buffalo City Metropolitan Municipality, CS Consulting, Eastern Cape.
- Motopo Free State Wetland Delineations, Virginia, Free State.
- Puma Energy Fuel Depot Wetland Delineation, Nelspuit, Mpumalanga.
- Mdantsane Roads Cluster 2 Environmental Control Officer, Buffalo City Metropolitan Municipality.
- Gluricich Chemical Removal at Vodacom Site, East London.
- Internal Environmental Management System Audits (ISO 14001) for the East London Distribution Centre and Ladismith Plant for Parmalat South Africa.
- Environmental Control Officer for the Eskom Albany-Mimosa 66KV Distribution Line near Alicedale, Eastern Cape.
- Environmental Impact Assessment for the Proposed Algoa Basin Oil & Gas Production Project for Aberdeen Offshore Engineering.
- Basic Assessment for the Proposed Ablution Facilities Along the Coast for Nyandeni Local Municipality.
- Environmental Control Officer for the Eskom Wittekleibosch-Dieprivier 132kV Power Line and Switching Station, Tsitsikamma, Eastern Cape.
- Specialist Walkdown and Site Specific EMPR for the Eskom Ankerlig-Omega Power line, Western Cape.

	• Wetland Assessment for the Lichtenburg Hospital Basic Assessment Process for PH Bagale (on behalf of the Department of Health). • Update of the Integrated Waste and Water Management Plan Eskom Lethabo Power Station, Free State. • Basic Assessment for the Upgrade of the Loop 16 (Garlep) Road for ACWA Power, Grobblershoop, Northern Cape. • Prospecting Rights Application and Basic Assessment for Black Mountain Mining, Aggeneys, Northern Cape. • Basic Asessment for the Eskom Riverbank IPP Projects, Eastern Cape. • Environmental Control Officer for the SANRAL N2 Section 15 from Buffalo River (km 2,94) to Braidbach Intersection (km 9,8) and the R63 from Alexandra Road (km 0) to Bhisho, Eastern Cape. • Environmental Control Officer for the Greenfields section of the SANRAL N2 Wild Coast Toll Highway (Southern Section), Eastern Cape. • Basic Assessment for the Upgrading to a Surface Standard Portion of Road DR06606 +1-12KM, Eastern Cape Department of Roads and Public Works, Eastern Cape. • Transnet TM2 Aquatic Monitoring Programme. • Prospecting Right Applications and Basic Assessment Processes for Black Mountain Mining near Aggeneys, Northern Cape. • Eskom Amathole Stormwater Environmental Control Officer, Eastern Cape. • Update of the ACWA Bokpoort Consentrated Solar Plant Integrated Waste and Water Management Plan, Northern Cape. • Update of the Rehabilitation Strategy and Implementation Plan, Mpumalanga. • Basic Assessment and Water Use Licence Application for the Proposed Megamor Park Extension, Meisieshalt, East London for Umbra Trading 11. • Creation of the Ekurhuleni Metropolitan Municipality Parks GIS Layer. • Enviro-legal review for Bax Kaplan Russel for a Waste Processing Facility in Wilsonia, East London. • Enviro-Legal Review: Demonstration of On-Site Faecal Sludge Treatment in East London, Impilo Yabantu Services (Pty) Ltd. • Umgeni Raw Water Management Audit for SizweNtsalubaGobodo, Pietermaritzburg. • Umgeni Waste Water Management Audit for SizweNtsalubaGobodo, Pietermaritzburg.

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- Competent Persons Report (Environmental) for the Ntshovelo Mining Resources (Pty) Ltd Welgemeend Colliery.
- Umgeni Potable Water Management Audit for SizweNtsalubaGobodo, Pietermaritzburg.
- Cambridge Pedestrian Bridge Enviro-legal Interpretation for CBM Consulting Engineers.
- Komati Power Station Legal Audit for Eskom.
- Beaconhurst Drive Enviro-legal Interpretation for CBM Consulting Engineers.
- Port of Ngqura Tank Farm Infrastructure Specialists Services for Transnet Group Capital.
- Prospecting Rights Application and Basic Assessment for Black Mountain Mining, Northern Cape.
- Independent Environmental Control Officer for the East London Industrial Development Zone (ELIDZ): GW1 Facilities in Zone 1A.
- Basic Assessment and Water Use Licence Application for the Proposed Summerpride Erf 107 Residential Development, East London.
- Harmony Target 1 & 2 Performance Assessment Audits, Welkom
- Harmony President Steyn North (Steyn 3, 7 & 9) Performance Assessment Audits, Welkom.
- City of Ekurhuleni Tsakane Sewer Pump Station Basic Assessment, Ekurhuleni.
- Eskom Duvha Power Station Legal Compliance Audit.
- Buffalo City Metropolitan Municipality Eastern Beach Sewer Upgrade Environmental Officer, East London.
- Transnet Group Capital Coega Kop Quarry Water Use Licence Application.
- SCAW Dimbaza Foundry Groundwater Monitoring, Dimbaza.
- Mulilo Struisbult PV2 Grid Connection Basic Assessment, Copperton.
- Mulilo Struisbult PV2 EMPr Amendment, Copperton.
- Tosaco Offshore Exploration Environmental Impact Assessment.
- Azinam Offshore Block 2B Stakeholder Engagement.
- TGS Orange Basin Offshore Reconnaissance Basic Assessment.
- GIS work for a large amount of projects from 2007 - Present including the following: the identification and mapping of sensitivities and interested and affected parties, the delineation of site boundaries, the identification of alternative development sites, geo-referencing of old maps and technical drawings, production of informative maps for Basic Assessments,

	Environmental Impact Assessments and Environmental Compliance Monitoring

LANGUAGE CAPABILITY

Language	Speak	Read	Write
English	Excellent	Excellent	Excellent
Afrikaans	Excellent	Excellent	Excellent

DECLARATION

I confirm that the above information contained in the CV is an accurate description of my experience and qualifications at the time of signature.

Signature of Staff Member

17 October 2022

Date

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002

Email: Appealsdirectorate@environment.gov.za

APPEAL RESPONSE REPORT

PROJECT NAME/TITLE: TGS Orange Basin Reconnaissance Permit

PROJECT LOCATION: Offshore of the West Coast, South Africa

PROJECT REFERENCE NUMBER: 1520

DATE PROJECT/ACTIVITY AUTHORISED: April 17, 2023

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DETAILS OF THE APPELLANT	DETAILS OF THE APPLICANT
Name of appellant: Aukotown Fisheries Primary Cooperative Ltd	Name of applicant: TGS Geophysical Company (UK) Limited
Appellant's representative (if applicable): Renthia van Wyk	Applicant's representative (if applicable): Environmental Impact Management Services (Pty) Ltd
Postal address: Joos Engelbrecht Street, Port Nolloth, 8280	Postal Address: P.O. Box 2083 PINEGOWRIE 2123
Email Address: aukotownfisheries@gmail.com	Email Address: tgs@eims.co.za
Telephone number: 063 721 9428	Telephone number: (011) 789 7170
Fax Number:	Fax number:

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GROUNDS OF APPEAL	RESPONDING STATEMENT	COMMENT BY THE DEPARTMENT / DNR
1. Issues with the consultation process: the co-op believes the consultation process was not done correctly, we do not believe that the information that was presented is accurate. We know that the government is for oil and gas, but as a community and a small-scale fisher organization we are against it. We have seen this happen in other countries, and it has messed the whole sea life up. That's why we see foreign boats in our waters. We say no but the government says yes. In a few years time we'll be like all the other countries with nothing in our waters and nothing for the generation behind us. We strongly say no to seismic surveys and oil and gas development.		
2. It is not an open and transparent participatory process according to NEMA. We go and listen to the consultations but do not consent to a seismic survey. TGS states that a mitigation measure is to "consult with communities on potential ways in which to		

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make a positive contribution to the communities." Why isn't this part of the consultation process? The private sector and the government should be coming to affected communities such as Port Nolloth with this question, instead of coming with only one option – either seismic surveys or exploration drilling. Why has nobody asked what the Port Nolloth community wants for development? Why would we agree to something that has absolutely no benefit for us? Meaningful consultation should allow us to decide what we want, not being told something that has the potential to destroy our livelihood and that is so significant to our culture.		
3. TGS states there is a "perceived impact" of the oil/gas industry on the fishing industry, not the actual impact on catch rates. We do not believe this to be true, as there have been studies and evidence of the harms of seismic surveys and issues with oil and gas developments, e.g., blowouts, that impact fish for years to come. For example, after the Deepwater Horizon blowout in 2010 in the Gulf of Mexico, fish and dolphins are still testing positive for the chemicals found in the oil that spilled. There		

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are scientific reports that were not included in the EIA that show different impacts on species from the noise of air guns used in seismic surveys. The difference in scientific information that is presented in the consultations and EIAs is concerning. Further, we are concerned about who is going to monitor the impacts of the seismic survey, and how will fishers and other coastal livelihoods be compensated if there is harm to marine life as a result of the survey.		
4. Does not meet South Africa's climate change goals, e.g., Paris Agreement and Kyoto Protocol, and effort to achieve net zero. The push for oil and gas does not align with South Africa's climate change goals, where the country is a signatory to meeting these challenges and reducing its carbon footprint. We believe that this seismic survey violates these agreements and our Constitutional right to Section 24 on the Environment. It violates our right to health and well-being as it affects our livelihood and food security. This survey has a direct impact on pollution and ecological degradation, does not promote conservation, and is not promoting justifiable economic and social development. There are no economic benefits of oil and		

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gas to the Port Holloth community.		
5. The government is allowing permits for activities that harm the ocean yet are diminishing quotas. We as small-scale fishers do not harm the ocean, yet are severely impacted by seismic survey activities. As TGS states, our livelihoods are "already compromised due to the fishing quota system, over-fishing, lack of employment opportunities, pollution, effects of climate change and the revent Covid pandemic." The government is not alleviating any of these challenges by allowing a seismic survey and oil and gas development. Even though this seismic survey is not in the exact boundary of our fishing grounds, we are still concerned that it will affect the migration patterns of the fish. Climate change and overfishing is already impacting those patterns and the amount of fish in the ocean, so please we do not want another activity that will harm the fish we depend on for our livelihood.		

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ANNEX B

APPEAL PURSUANT TO SECTION 43(1A) OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND SECTION 4(1) OF THE NATIONAL APPEAL REGULATIONS OF 2014 AGAINST ENVIRONMENTAL AUTHORISATION GRANTED TO TGS GEOPHYSICAL COMPANY (UK) FOR THE PROPOSED ORANGE BASIN RECONNAISSANCE PERMIT PROJECT

INTRODUCTION

1. This is an appeal to the Honourable Minister of Forestry, Fisheries and the Environment ("**Appeal**" to the "**Minister**"), directed to the Director: Appeals and Legal Review of the Department of Forestry, Fisheries and the Environment ("**DFFE**"), to set aside the decision of the Director-General of the Department of Mineral Resources and Energy (as "**DG**" or "**DMRE**") dated 17 April 2023 granting environmental authorisation to TGS Geophysical Company (UK) (as "**Third Respondent**") allowing for a 3D seismic survey off the West Coast of South Africa.

2. The Minister should set aside the decision to grant authorization because the Environmental Basic Assessment Report (BAR) did not comply with NEMA in several ways. The decision to grant authorization violates various provisions of NEMA, including the requirements for granting environmental authorizations and the National Environmental Management Principles. The BAR and the decision-maker failed to establish the need and desirability of the Project, failed to adequately consider marine impacts, and neglected to assess the cumulative impacts of the Project. The Second and Third Respondent also failed to engage in meaningful consultation, violating principles of fair administrative decision-making and the right of affected communities to be consulted. This failure to consult is inconsistent with NEMA's requirement to promote participation and take into account the interests of all parties. Moreover, the decision-maker disregarded NEMA Principles, including the precautionary principle and the principle of sustainable development, as well as the constitutional right to a non-harmful environment. The decision therefore to issue the authorization and the reasons provided are deemed irrational and unreasonable.

3. The Appellant submit this appeal on the following grounds:

3.1. Ground 1: A flawed and misguided need and desirability assessment

3.1.1. Climate Change Impacts.

3.1.2. The climate crisis.

3.1.3. South Africa's international climate change commitments.

3.1.4. Need for seismic data.

3.2. Ground 2: Failure to adequately consider marine impacts

3.2.1. Underwater sound from acoustic seismic surveys.

3.2.2. Harms to marine life.

3.2.3. Acoustic Modelling

3.2.4. Heightened Legislative Requirements are Not Considered for Critical Biodiversity Areas (CBAs), Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs).

3.2.5. CBAs

3.2.6. EBSAs and MPAs.

3.2.7. Cape Fur Seals

3.2.8. Whale and Dolphins.

3.2.9. Fish.

3.2.10. Zooplankton.

3.2.11. The proposed mitigation measures are inadequate to prevent unacceptable harm to marine life.

3.2.12. Simultaneous Surveys.

3.2.13. Lack of baseline noise assessment.

3.2.14. Chronic Noise Impacts.

3.3. Ground 3: Failure to adequately assess cumulative impacts

3.4. Ground 4: Failure to conduct meaningful consultation with communities and local people (and in particular small-scale fishers), within the public participation process, including the Social Impact Assessment process.

3.5. Ground 5: The FBAR does not contain a proper and objective assessment of the negative impacts of the project on people's human rights

3.6. Ground 6: Failure to consider relevant coastal management considerations or to comply with the National Environmental Management: Integrated Coastal Management Act 24 of 2008

3.7. Ground 7: Failure to provide adequate reasons for the decision.

3.8. Ground 8; Decision to grant authorisation contravenes NEMA Principles, the Constitution and PAJA

4. The Authorisation, with reference number 12/1/040, was granted in terms of regulation 24 of the National Environmental Management Act, 1998 ("**NEMA**") Environmental Impact Assessment Regulations, 2014 ("**EIA Regulations**").

5. The Appeal is lodged in terms of section 43(1A) of NEMA, which provides that: "*Any person may appeal to the Minister against a decision made in terms of this Act or any specific environmental management Act by the Minister responsible for mineral resources or any person acting under his or her delegated authority*", read with the NEMA National Appeal Regulations, 2014[1] ("**the Appeal Regulations**"), which provide for the submission of an appeal within 20 days from the date that the notification of the decision for an application for environmental authorisation was sent to the registered interested and affected parties (**I&APs**) by the Applicant (26 April 2023).[2]

6. In accordance with the requirements of Regulation 4(2)(a) of the Appeal Regulations:

   6.1. this Appeal is submitted in writing in the form obtained from the Appeal Administrator, and accompanied by this more detailed appeal document, being a statement setting out the grounds of appeal ("**the Grounds of Appeal**"). The Appellants are entitled to also submit these more detailed Grounds of Appeal as the Appeal submission. This submission must be taken into account by the Minister in making a decision on the Appeal;

   6.2. to the extent possible, the Appeal is accompanied by relevant supporting documentation which is referred to in this Appeal submission - attached as Annexure B; and

[1] GN R 993 GG 38303 of 8 December 2014.
[2] Regulation 4(1)(a) NEMA National Appeal Regulations, 2014.

6.3. we confirm, in compliance with Regulation 4(1) of the Appeal Regulations, that this Appeal is submitted within 20 days[3] from the date of notification to I&APs to the Appeal Administrator. A copy of the Appeal will be provided to the Applicant and to those registered I&APs, and organs of state with an interest in the matter, insofar as possible and within time and cost constraints. The statement regarding compliance with Regulation 4(1) is contained in the cover letter to which these Grounds of Appeal are attached. In any event, we confirm compliance with Regulation 4(1).

7. The Appellants further submit that there are grounds for judicial review under the Promotion of Administrative Justice Act, 2000 ("**PAJA**") because the Authorisation comprises administrative action that *inter alia*:

7.1. is unconstitutional or unlawful;[4]

7.2. was taken because of the failure to consider relevant considerations;[5]

7.3. is not rationally connected to the information before the decision-maker in making the Decision or to the reasons provided by the decision-maker for the Decision;[6] and

7.4. is so unreasonable that no reasonable person could have granted it.[7]

PARTIES

8. The First Appellant is **Natural Justice.**

8.1. Natural Justice: Lawyers for Communities and the Environment is a non-profit organization specializing in environmental and human rights law in Africa – with a focus on the pursuit of social and environmental justice for local and

[3] The Appellants submit that the process provided for in the Appeal Regulations, in particular the requirement to submit an appeal in 20 days of the notification, severely prejudices the Appellants and infringes on their rights to a fair process. The Appellants continue to assert that the unreasonably short timeframes and onerous notification requirements of regulation 4(1), among others, render the Appeal Regulations a violation of the rights to just administrative action, and are thus unconstitutional.

[4] PAJA section 6(2)(d),(f)(ii) and (i).
[5] PAJA section 6(e)(iii).
[6] PAJA section 6(f)(ii)(cc) and (dd).
[7] PAJA section 6(h).

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indigenous communities. Natural Justice offers direct support to local and indigenous communities impacted by the ever-increasing demand for land and natural resources..

9. The Second Appellant is the Green Connection.

9.1. Green Connection is a registered non-governmental organisation, that believes that economic growth and development, improvement of socio-economic status and conservation of natural resources can only take place within a commonly understood framework of sustainable development. The Green Connection aims to provide practical support to both the government and non-governmental/civil society sectors, which are an integral part of sustainable development.

10. The Appellants have legal standing to bring the Appeal not only in terms of section 43 of NEMA, but also to enforce environmental laws in terms of NEMA section 32, in that they *inter alia* act: *"(c) in the interest of or on behalf of a group or class of persons whose interests are affected; (d) in the public interest; and (e) in the interest of protecting the environment."*[8] The Appellants act in the interest of, or on behalf of, persons who, for practical reasons, are unable to institute such proceedings, including members of coastal communities who do not have the capacity or resources to do so, in the interests of coastal communities who are affected by the proposed seismic activities, in the public interest, and in the interest of protecting the environment, to further the objectives of section 24 of the Constitution of the Republic of South Africa, 1996 ("the Constitution") and NEMA.

11. The Appellants are also Registered Interested and Affected parties (I&AP) in respect of the application process for this authorisation.

BACKGROUND AND DESCRIPTION OF THE PROJECT

12. The proposed project area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km

[8] NEMA section 33(1)(c)-(d).

offshore of Hondeklip Bay over a number of petroleum licence blocks. The application area for the proposed 3D seismic survey is approximately 57 400 km² in extent. TGS proposes that a single survey vessel equipped with seismic sources and streamers be used. The proposed 3D survey would be supported by two escort vessels. It is estimated that the 3D survey will take 70 days (including downtime).[9] The area proposed for the seismic survey is a large under-explored area with potential for both oil and gas.

13. On the 25th of November 2022, the Applicants submitted comments on the draft Basic Assessment Report prepared as part of the Environmental Impact Assessment (EIA) process. As mentioned above, the DG granted the Project an Environmental Authorisation on 17 April 2023, and the Appellants received notification of the decision on 26 April 2022.

14. The Reasons for the Decision are set out in Annexure 1 to the Authorisation.

GROUNDS OF APPEAL

15. The decision to grant the Authorisation should be set aside by the Minister because the final Environmental Basic Assessment Report ("BAR") failed to comply with NEMA in various respects; and the Director General"s decision to grant the Authorisation contravenes various provisions of NEMA, including the requirements for granting environmental authorisations, the requirements of the National Environmental Management Act and the National Environmental Management Principles (section 2 of NEMA) ("NEMA Principles"), in that:

    15.1. the need and desirability of the Project has not been established, as required by regulation 18 of the EIA Regulations read with regulation 23(3) and Appendix 3 to the EIA Regulations.

    15.2. the BAR and the DG failed to adequately consider the marine impacts and therefore have failed to meet the requirements of, inter alia, section 24O(1) NEMA to account for all relevant factors,[10] in particular those

[9] BAR Executive Summary, pxvi.
[10] NEMA, section 24O1(b).

regarding the pollution, environmental impacts or environmental degradation "*likely to be caused if the application is approved*",[11] as well as any guidelines, departmental policies, and environmental management instruments and any other information in the possession of the competent authority relevant to the Application.[12] This is also in contravention of the NEMA requirement to ensure that the activity's potential environmental impacts are properly assessed;[13]

15.3. The FBAR and DG have failed to adequately assess and consider the cumulative impacts of the Project, as required by the NEMA EIA Regulations, Appendix 3 section 3(j)(i).

15.4. TGS, and its appointed Environmental Assessment Practitioner ("EAP", has failed to engage in meaningful consultation in violation of the principles of fair administrative decision-making and the right of interested and affected communities to be meaningfully consulted prior to a decision on authorisation being made, and in violation of section 2(4)(f) of NEMA, which stipulates that the participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured. It is also inconsistent with section 2(4)(g) of NEMA, which requires that decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge.

15.5. the DG failed to consider and/or give effect to: the NEMA Principles, including the precautionary principle and the principle that requires development to be environmentally, socially and economically sustainable; and the Constitutional rights to an environment that is not

[11] NEMA, section 24O1(b)(i).
[12] NEMA, section 24O2(b)(viii).
[13] NEMA, section 24(4)(a)(iv).

harmful to health or wellbeing – as enshrined in section 24 of the Constitution of the Republic of South Africa, 1996 ("the Constitution"). The decision to issue the Authorisation and the reasons provided therefore are, furthermore irrational and unreasonable, and thus in contravention of PAJA.

15.6. The DG failed to consider relevant coastal management considerations or to comply with the National Environmental Management: Integrated Coastal Management Act 24 of 2008.

15.7. Ground 7: The DG failed to provide adequate reasons for the decision.

15.8. Ground 8. Decision to grant authorisation contravenes NEMA Principles, the Constitution and PAJA

Ground 1: A flawed and misguided need and desirability assessment

16. The NEMA EIA Regulations stipulate that a basic assessment report must include a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location.[14]

17. Section 5 of the BAR includes a motivation of need and desirability for the proposed 3D seismic survey. Unsurprisingly, the BAR focusses on justifying the 'need and desirability' of the proposed project and fails to reflect views critical to 3D seismic surveys and offshore oil and gas exploration (and ultimately production). As a consequence, the 'need and desirability' assessment provided in the BAR follows

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[14] NEMA EIA Regulations, Appendix 1, section 2(c). With regard to need and desirability, a distinction is drawn between the 'general purpose and requirements' of the proposed activity and 'need and desirability'. The 2017 Guideline on Need and Desirability states as follows (at p10):

> In order to properly interpret the EIA Regulations' requirement to consider "need and desirability", it is necessary to turn to the principles contained in NEMA, which serve as a guide for the interpretation, administration and implementation of NEMA and the EIA Regulations. With regard to the issue of "need", it is important to note that this "need" is not the same as the "general purpose and requirements" of the activity. While the "general purpose and requirements" of the activity might to some extent relate to the specific requirements, intentions and reasons that the applicant has for proposing the specific activity, the "need" relates to the interests and needs of the broader public.
>
> ...
>
> The consideration of "need and desirability" in EIA decision-making therefore requires the consideration of the strategic context of the development proposal along with the broader societal needs and the public interest. The government decision-makers, together with the environmental assessment practitioners and planners, are therefore accountable to the public and must serve their social, economic and ecological needs equitably. Ultimately development must not exceed ecological limits in order to secure ecological integrity, while the proposed actions of individuals must be measured against the short-term and long-term public interest in order to promote justifiable social and economic development – i.e. ensuring the simultaneous achievement of the triple bottom-line. Considering the merits of a specific application in terms of the need and desirability considerations, it must be decided which alternatives represent the "most practicable environmental option", which in terms of the definition in NEMA and the purpose of the EIA Regulations are that option that provides the most benefit and causes the least damage to the environment as a whole, at a cost acceptable to society, in the long-term as well as in the short-term. (emphasis added)

The Guideline requires need and desirability assessments to address the impact of planned activities on global and international responsibilities relating to the environment, including climate change (at p11).

the pattern of previous seismic survey EIAs by (among other things) limiting the assessment of potential impacts to the proposed 3D seismic survey, with no assessment of the need and desirability of exploring for (and ultimately producing and using) new oil and gas reserves (including in the context of the climate change crisis and the right to food). The assessment also includes a section motivating the 'need' for seismic data.

18. It is noted that the BAR Needs and Desirability analysis indicates that the proposed project '*aims to identify oil and gas resources to be used in… energy production and/or processing or manufacturing of materials*'.[15] The BAR also claims in passing that "seismic surveying is not only used for petroleum and natural gas exploration and development, it can in certain instances also be used for development of offshore wind, geothermal energy, and low-carbon solutions such as carbon capture and storage and also more generally for providing more insight and understanding into the regional geology of the area for scientific purposes." This statement about other uses is misguided and irrelevant. These other purposes of the projects surveying results are speculative at best, and have far less impacts on the ocean than oil and gas surveying.[16] It is also abundantly clear from the BAR that the main purpose of this project is to survey for oil and gas deposits.

19. The BAR concludes that '*[a]s a result of the fact that this project entails only survey activities, it is anticipated that this project will not lead to a significant impact on the receiving environment*'.[17] In line with this, the BAR does not consider or assess the potential climate and other negative impacts of subsequent oil and gas exploration,

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[15] BAR, Item 1.7.1, p24.

[16] For example, the offshore wind industry does not use airguns, and instead relies on High Resolution Geophysical (HRG) surveys to map the ocean bottom and its shallow geological features. That technology, such as echosounders, sidescan sonar, and sparkers, uses considerably less power as compared to seismic airguns and also tends to operate at higher frequencies. Not only do higher frequency sounds dissipate more quickly in the ocean but they also tend to fall outside of the general hearing range of baleen whales, such as humpbacks and right whales. The use of seismic surveying to develop offshore wind is the equivalent of using a hammer when a feather could do the job. The area that is being surveyed is also 120 – 230 km offshore and includes deep to ultradeep depths between 1,500 – 4,000m. It would not be feasible to install a fixed nor floating turbines at those depths, as they are more suitable for depths of less than 50m and 50 to 1,000m, respectively. Lastly, a World Bank analysis does not find the area TGS is surveying to be ideal for offshore wind generation. ESMAP. 2019. Going Global: Expanding Offshore Wind to Emerging Markets at p. 20-21. Washington, DC: World Bank ("fixed foundation is considered technically viable in areas with water depth less than 50 m and average wind speeds over 7 m/s. Floating wind is considered technically viable with water depths from 50 m up to 1,000 m.").

[17] Ibid, Item 1.8.3, p24.

production and use. In other words, it fails to consider the lifecycle impacts associated with exploring for and exploiting oil and gas resources. Yet, at the same time, it does consider the positive impacts should oil and gas be eventually produced, such as the claim that it will provide energy security to South Africa. This self-serving analysis is not only deceiving, it is unlawful.

Climate change impacts

20. The BAR states that from a climate change perspective, it is '*not currently possible to accurately assess the risks associated with oil and gas activities, given that the specific details of these potential future activities are not known and therefore climate change impacts would need to be assessed in detail during any subsequent Scoping and EIA processes for any potential subsequent oil and gas production projects*'.[18] As a result, the BAR does not conduct any climate change impact assessment, even in broad terms.

21. It is relevant to note that the issue of whether the decision-maker properly considered climate change impacts was referred to in the judgment of the full bench of the Makhanda High Court in the Shell Wild Coast seismic survey case.[19] The court stated in its judgement that the intervening parties' contention that the decision-maker gave no proper consideration to climate change impacts of the decision to grant the exploration right is an important factor to be considered in the process of granting an exploration right. The court referred to expert testimony relied upon to support this contention, which showed that '*most of the discovered reserves of oil and gas cannot be burnt if we are to stay on the pathway to keep global average temperature increases below 1.5 degrees Celsius. Authorising new oil and gas exploration, with its goal of finding exploitable oil and/or gas reserves and consequently leading to production, is not consistent with South Africa complying with its international climate change commitments*'.[20]

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[18] BAR, p33.

[19] *Sustaining the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021, at paras 120 to 125.

[20] Ibid, at para 121.

22. The court noted that according to the respondents in that case, climate change considerations are irrelevant when considering an application for an exploration right, and these considerations are premature because they fall to be considered at a much later stage.

23. The court pointed out that on the authority of the *Save the Vaal* case,[21] the '*processes are discrete stages in a single process that culminates in the production and combustion of oil and gas, and the emission of greenhouse gases that will exacerbate the climate crisis and impact communities' livelihoods and access to food*'.[22] The court went on to state that the respondent's thesis does not find support in *Earthlife Africa Johannesburg v Minister of Environmental Affairs and Others* either, and referred approvingly to the following passage in Murphy J's judgement:

> The absence of express provision in the statute requiring a climate change impact assessment does not entail that there is no legal duty to consider climate change as a relevant consideration and does not answer the interpretative question of whether such a duty exists in administrative law. Allowing for the respondents' argument that no empowering vision in NEMA or the regulations explicitly prescribes a mandatory procedure or condition to conduct a formal climate change assessment, the climate change impacts are undoubtedly a relevant consideration as contemplated by section 24O of NEMA for the reasons already discussed. A formal expert report on climate change impacts will be the best evidentiary means of establishing that this relevant factor in its multifaceted dimensions was indeed considered, while the absence of one will be symptomatic of the fact that it was not.[23]

24. The court in the Shell Wild Coast seismic survey case went on to state the following:

> It seems clear from the aforegoing, even taking into account the contentions raised by the respondents, that, had the decision-maker had the benefit of considering a comprehensive assessment of the need and desirability of exploring for new oil and gas reserves for climate change and the right to food perspective, the decision-maker may well have concluded that the exploration is neither needed nor desirable.[24] (emphasis added)

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[21] *Director: Mineral Development, Gauteng Region and Another v Save the Vaal Environment and Others* (133/98)[1999] ZASCA 9 (12 March 1999).
[22] Ibid, para 123.
[23] Ibid, para 124.
[24] Ibid, para 125.

25. The Green Connection and Natural Justice submit that the BAR is deficient, and the Needs and Desirability analysis incomplete, without at the very least a broad assessment of the climate change impacts should commercially exploitable oil and gas resources be identified through the proposed seismic survey (and should these resources be produced and utilised). It would be pointless to authorise this (and other) 3D seismic surveys should such an assessment conclude that the development of new oil and gas fields is incompatible with South Africa's climate change commitments.

The 'climate crisis'

26. The need and desirability (from a climate change perspective) of conducting a 3D seismic survey (which – as mentioned above – the BAR aims to identify oil and gas resources to be used in energy production and/or processing or manufacturing of materials) is particularly important given that climate change has been acknowledged as a 'crisis' with human-induced climate change impacts being experienced in every region. It is also recognised that the climate change 'crisis' requires immediate, rapid and large-scale reductions in greenhouse gas (GHG) emissions to limit global warming to 1.5°C (including accelerated action in this decade to reduce global carbon dioxide emissions by 45 per cent by 2030 relative to the 2010 level and to net-zero around mid-century). In support of these submissions, some of the recent developments relating to the climate crisis are discussed briefly below.

27. In August 2021, the Intergovernmental Panel on Climate Change (IPCC) (an international body for assessing the science related to climate change) released its 6th Assessment Report (AR6).[25] In its summary for policymakers, the IPCC indicates (among other things) that:

    27.1. It is unequivocal that human influence has warmed the atmosphere, ocean and land, and that widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred;[26]

[25] Climate Change 2021: The Physical Science Basis, available online at: https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/
[26] Para A.1

27.2. The scale of recent changes across the climate system as a whole – and the present state of many aspects of the climate system – are unprecedented over many centuries to many thousands of years;[27]

27.3. Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since AR5;[28]

27.4. Global surface temperature will continue to increase until at least mid-century under all emissions scenarios considered, and that global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in CO_2 and other GHG emissions occur in the coming decades;[29]

27.5. Many changes in the climate system become larger in direct relation to increasing global warming. They include increases in the frequency and intensity of hot extremes, marine heatwaves, heavy precipitation, and, in some regions, agricultural and ecological droughts; an increase in the proportion of intense tropical cyclones; and reductions in Arctic sea ice, snow cover and permafrost;[30]

27.6. Continued global warming is projected to further intensify the global water cycle, including its variability, global monsoon precipitation and the severity of wet and dry events;[31]

27.7. Many changes due to past and future GHG emissions are irreversible for centuries to millennia, especially changes in the ocean, ice sheets and global sea level;[32]

27.8. From a physical science perspective, limiting human-induced global warming to a specific level requires limiting cumulative CO_2 emissions, reaching at least net zero CO_2 emissions, along with strong reductions

[27] Para A.2
[28] Para A.3
[29] Para B.1
[30] Para B.2
[31] Para B.3
[32] Para B.5

in other GHG emissions. Strong, rapid and sustained reductions in CH_4 emissions would also limit the warming effect resulting from declining aerosol pollution and would improve air quality.[33]

28. On 9 August 2021, the IPCC issued a press release relating to its AR6 report. It states that the report provides new estimates of the chances of crossing the global warming level of 1.5°C in the next decades, and finds that unless there are immediate, rapid and large-scale reductions in GHG emissions, limiting warming to close to 1.5°C or even 2°C will be beyond reach.[34]

29. Also on 9 August 2021, UN Secretary-General António Guterres described the AR6 report as nothing less than "*a code red for humanity. The alarm bells are deafening, and the evidence is irrefutable*". (emphasis added)

30. Guterres is reported as noting that the internationally agreed threshold of 1.5 degrees above pre-industrial levels of global heating was perilously close, and that we are at imminent risk of hitting this threshold in the near term. Guterres is indicated as advising that the only way to prevent exceeding this threshold, is by urgently stepping up our efforts, and pursuing the most ambitious path. Guterres is reported as stating that solutions are clear: "*inclusive and green economies, prosperity, cleaner air and better health are possible for all, if we respond to this crisis with solidarity and courage*". Ahead of the COP26 climate conference in Glasgow in November 2021, Guterres stated that all nations needed to join the net zero emissions coalition, and reinforce their promises on slowing down and reversing global heating "*with credible, concrete, and enhanced Nationally Determined Contributions (NDCs)*" that lay out detailed steps.

31. In April 2022, Guterres tweeted that '*[c]limate activists are sometimes depicted as dangerous radicals. But the truly dangerous radicals are the countries that are increasing the production of fossil fuels. Investing in new fossil fuels infrastructure is moral and economic madness*'.[35] Addressing graduate students in May 2022, Guterres expressed the view that investing in fossil fuels is now "*a dead end* -

[33] Para D.1
[34] https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/
[35] https://twitter.com/antonioguterres/status/1511294073474367488?lang=en

economically and environmentally. No amount of greenwashing or spin can change that. So, we must put them on notice: Accountability is coming for those who liquidate our future."[36]

32. The 26th Conference of the Parties of the UNFCCC (COP26) was held in Glasgow in the last quarter of 2021. Recognition of the climate 'crisis', as well as the urgent need to increase effort and to accelerate action to address climate change (including by developing nations), are reflected in the outcome of COP26 and recorded in the Glasgow Climate Pact. The Glasgow Climate Pact (among other things):

32.1. Expresses alarm and utmost concern that human activities have caused around 1.1°C of global warming to date and that impacts are already being felt in every region;

32.2. Reaffirms the long-term global goal to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;

32.3. Recognizes that the impacts of climate change will be much lower at the temperature increase of 1.5°C compared with 2°C and resolves to pursue efforts to limit the temperature increase to 1.5°C;

32.4. Recognizes that limiting global warming to 1.5°C requires rapid, deep and sustained reductions in global GHG emissions, including reducing global carbon dioxide emissions by 45 per cent by 2030 relative to the 2010 level and to net zero around mid-century as well as deep reductions in other GHGs;

32.5. Also recognizes that this requires accelerated action in this critical decade, on the basis of the best available scientific knowledge and equity, reflecting common but differentiated responsibilities and respective capabilities and in the context of sustainable development and efforts to eradicate poverty,

32.6. Invites Parties to consider further actions to reduce by 2030 non-carbon dioxide GHG emissions, including methane which has been

[36] https://news.un.org/en/story/2022/05/1118932

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identified as a driver of climate change and the main polluting emission from natural gas;

32.7. Calls upon Parties to accelerate the development, deployment and dissemination of technologies, and the adoption of policies, to transition towards low-emission energy systems, including by rapidly scaling up the deployment of clean power generation and energy efficiency measures, including accelerating efforts towards the phasedown of unabated coal power and phase-out of inefficient fossil fuel subsidies, while providing targeted support to the poorest and most vulnerable in line with national circumstances and recognizing the need for support towards a just transition;

32.8. Emphasizes the importance of protecting, conserving and restoring nature and ecosystems, including forests and other terrestrial and marine ecosystems, to achieve the long-term global goal of the Convention by acting as sinks and reservoirs of GHGs and protecting biodiversity, while ensuring social and environmental safeguards.

33. The climate 'crisis' is also recognised by the International Energy Agency (IEA), of which South Africa is an IEA associated country. During or about July 2021, the IEA published its *Net Zero by 2050 – A Roadmap for the Global Energy Sector* report. In the foreword to this report, the Executive Director of the IEA states (among other things) as follows:

> We are approaching a decisive moment for international efforts to tackle the climate crisis – a great challenge of our times. The number of countries that have pledged to reach net-zero emissions by mid-century or soon after continues to grow, but so do global greenhouse gas emissions. This gap between rhetoric and action needs to close if we are to have a fighting chance of reaching net zero by 2050 and limiting the rise in global temperatures to 1.5 °C.
>
> Doing so requires nothing short of a total transformation of the energy systems that underpin our economies...
>
> Despite the current gap between rhetoric and reality on emissions, our Roadmap shows that there are still pathways to reach net zero by 2050. The one on which we focus is – in

our analysis – the most technically feasible, cost-effective and socially acceptable. Even so, that pathway remains narrow and extremely challenging, requiring all stakeholders – governments, businesses, investors and citizens – to take action this year and every year after so that the goal does not slip out of reach.

This report sets out clear milestones – more than 400 in total, spanning all sectors and technologies – for what needs to happen, and when, to transform the global economy from one dominated by fossil fuels into one powered predominantly by renewable energy like solar and wind. Our pathway requires vast amounts of investment, innovation, skilful policy design and implementation, technology deployment, infrastructure building, international co-operation and efforts across many other areas.

Since the IEA's founding in 1974, one of its core missions has been to promote secure and affordable energy supplies to foster economic growth. This has remained a key concern of our Roadmap, drawing on special analysis carried out with the International Monetary Fund and the International Institute for Applied Systems Analysis. It shows that the enormous challenge of transforming our energy systems is also a huge opportunity for our economies, with the potential to create millions of new jobs and boost economic growth.

Another guiding principle of the Roadmap is that clean energy transitions must be fair and inclusive, leaving nobody behind. We have to ensure that developing economies receive the financing and technological know-how they need to continue building their energy systems to meet the needs of their expanding populations and economies in a sustainable way. It is a moral imperative to bring electricity to the hundreds of millions of people who currently re deprived of access to it, the majority in of them in Africa...

34. On fossil fuels used in energy production, the report states that:

There is no need for investment in new fossil fuel supply in our net zero pathway. Beyond projects already committed as of 2021, there are no new oil and gas fields approved for development in our pathway, and no new coal mines or mine extensions are required.

35. When natural gas is burned for energy, it releases carbon dioxide into the atmosphere. More importantly, the extraction, processing, transport and use of natural gas cause significant amounts of methane to be released into the atmosphere too. *According to the United Nations, **methane is a 84-86 times more potent greenhouse gas than carbon dioxide over a 20-year period, and 28-34 times more potent over 100-***

year period.[37] More research is also showing that methane often leaks during the production, transport and use of natural gas. Therefore, its contribution to climate change is significantly unaccounted for.[38] Drones, laser absorption spectroscopy, and satellites, among other new methane monitoring technologies, have improved the identification and quantification of emissions across the gas lifecycle, leading researchers to conclude that national governments have almost universally underestimated these emissions.[39]

36. If 3,000 megawatts of new gas-to-power plants were built to meet South Africa's 2019 Integrated Resource Plan for Electricity, and the plants were fuelled by imported LNG, the annual emissions from this fuel use would be more than 2.5 million tonnes of CO2e (carbon dioxide equivalent) if the plants ran at 75% capacity. This is the equivalent of driving over half a million gasoline-powered vehicles for a year.[40] For gas or any other fossil fuel, a life-cycle analysis is therefore necessary to quantify the total amounts of GHG emissions (predominantly carbon dioxide and methane) that result from every step in the energy production process: from extracting the fossil fuel at the well or mine to burning it at a power plant or other facility. This is therefore important because all these processes are linked and should not be viewed in isolation.

South Africa's international climate change commitments

37. South Africa is a Party to the United Nations Framework Convention on Climate Change (UNFCCC), which enjoins State Parties to take precautionary measures to anticipate, prevent or minimize the causes of climate change (Article 3.3).

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[37] International Energy Agency, Global Methane Tracker 2022- Overview, https://www.iea.org/reports/global-methane-tracker-2022/overview. See also International Energy Agency, Global Energy Review: CO2 Emissions in 2021,(2022), https://iea.blob.core.windows.net/assets/c3086240-732b-4f6a-89d7-db01be018f5e/GlobalEnergyReviewCO2Emissionsin2021.pdf.

[38] South Africa is likely among those that are underreporting because the Technical Guidelines for GHG reporting uses outdated emission factors from the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines

[39] Jonathan Mingle, Methane Detectives: Can a Wave of New Technology Slash Natural Gas Leaks?, YALE E360, (2019), https://e360.yale.edu/features/methane-detectives-can-a-wave-of-new-technology-slash-natural-gas-leaks.

[40] EPA, EPA equivalency calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results

38. South Africa, as a Party to the UNFCCC that ratified the Kyoto Protocol and adopted the Paris Agreement, has committed to *'working with others to ensure temperature increases are kept well below 2°C above pre-industrial levels, which could include a further revision of the temperature goal to below 1.5°C in light of emerging science'* by reducing GHG emissions. South Africa has also committed (among other things) to:

    38.1. Preparing, communicating and maintaining Nationally Determined Contributions (NDCs) that it intends to achieve reach global peaking of GHG emissions as soon as possible, and to undertake rapid reductions thereafter;[41] and

    38.2. Striving to formulate and communicate long-term GHG emission development strategies.[42]

39. There have been various Conferences of the Parties and meetings since, with decisions related to Nationally Determined Contributions (NDCs) contained in decisions 4/CMA.1 and 18/CMA.1 and their annexes.

40. South Africa submitted its first Intended Nationally Determined Contribution under the Paris Agreement on 25 September 2015, which became the country's first NDC on 1 November 2016. Subsequently, South Africa revised its first NDC in 2021:[43]

Table 2 - South Africa's updated NDC mitigation targets

Year	Target	Corresponding period of implementation
2025	South Africa's annual GHG emissions will be in a range from 398-510 Mt CO_2-eq.	2021-2025
2030	South Africa's annual GHG emissions will be in a range from 350-420 Mt CO_2-eq.	2026-2030

[41] Paris Agreement, Article 4.1 – 4.3.

[42] Paris Agreement, Article 4.19

[43] Available online at: https://www.dffe.gov.za/sites/default/files/reports/draftnationallydeterminedcontributions_2021updated.pdf#:~:text=South%20Africa%E2%80%99s%20intended%20nationally%20determined%20contribution%20%28NDC%29%28RSA%2C%20n.d.%29.Agreement%20The%20NDC%20and%20first%20NDC%20are%20identical. This revised NDC is indicated as an enhancement and update of South Africa's NDC under the Paris Agreement, 'meeting its obligation under Article 4.9 to communicate NDC's every 5 years, and responding to requests in paragraphs 23 to 25 of decision 1/CP.21'. South Africa's second (next) NDC is intended to be communicated in 2025.

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41. South Africa's energy sector is estimated at contributing about 84% percent to the country's overall GHG emissions (including Carbon Dioxide and Methane).[44]

42. In February 2020, South Africa submitted to the UNFCCC its first long-term low GHG emission development strategy titled *South Africa's Low Emission Development Strategy 2050*. It is indicated in the executive summary of this strategy that South Africa, as one of the top 20 global GHG emitters and with a high dependency on fossil fuels, will need to make substantial emission cuts to contribute its fair share to global GHG emission reductions.[45]

43. The BAR does not provide any indication (or estimation) of how future GHG emissions (resulting from future exploitation of oil and gas that may be discovered through the exploration drilling project) would impact on South Africa's ability to achieve its GHG emissions targets (as set out in South Africa's NDC) or its updated GHG emissions targets (as set out in South Africa's revised NDC). This is particularly relevant given that the emissions targets for the 2026-2030 period are lower than the targets for the 2021-2025 period, while offshore oil and gas developments could take at least a decade to reach the production stage. This could result in offshore oil and gas investments (as well as associated gas infrastructure developments) in the future becoming unneeded 'stranded assets' and a burden on future generations. There is also a risk that in the future tariffs will be levied on various goods exported by fossil-fuel dependent countries – the European Union is reported to be gradually phasing in its Border Adjustment Mechanism as part of the EU's Green Deal.[46]

Need for seismic data

44. Under the sub-heading 'Need for seismic data', the BAR states that a discussion of the needs and desirability of the project '*would not be complete without understanding*

[44] https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-south-africa

[45] South Africa's Low Emission Development Strategy 2050, pviii.

[46] See for example *Just Energy Transitions and Natural Gas in Africa: Balancing Climate Action and Structural Transformation*, The African Climate Foundation, August 2022, at p14. Available online at: https://africanclimatefoundation.org/wp-content/uploads/2022/10/ACF-GAS-REPORT-V7.indd-final-1.pdf

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the need for acquisition of the seismic data and possible oil and gas exploration and production that could potentially take place in the future as a result of the survey'.[47]

45. Ironically, the BAR then quickly goes on to state that *'[i]t cannot be said with absolute certainty that exploration drilling, let alone production activities, will be undertaken in the future. As such, it is not currently possible to accurately assess the risks associated with these activities, given that the specific details of these potential future activities are not known. While it is acknowledged that the risks mentioned would need assessment, such assessment falls outside of the scope of the current application and would need to be assessed in detail during subsequent Scoping and EIA processes, should exploration drilling or production be proposed. The environmental consequences applicable to the planned survey activities have been identified and assessed in this BA Report'.*[48] The views of the Makhanda High Court in this regard (in the context of future production, climate change and the right to food) have been traversed earlier in the Green Connection and Natural Justice's comments (see paragraphs 27 to 30 above) and are not repeated here. The Green Connection and Natural Justice stands by their view that at the very least a broad assessment of the impacts and risks associated with future invasive exploration activities, production activities and use of any discovered oil reserves should be included in the BAR.

46. The BAR report then proceeds with a glowing (and one-sided) endorsement of the use of natural gas:

> The fastest growing sector for the use of natural gas is for the generation of electric power. Natural gas power plants usually generate electricity in gas turbines, directly using the hot exhaust gases from the combustion of the gas... Of the three fossil fuels used for electric power generation (coal, oil and natural gas), natural gas emits the least carbon dioxide per unit of energy produced. Natural gas emits 30% and 45% less carbon dioxide than burning oil and coal, respectively. Burning natural gas also releases lower amounts of nitrogen oxides, sulphur dioxide, particulates and mercury when compared to coal and oil.
>
> The increased use of natural gas can, in the short term, serve as a transition fuel on the path to the carbon-neutral goal of the Paris Agreement. In addition to gas as a key transitional fuel reducing reliance on coal, the benefits of oil and gas could include

[47] BAR, p33-34.
[48] Ibid.

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significant amount of job creation, especially if local beneficiation takes place. An increase in domestic natural gas reserves would enable South Africa to take steps to secure the countries' energy supply (through diversification), assist in reducing the emissions of greenhouse gases (by reducing the country's reliance on coal for electricity generation) and reduce the need for the importation of gas. As such, exploration for additional domestic hydrocarbon reserves is considered important and supported by national policy, and any discoveries would be well received by the local market and are consistent with the objectives stated in the 2019 IRP. Natural gas emits 30% and 45% less carbon dioxide than burning oil and coal, respectively, and 65% less carbon dioxide than coal when the increased efficiency of Combined Cycle Gas Turbines versus coal fired power stations is considered. Eskom produces over 200MtCO2/yr, over 40% of South Africa's total. South Africa also has SASOL's Secunda coal to liquids plant, the biggest single source of CO2 in the world at 57MtCO2/yr (~12.5% of South Africa's total) to produce 160k barrels of products per day. Supplying these products from conventional oil production and refining would generate approximately 10% of those emissions, 5 to 6MtCO2/yr.

According to the 2019 IRP the availability of gas in the short to medium term is a risk as South Africa does not currently have gas resources. There is also a supply and foreign exchange risk associated with likely increase in gas volumes depending on the energy mix adopted post 2030 when a large number of coal fired power stations are decommissioned. South Africa's economic growth is dependent on the availability of energy, ensuring a sustainable and reliable supply of electricity with sufficient capacity is a key aspect to growing the economy of South Africa in the future. The electricity shortages experienced in South Africa over the past decade are a contributing factor to the significant slowdown in economic growth rate. To enable economic growth within the target rate of between 5% and 8% to be achieved, it will be necessary for Government to continue increasing electricity generating capacity in the country. The use of natural gas for electricity generation is identified in national policy, together with renewable energy technologies, as an alternative in diversifying the domestic energy supply away from its current reliance on coal. Gas is identified in the draft Integrated Resources Plan as significant contributor to South Africa's energy mix in the period up to 2030. Availability of gas also provides an opportunity to convert to Combined Cycle Gas Turbine and run open-cycle gas turbine plants at Ankerlig (Saldanha Bay), Gourikwa (Mossel Bay), Avon (Outside Durban) and Dedisa (Coega IDZ) on gas (IRP 2019).[49]

47. Perhaps concerned that it is making the case that seismic surveys are indeed the 'thin edge of the wedge' that will lead to increased fossil fuel extraction, production and use

[49] Ibid.

(with associated climate change impacts), the BAR steps back from its natural gas endorsement to repeat the point that *'[f]rom a climate change perspective, it is not currently possible to accurately assess the risks associated with oil and gas activities, given that the specific details of these potential future activities are not known and therefore climate change impacts would need to be assessed in detail during any subsequent Scoping and EIA processes for any potential subsequent oil and gas production projects'*.[50]

48. The BAR then proceeds to argue that:

> The feasibility of using natural gas for domestic power generation is considered to be dependent on the extent of available domestic reserves of natural gas, as well as the financial cost of importing natural gas should those reserves be insufficient. The acquisition of seismic survey data is therefore considered important with respect to understanding the potential for future oil and gas production as part of the energy mix of the country going forward and the need and desirability of the project is therefore supported from an energy security perspective.[51]

49. We note here that despite reliance on the IRP to motivate for the project, the BAR fails to assess whether the amount of gas called for in the IRP would in any event require the exploitation of the resources sought by TGS.

50. Two recent independent studies (among others) challenge the view that fossil gas is necessary for electricity generation and as a transition fuel.

51. The International Institute for Sustainable Development's (IISD) *Gas Pressure: Exploring the case for gas-fired power in South Africa* (March 2022) report points out that while there used to be a rational view that fossil gas would be necessary either during a transition to low-carbon energy or as part of the long-term energy mix for electricity production:

> ....revolutions first in renewable energy costs and then in battery storage costs have upended this view. Analysis of the South African electricity system shows that gas supply is not technically necessary until at least 2035, if ever. In the last few years, either the risks associated with gas have increased, or the understanding of existing risks has increased.

[50] Ibid.
[51] Ibid.

> Consequently, South Africa may see significant negative outcomes from developing a large gas-to-power system now... the trend toward decarbonization, coupled with cost reductions for renewable energy and storage, creates risks for gas investment. Investment in gas can reasonably be expected to lead to higher costs for consumers, just transition challenges for workers, and losses for investors.[52]

52. The ISSD report highlights some of the risks associated with gas-to-power investment in South Africa. These risks include significant contributions to climate change (as a consequence of CO_2 and methane emissions when gas is burned), increasing international pressure to move away from gas due to climate impacts, financial risks linked with gas-to-power, the risk of reduced security of affordable gas supply, the risk of stranded assets, and the risk of creating an additional just transition burden (future gas workers and communities face a repeat of the transition hardships currently faced by the coal sector).[53]

53. Meridian Economics' *'Hot Air about Gas – An Economic Analysis of the Scope and Role for Gas-Fired Power Generation in South Africa'* (June 2022) report points out that while South Africa's large-scale use of gas appears to be central to current energy policy direction in South Africa, *'this rests on a 2012 vision which pre-dates dramatic reductions in renewable energy costs and carbon emissions space'*.[54] The report goes on to state that independent analysis of the power sector across multiple recent studies shows that South Africa's power needs can be met both now and in the future with very little use of gas, and that there is *'no evidence to support the large-scale gas envisaged in the GMP; this is uneconomical even before carbon emissions are considered'*.[55] Meridian point out that *'the assumption that gas-fired power generation would replace coal ignores the fact that other technology combinations are now better at replacing coal-fired power than gas, and it is against these technologies that gas-fired generation should actually be compared'*.[56] Meridian demonstrate that existing modelling provides no economic rationale for "big gas" in the power sector, and that *'the impact of using large volumes of gas to generate power will be borne by electricity*

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[52] IISD report, piv. Available online at: https://www.iisd.org/publications/report/south-africa-no-need-for-gas
[53] IISD report, pages 8 – 12.
[54] Meridian report, page ii. Available online at: https://meridianeconomics.co.za/wp-content/uploads/2022/06/Hot-Air-About-Gas.pdf
[55] Ibid.
[56] Ibid, p1.

consumers and will essentially be a subsidy provided by power consumers to otherwise unviable gas use in other sectors'.[57]

54. The Vital Ambition Report[58] by Meridian Economics in collaboration with the Council for Scientific and Industrial Research ("CSIR") Energy Centre ("Vital Ambition Report") states that gas to power is only justified in the South African energy mix in so far as it is required for low-utilisation flexible capacity (peaker plants) for balancing the system during peak power demand. The report confirms that no investments in gas infrastructure for energy production and generation is needed now or in the near future.[59] Furthermore the 2019 IRP will likely need to be updated in the foreseeable future to align with South Africa's 2021 Nationally Determined Contribution under the Paris Agreement and to keep pace with quickly evolving science and significant reductions in price for solar and wind energy. However, even the 2019 IRP, which is rooted in an outdated and scientifically and economically unsound understanding of the necessity for any gas in the energy mix[60], only projects the collective contribution of gas and diesel to the 2030 energy mix to be 1.3% combined.[61]

55. According to a recent report prepared by Robert W. Howarth titled "Methane emissions and climate warming risk from hydraulic fracturing and shale gas development: implications for policy"[62] the climate impacts of gas are greater than those of coal per unit of energy produced when evaluated over a 20-year timeframe, the period most relevant for climate change if humans are to avoid catastrophic run-away warming. Though gas emits less carbon dioxide per unit energy than coal, its upstream GHG emissions are more problematic for the climate, as it leaks and vents potent methane throughout its lifecycle; researchers have been able to better detect emissions across

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[57] Ibid, p37.

[58] Meridian Economics, 2020. A Vital Ambition: Determining the Cost of Additional CO2 Emission Mitigation in the South African Electricity System. See at https://meridianeconomics.co.za/wp-content/uploads/2020/07/Ambition.pdf

[59] Gas and peaking resources contribute just 1.1% of total electricity generation in 2025, and 2.4% by 2035 according to the same Meridian report.

[60] Meridian Economics, Not Air About Gas: An Economic Analysis of the Scope and Role for Gas-Fired Power Generation in South Africa (2022), pages 2-3, https://meridianeconomics.co.za/wp-content/uploads/2022/06/Not-Air-About-Gas.pdf

[61] 2019 Integrated Resource Plan, page 42.

[62] Robert W Howarth, 2015. Methane emissions and climate warming risk from hydraulic fracturing and shale gas development: implications for policy" Energy and Emissions Control Technologies at pages 47-50. See https://www.research.howarthlab.org/publications/1_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100615_27470.pdf

the lifecycle of gas ever more accurately thanks to new methodologies and technologies (particularly "top-down" measurements using satellite and aerial assessments).

56. The use of fossil fuels must be phased out quickly due to the urgent need to address global warming. A recent study published in *Nature*, the world's leading multidisciplinary science journal, discovered that "by 2050, we find that nearly 60% of oil and fossil methane gas, and 90% of coal, must remain unextracted to stay within a 1.5 °C carbon budget." According to the study, "most regions must reach peak production now or within the next decade, making many operational and planned fossil fuel projects unviable."[63] It is common practice that proposed exploration activities such as reconnaissance, only commence months and sometimes years after the need and desirability assessment is undertaken, with extraction and production only commencing years later.[64] According to one study, the world's largest oil and gas fields took an average of 5.5 years from discovery to first production and 17 years to reach peak output.[65] Chevron Corporation's (CVX) Gorgon natural gas development project off the coast of Australia took 30 years to complete, and another six years to begin producing liquefied natural gas.[66] Therefore exploration projects whose objectives are to locate gas deposits for energy companies to exploit through the construction and production of fossil fuels, run the risk of creating risks for such infrastructure to become stranded assets which invariably impacts on the development potential of South Africa in achieving its climate goals. With no economic justification for large-scale gas use in power, such a strategy would result in assets that are stranded before their first kWh of power is generated. Given this, the proposed reconnaissance project in no way provides a remedy nor will address in the immediate future South Africa's current energy insecurity issues.

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[63] Welsby, D., Price, J., Pye, S. et al. Unextractable fossil fuels in a 1.5 °C world. Nature 597, 230–234 (2021). https://doi.org/10.1038/s41586-021-03821-8.

[64] While new wells in developed reservoirs can be drilled and brought online in a matter of months, production from new fields can take years due to complex permitting requirements and the construction of infrastructure such as pipelines and storage facilities

[65] Henrik Wachtmeister, Mikael Höök, "Investment and production dynamics of conventional oil and unconventional tight oil: Implications for oil markets and climate strategies" Energy and Climate Change, Volume 1, 2020, 100010, ISSN 2666-2787, https://doi.org/10.1016/j.egycc.2020.100010. (https://www.sciencedirect.com/science/article/pii/S2666278720300106

[66] https://australia.chevron.com/-/media/australia/our-businesses/documents/Gorgon-Project-Milestones-Fact-Sheet.pdf

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57. Importantly, seismic surveys to explore for oil and gas will not have any immediate impact on South Africa's energy security, as any oil and gas extracted would not belong to South Africa, but would invariably belong to the companies that extract for profit.[67] Energy companies compete for access to mineral rights granted by governments by either entering a concession agreement, meaning any discovered oil and gas are the property of the producers, or form part of a production-sharing agreement which favours the interest of the producers and ultimately diminishing the general interests of the broader South African Republic.

58. The oil and gas that will be eventually extracted by oil and gas companies is ultimately exploited for profit. It is not used to generate a benefit that results in broad based security for energy production nor does it lead to the production of energy for South Africa and its citizens. If oil and gas found following a successful reconnaissance, and that are ultimately exploited, are not used to produce energy for South Africa, this invariably undermines the sole stated goal underpinning the need and desirability of this proposed reconnaissance project—its supposed contribution to energy security for South Africa—and provides no tangible benefit for South Africans.

59. While the increased use of gas as a 'transitional fuel' is promoted by government and vested interest groups, the Green Connection and Natural Justice submit that the increased use of fossil gas (especially in electricity generation) will lead to increased emissions of climate warming GHGs, and methane (CH_4) in particular. While natural gas combustion is less carbon-intensive than that of coal, fugitive emissions arising from the production, transport, storage and use of natural gas have a much greater climate impact than CO_2. In particular, over a 20-year period (which is particularly relevant since the next 20 years are a critical window for addressing the climate crisis) methane emissions, which make up approximately 70-90% of natural gas emissions, are projected to be 82.5 times as impactful as those of CO_2.[68] The desirability of using gas as a 'transitional' fuel is also questionable having regard to volatile international gas prices, as well as the potential risk of Carbon Border Taxes being introduced in

[67] Stewart Glickman and Shang Yang Chuah, Oil, Gas & Consumable Fuels Industry Survey (New York: CFRA, 2019)

[68] See the IPCC's 6th Assessment Report (AR6), Working Group 1, Chapter 6 *The Earth's Energy Budget, Climate Feedbacks and Climate Sensitivity*, Table 7.15 at p1017 Available online at: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter07.pdf

the future.[69] This risk will impose restrictions on the export of products with a high carbon footprint, putting South Africa's economy at greater risk of developing gas to power rather than clean renewable alternatives. This invariably diminishes the need and desirability for promoting new gas development projects, as the negative climate impacts and financial risks undermine the potential for gas to represent a viable solution for South Africa's ambitions to address development whilst respecting universal and regional climate change obligations.

60. The fundamental outcome of the need and desirability assessment should not be centred on the determination of whether gas technology will ensure security of supply for electricity. Instead, due to the climate crisis, this assessment should be centred on whether South Africa needs, or should rely on, gas to provide security of supply of electricity and whether alternative technologies could meet the same supply objectives with less harm and risk. Renewable energy and/or storage can replace gas to provide reliable and cost-effective generating capacity while greatly reducing the environmental and health risks associated with gas.[70]

61. The call for gas as part of the energy mix set forth in the 2019 IRP does not excuse the decision-maker from taking climate change impacts into account, including as part of the need and desirability assessment. The case for need and desirability must address climate impacts and cannot simply rest on the 2019 IRP as evidence of need or desirability as relied upon by the EAP in the BAR. In the judgment of the High Court in *Earthlife Africa*[71], the court expressed that with respect to a decision maker's reliance on the IRP when rendering a decision on an application for environmental authorisation, the following is important to acknowledge:

(a) "Policy instruments developed by the Department of Energy cannot alter the requirements of environmental legislation for relevant climate change factors to be considered".[72]

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[69] https://cer.org.za/wp-content/uploads/2022/10/Natural-Gas-factsheet.pdf

[70] See, e.g., Union of Concerned Scientists, Turning Down the Gas in California (13 July 2018), https://www.ucsusa.org/resources/turningdown-gas-california?_ga=2.79265367.2135392956.1587590973-34786515.1587590973#ucs-report-downloads

[71] Earthlife Johannesburg and Another v. Minister of Energy and Others 2017 2 All SA 519 (GP)

[72] See above at para 97.

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(b) Establishing the need and desirability of a proposed project, is a key objective of each stage of scoping and impact assessment and must account for South Africa's 2021 NDC under the Paris Agreement. The EAP must therefore provide a broad and robust analysis of multiple alternative literature on renewable energy resources and make a justifiable and reasonable case for a project's need and desirability having considered the available literature, without relying solely on the 2019 IRP and other policy documents. This invariably assists the decision maker to prioritise the granting of the best decision which will prioritize the integrity of the environment, and the social welfare, health and safety aspects of the socio-economic environment for present and future generations.

Ground 2: Failure to adequately consider marine impacts.

Underwater sound from seismic surveys

62. The ocean is an acoustic world. This is because water is a dense medium, and sound travels faster and farther underwater. Marine species, from larvae to whales, utilise this efficiency and have evolved to depend on sound for essential biological functions, including feeding, breeding, communicating, navigating, and socializing.[73]

63. Sound is also a fundamental component of marine habitats. Different ocean environments have distinct acoustic signatures that comprise their acoustic habitat. These acoustic habitats are created from a combination of biological sounds (e.g., fish choruses, snapping shrimp, urchin movement, whale calls) and environmental sounds (e.g. waves crashing, rain, earthquakes). The addition of anthropogenic noise to these

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[73] Supporting Affidavit of Dr. Aaron N. Rice at paras. 8, *Sustaining the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021, attached marked Annex B1; Supporting Affidavit of Dr. Douglas P. Nowacek at paras. 9 & 13, *Sustaining the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021, attached marked Annex B2.

This appeal incorporates the expert opinions of Dr. Rice and Dr. Nowacek who submitted affidavits in the matter of *Sustaining the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021. Both of the affidavits provide expert insight on underwater acoustics, how marine species utilize acoustic cues for biological processes, and how seismic surveys may impact different taxa. The declarations will be used to assist the court to understand general principles and processes and will not be used to support specific impacts that were associated with that case on the east coast of South Africa.

soundscapes disrupts the abilities of marine species to use naturally occurring acoustic cues and has detrimental effects on individual organisms, populations, and communities. [74]

64. Seismic airgun blast are the loudest human-created noises introduced into the ocean environment and they travel long distances through seawater. Studies have shown that seismic blasts are at least detectable at distances greater than 500-700 km, even up to 4,000 km.[75] Other studies have detected seismic surveys at levels sufficient to mask, or obscure, baleen whale calls at distances of thousands of kilometres away from the source.[76] Airgun noise influences and degrades the acoustic habitat of marine species over a far greater area than the metres and kilometres that the FBAR considers and in fact, according to the science, can easily reach coastal areas 120 – 230 km from the survey area.

65. In addition, the noise produced by airgun arrays becomes virtually continuous at greater distances from the source creating chronic noise impacts. This is because the sounds emanating from a seismic airgun array do not behave as individual and finite sound source *in situ* but reflect off the ocean surface and seafloor as they travel, leading to a continuous increase in the sound level through reverberation. The effect has repeatedly been documented.[77] Studies have found seismic surveys causing elevated ambient noise levels by more than 25 dB (approximately a 4-fold increase in noise levels) across distances of 40 km and these sound levels remain elevated during the periods between airgun blasts.[78] Open ocean condition observations have found that the noise produced and were sustained for months at a time.[79]

66. Because of several flaws in its approach, the BAR does not fully identify and assess the risk posed to marine species and ecosystems and does not effectively mitigate the risks from the proposed the proposed surveying.

Harms to marine life

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[74] Rice Supporting Affidavit at para. 12.
[75] Rice Supporting Affidavit at para. 18; Nowacek Supporting Affidavit at paras. 9-10.
[76] Rice Supporting Affidavit at para. 18; Nowacek Supporting Affidavit at paras. 13.
[77] Rice Supporting Affidavit at para. 19-20; Nowacek Supporting Affidavit at para. 10.
[78] Rice Supporting Affidavit at para. 19-20; Nowacek Supporting Affidavit at para. 10.
[79] Rice Supporting Affidavit at para. 19-20; Nowacek Supporting Affidavit at para. 10.

67. It is well established that marine seismic surveys cause serious and irreparable harms to marine life. The Biodiversity and Ecosystem Services Assessment Report[39] ("Pisces Report") prepared for the Project acknowledges the a wide range of impacts on numerous species:

- Physiological injury and/or mortality;
- Behavioural avoidance;
- Reduced reproductive success/spawning;
- Masking of environmental sounds and communication;
- Collision of turtles/marine mammals with the survey and support vessels or entanglement in towed acoustic apparatus; and
- Indirect impacts on piscivorous predators due to seismic effects on prey species.

68. According to the Pisces Report, the following species are present in the Project area and face the highest risk of harm from the proposed survey:

- humpback whales, which migrate through the area between June and November (inclusive);
- sperm whales, beaked whales and other odontocetes that frequent offshore waters;
- large migratory pelagic fish and shark species that show seasonal association with Child's Bank and Tripp Seamount;
- leatherback turtles which frequent offshore waters in low numbers and aggregate around seamounts to feed on jellyfish; and
- various pelagic Albatross, Petrel, Storm Petrel and Shearwater species (the Pisces report indicates that pelagic seabirds are likely to be relatively frequently encountered in the offshore waters of the Reconnaissance Permit area).[41]

[39] PISCES Environmental Svcs (Pty) Ltd (for TGS Geophysical Company), *Biodiversity and Ecosystem Services Assessment Report* ("Pisces Report") (Sept. 2022).
[41] Pisces Report at 45.

69. A 2022 review of peer-reviewed literature on the physiological, behavioural and ecological impacts of the 3D seismic survey activities on marine wildlife[42] ("Harris Report", attached marked **Annex B3**) found that the type of sound emitted during seismic surveys has been directly linked to physical damage to marine animals, including soft tissue trauma damage, embolisms, damage to organs used in balance and orientation, concussions, haemorrhaging, decompression sickness and both temporary and permanent threshold shifts to hearing ability. The Harris Report also found that some species display physiological stress responses and behavioural changes to seismic activities, such as moving away rapidly, diving or remaining still. These responses are likely to increase their energy consumption and energy costs, reduce their time to forage, and/or affect their vulnerability to predation, thus having negative impacts on the survival of individuals (especially young or compromised animals) as well as the overall population growth and survival of a species (especially for threatened species that are already at risk of extinction).

Acoustic Modelling

70. The Appellants submit that the underwater noise modelling was largely a desktop study rather than a meaningful examination of the acoustic harms that seismic surveying will have.

71. The acoustic modelling failed to provide meaningful information in several ways:

    71.1. The model should have included in situ testing to 'ground truth' the modelling and accurately determine the potential noise impacts associated with various aspects of the proposed 3D seismic survey (sound in the ocean is affected by pressure, salinity, temperature and temperature gradients, and can travel many kilometres from the source).

    71.2. The model should have assessed the impacts of noise on all species (different species have different sensitivities to noise) during the environmental impact assessment process (not ex post factor).

    71.3. The assessment should include (but not be limited to) potential impacts on the migration of snoek (a species that is important to the

[42] Harris, Gilbert & Wright, *Report on Scientific Basis for concerns of significant harm inflicted to marine wildlife by 2D and 3D seismic surveys on the South and West Coasts of South Africa* (14 January 2022).

livelihoods of small-scale fishers) and juvenile turtles (which are significant from a biodiversity perspective given their endangered status) that are in turn dependent on other species.

Heightened Legislative Requirements are Not Considered for Critical Biodiversity Areas (CBAs), Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs)

72. The National Environmental Management: Biodiversity Act, 2004 ("NEMBA") provides for ecosystems that warrant special conservation attention. These include ecosystems identified as Critical Biodiversity Areas ("CBAs") or Ecological Support Areas ("ESAs") in a bioregional plan, biodiversity sector plan or provincial spatial biodiversity plan.

73. The Appellants contend that the Minister ignored the critical importance of NEM:BA, NEM:PAA and relevant provisions of NEM:ICMA in terms of protecting and conserving the identified CBAs within the survey area, as well as the EBSAs and MPAs. At the very least, the value of these areas and the extent of potential negative impacts of exploratory activities on these areas should have been considered. The BAR failed to provide any assessments for the CBAs contained within the Application Area or the EBSAs and MPAs that are adjacent to the area.

CBAs

74. The FBAR failed to meet even minimal standards of providing a "detailed assessment" and relevant mitigation in order to protect irreplaceable and near-irreplaceable CBAs from the intense and chronic blasts of the seismic survey. In fact, the Sound Transmission Loss Modelling report makes no reference to critical biodiversity areas.

75. FBAR acknowledges that there are several CBAs within the Application Area itself:

> *The Application Area overlaps with areas mapped as Critical Biodiversity Area 1 (CBA 1): Natural and Critical Biodiversity Area 2: (CBA 2) Natural. Approximately 32.25 % of the proposed 3D acquisition area is covered by CBA 1 and CBA 2 Natural, 0.22% by CBA 1 and CBA 2 Restore, and 1.75% by ESA (see Figure 91).*[83]

[83] BAR at 162.

76. CBA 1 are irreplaceable or near-irreplaceable sites that are "required to meet biodiversity targets with limited, if any options to meet targets elsewhere."[84] CBA 2 are best design sites where there may be alternative areas where biodiversity targets can be met at a higher cost or requiring the allocation of additional area to achieve the targets.[85]

77. The FBAR recognizes that the exploration activities, including seismic surveys, are classified as having restricted compatibility with CBAs, which require a "detailed assessment to determine whether the recommendation is that they should be permitted (general – as is the case for this assessment), permitted subject to additional regulations (consent), or prohibited, depending on a variety of factors."[86] The BAR fails to even identify the unique and irreplaceable features of the CBAs in order to be able to assess whether this activity should be permitted.

78. CBA areas have been identified and set aside, and resources have been invested, in order to protect these biologically critical habitats and the marine species that depend on them. Seismic surveys will run directly over these critical biodiversity areas designated as irreplaceable and near-irreplaceable, causing severe and potentially irreversible impacts.

79. The FBAR has failed to look in detail at the CBAs, understanding why they were identified as critical biodiversity areas, and then propose specific mitigation measures in order to make an informed assessment as to the "restricted capability."

<u>EBSAs and MPAs</u>

80. The underwater Sound Transmission Loss Modelling report conducted for the BAR indicates in its introduction that the proposed survey areas are adjacent to a few Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs) including Childs Bank and Shelf Edge, and Cape Canyon and Associated Islands, Bays and Lagoon.[87] The BAR expands that list adding important areas such as the Benguela Muds MPA, Robben Island MPA, Southeast Atlantic

[84] BAR at 162.
[85] BAR at 162.
[86] BAR at 162.
[87] TGS: South Africa Orange Basin 3D Seismic Survey, Sound Transmission Loss Modelling at at 1-2

Seamounts MPA and additional MPAs "that fall within the broader project area."[88] The Bar also identifies and describes eight EBSAs, including transboundary relevant to the seismic survey area.[89]

81. Although these protected areas do not fall within the seismic survey area itself, the nature of seismic survey will cause impacts on the habitats and the marine species that these areas are meant to protect. These include endangered and protected species, breeding areas, sensitive and vulnerable habitat, resident whales, and many other features which make the spaces fragile and sometimes slow to recover, which has warranted their protection.

82. The FBAR makes no effort to identify impacts to these sensitive areas and to mitigate the potentially irreversible harms that the seismic survey will cause. As noted above, the sound from seismic surveys can travel hundreds of kilometres and will penetrate into the MPAs and EBSAs. Further, the seismic surveys will increase the ambient noise beyond the survery area. The chronic blasting every 6-20 seconds for months (70 days) will cause behavioural disturbances and possibly more damage to these sensitive areas, which the BAR did not take into account.

Cape fur seals

83. In South Africa, since October 2021, thousands of dead and/or dying Cape fur seals, have washed ashore along the south and west coasts. The cause of these die-offs remains unknown but avian flu has been ruled out and malnourishment appears to be the most widely accepted reason. Activities associated with the Project could further pressure this species by physically harming individual seals, and by disrupting the seals' food supply.

84. The Pisces Report states that Cape fur seals are unlikely to be found in the project area, citing map that shows generalized foraging areas that extend nearly exactly to the edge of the reconnaissance area.[90] However, the report also states, "[s]eals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles (~220 km) offshore,"[91] meaning a large part of the

[88] BAR at 157-59.
[89] BAR at 159-61.
[90] Pisces Report at 69 (Fig. 37).
[91] *Id.* at 111.

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reconnaissance area is well within the foraging range of Cape fur seals. Moreover, the Based on the questionable assumption that Cape fur seals are unlikely to occur within the reconnaissance area, the Pisces Report authors deemed their sensitivity to the proposed seismic operations to be "LOW," in spite of the finding that "The potential impact of physiological injury to seals as a result of seismic noise is deemed to be of HIGH intensity."[92]

Whales and dolphins

85. There is genuine conservation concern for beaked whales that are particularly sensitive to anthropogenic noise, including seismic surveys. It has been demonstrated that even minor, non-lethal disturbances, resulting in changes in behaviour such as displacement from preferred habitats, could impact a population.[93]

86. The phenomenon of energy-cost (from stress and avoidance behaviour) is of particular concern for some of the species expected to be encountered in the survey area in question, particularly the humpback whales and southern right whales who are at risk of the airgun noise affecting their behaviour or interfering with the communication between mother and calf. Any impact on their energy reserves could impact on their condition (weight-loss and physiological condition) and affect survival of the animals during a vulnerable time (especially for lactating mothers and their calves) on their long migration to feeding grounds in Antarctica.[94]

Fish

87. The BAR downplays the impacts of seismic surveys on fish and the fisheries they support, particularly in the case of the large pelagic longline fishery and the tuna pole-line fishery. While the BAR assesses the exclusion of fishing vessels due to temporary safety zones during seismic surveys, it fails to adequately assess the actual impacts of seismic activities on the target fish species themselves, both in the short and long-term. During the seismic survey, fishing vessels would be required to maintain a safe operational distance from the survey vessel and streamer array, which may extend up to 6 nautical miles. The FBAR assessed the impact of potential

[92] *Id.*
[93] Harris Report
[94] Harris Report

exclusion for each commercial sector based on the affected area of fishing ground and the amount of catch reported within the Reconnaissance Permit area. Given the location of the Reconnaissance Permit application area, two high-value fisheries are directly impacted: the large pelagic longline fishery (targeting tuna, swordfish and shark) and the tuna pole-line fishery.

88. The FBAR concluded that the Project's activities will result in exclusion to fishing grounds for at least the large pelagic longline fishery. The FBAR states that "[t]here is a high probability that the large pelagic longline sector (targeting tuna, swordfish and shark) will experience loss of access to fishing ground over the duration of the proposed 70-day survey," and that [t]he impact of exclusion is assessed to be of high magnitude."[95]

89. In terms of noise impacts to the target fish of the large pelagic longline fishery and the tuna pole-line fishery, the Pisces Report acknowledges that "[s]eismic activities have been predicted to possibly affect the migration patterns of tuna leading to substantially reduced catches of albacore and southern bluefin tuna in southern Namibia and the Great Australian Bight, respectively,"[96] yet ultimately the Report concludes that "[a]s there is currently a dearth of information on the impacts of seismic noise on truly pelagic species such as swordfish and tuna (Evans et al. 2018; Webster et al. 2018), links between changes in migration patterns and subsequent catches thus remains speculative."[97] The FBAR thus maintains that potential impact on individual fish behaviour is of MEDIUM consequence and that "the residual impact due to seismic noise is considered to be of LOW NEGATIVE significance for the large pelagic longline and tuna pole-line sectors."[98]

90. Overall, the FBAR concludes that with mitigation (timing of the surveys to avoid peak fishing periods), the following overall impact significance:

> Based on the combination of extent, duration and magnitude of the impact, and considering the high probability that the impact would occur, the overall

[95] BAR, pg. 212.
[96] Pisces Report, pg. 132.
[97] Pisces Report, pg. 132.
[98] BAR, pg. 244.

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> significance of the impact is considered to be MEDIUM NEGATIVE. Due to the low probability of the operations of the tuna pole-line sector within the Reconnaissance Permit area, the overall significance of the impact on the sector is considered to be LOW NEGATIVE.

91. The FBAR fails to adequately assess the vulnerability of the targeted fish species (including tuna and sharks) to noise impacts, and any decision-based on it would be unreasonable. This is a major flaw because many of the large pelagic fish and shark species likely to occur in the offshore regions of the Orange Basin are considered globally 'Vulnerable' (e.g., bigeye tuna, blue marlin, Oceanic Whitetip shark, dusky shark, great white shark, longfin mako), 'Endangered' (e.g., shortfin mako, whale shark) and 'Critically Endangered' (Southern bluefin tuna).

92. The impact on fish assemblages is difficult to interpret, due to multiple factors at play including but not limited to the ability of a species to move from an area as well as the receiving habitat. A global review of the effect of seismic activities on fish and invertebrates acknowledged the limits of the current research due to experimental designs used or due to the focus on single species during investigations. A key concern is a lack of research focused on confounding effects and multiple stressors, therefore potential impacts of seismic surveys that have been previously identified may be reflective of underestimation or overestimation and would depend on the type of interaction (synergistic, additive, or antagonistic).[99]

93. Sounds pollution from seismic surveys may have a wide range of effects on fish species. Exposure to intense sounds can result in mortal injury, but over longer distances issues are associated with sounds that are detectable by fish and which may affect their behaviour, causing them to move away from their migration routes, flee important habitats in which they feed or breed, interfere with their communications, affect reproductive behaviour (where sound is used to attract mates and facilitate spawning), or prevent or mask the detection of other biologically important sounds. Because of these many-pronged effects, seismic surveys can have compounding negative impacts on marine fish.

[99] Harris Report

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94. In his expert affidavit filed in a recent seismic survey case,[100] Dr Alexander Claus Winkler provided testimony regarding evidence of direct, lasting behavioural effects of seismic surveys on the rhythmic behavioural foraging patterns of cod in the North Sea. Winkler points out that both hake and snoek perform rhythmic diel foraging migrations off the seafloor at night and onto the seabed during the day. Given that seismic surveys are conducted both during the day and night, it is likely that these benthic fish species will migrate higher up the water column at night, bringing them within distances that may expose them to direct injury and mortality impacts from seismic surveys. It is noted that the Pisces report indicates that species most likely to be found in the area of interest include large migratory fish (such as tuna, billfish and sharks), many of which are considered threatened by the IUCN due to overfishing.[101]

95. In addition, contrary to the FBAR's conclusions that there is only LOW NEGATIVE significance for the large pelagic longline and tuna pole-line sectors,[102] a 2018 desktop survey of South Africa fisheries impacts from seismic surveying by Namibian fisheries expert David Russell ("Russell Report") concluded the following:

> [W]here there are cumulative impacts from repetitive surveys in the same area, as has occurred off Southern Namibia tuna fishing grounds, where catches have severely declined since 2011, and in 2017 dropped off to non-commercial catch rates, there is the ominous possibility that the tunas change their migration path. Environmental factors such as El Nino appear to also have contributed significantly, but combined with regular seismic surveys, the environmental signals are potentially devastating.[103]

96. There is a possibility that up to three seismic surveys (Searcher, TGS, and GX Technologies) would take place simultaneously in the area, which would further increase geographic exclusion of the fishery. If multiple 3D seismic surveys were not undertaken simultaneously, then sequential surveys in the same area would prolong the loss of access to the pelagic longline sector and duration of seismic impacts to

[100] Available online at: https://drive.google.com/drive/folders/1m-h8MoRtdfUKHLiB_ulD1KX-dBktua [21. Alexander Winkler].
[101] Pisces Report at 40.
[102] Capricorn Report, pg. xxx.
[103] Assessing the Impact of Seismic Surveys on South African Fisheries, 2018. David Russell Fisheries Consultancy for the Responsible Fisheries Alliance ("Russell Report"), pg. 6.

fisheries. Yet the FBAR does not directly assess the impacts of simultaneous surveys on the fisheries.

97. The FBAR concludes, without citing any evidence, that after months of up to three simultaneous seismic surveys in the pelagic longline sector, "[o]nce completed there is not expected to be any residual impact."[104] As noted above, the Russell report identified potential long-term impacts of repeat seismic activity on Southern Namibian tuna fisheries, with implications that tuna may change their migration patterns to avoid noise pollution.[105] The BAR fails to adequately consider or mitigate impacts to the pelagic longline sector that are both short-term (potentially closing the fishery for 70 days or longer given multiple surveys in a single year) and long-term (inflicting behavioural and migration shifts).

98. The sector had an estimated wholesale value of R124 Million in 2018, or 1.2% of the total value of all fisheries combined. For tuna pole-line, the fishery runs predominantly from November through June, while the large pelagic longline fishery runs highest from May to November.[106] The FBAR lists a proposed window of January – May for its 70-day 3D seismic survey, meaning a large fraction (up to 30% with an approximate wholesale value of R40 Million) of the fishery year stands to be excluded. Because its assessment did not adequately consider the longer-term residual impacts on the fisheries from seismic activity, this monetary loss stands to be much greater than that estimated from fishery exclusion alone.

99. The FBAR fails to consider the long-term behavioural or migration impacts that seismic activity could have on the pelagic longline fishery, which include several species of tuna. Such changes in the fishery could have severe and lasting implications for communities dependent on this important fishery for many years to come and should have been included in the impact assessment.

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[104] BAR, pg. 236.

[105] Russell Report.

[106] BAR App. 3.2 PROPOSED 3D MULTI-CLIENT SEISMIC SURVEY IN THE ORANGE BASIN, OFFSHORE SOUTH AFRICA Fisheries Specialist Study, September 2022 ("Capricorn Report"), pg. 66.

100. The FBAR states that "[t]he zones of TTS [temporary threshold shift] effect for fish species with and without swim bladders are predicted to be within 3.5 km from the survey lines for the 3D survey 24-hour operation scenarios considered."[107] This predicted zone of TTS for fish both with and without swim bladders is a gross underestimation and based on minimal and non-regional specific data, including data from riverine 2D seismic activity on freshwater species (e.g. Popper et al., 2005). As the Capricorn Report admits, "[t]o date there have been no studies focused directly on the [fish] species found locally."[108]

101. Most of the mitigation measures proposed in the BAR are designed to minimise impacts to marine mammals. As admitted in the Pisces Report, vastly less is known about how such mitigation measures alleviate sound impacts experienced by marine fish species.[109] Large pelagic fish (e.g. tuna, sunfish, or sharks) would not be detected by PAM (which would be tuned for marine mammal vocalisations) and would not likely be detected visually at night by observers or using an infrared thermal imaging camera (since cold-blooded fish, as opposed to warm-blooded mammals, do not have high enough temperature differences from the water).

102. The FBAR further fails to provide evidence that infrared thermal imaging is effective as a mitigation measure.

103. TGS takes no preventative mitigation measures to minimise impacts to marine fish species during 3D surveying and has a single and insignificant mitigation measure (7.1) to shut down seismic shooting in the case the following is observed: "mass mortalities of squid and fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO [marine mammal observer] to be as a direct result of the survey."[110]

104. Although it has been suggested that the sound energy from air guns may harm fish species with swim bladders and those without, there are very few studies directly

[107] BAR, pg. 235.
[108] Capricorn Report, pg. 10.
[109] PISCES Report, pg. 192.
[110] PISCES Report, pg. 197.

examining the potential effects on fish physiology or behaviour, and even fewer focusing on pelagic fish species. Unknown impacts are not the same as no impacts, and the precautionary principle should be invoked. There are significant knowledge gaps regarding the impact of 3D seismic surveys on marine fish species, particularly those that would be impacted by the Project. Specifically, there is currently not enough information about the fish species in the area or their response to sound to be able to make any meaningful assessment of the impacts. Therefore, the precautionary approach set out in NEMA suggests that this lack of knowledge should weigh against the proposed 3D seismic surveying in a vital and valuable offshore fishery.

Zooplankton

105. The FBAR disregards the precautionary approach at every step in the analysis of impacts on plankton, which it concludes does not warrant mitigation measures and will have a medium pre-mitigation impact, yet a very low residual impact.[111] Yet, as demonstrated below, there is a significant concern that the BAR underestimates the impacts of seismic surveys on plankton, which form the base of the ocean food chain.

106. The FBAR does not provide actual data to demonstrate that there is not significant or even medium plankton abundance in the survey area. The BAR "expects" that plankton abundance to be low with seasonal peaks may occur associate with MPAs.[112] Yet, the surveying is meant to have temporal overlap with speak spawning products of commercially important species.[113]

107. Studies by McCauley et al. (2017) referenced in the Pisces Report indicates that seismic blasts may kill various species of zooplankton in Australia at distances of up to 1200 m from an airgun[114], and more recent research shows lethal and behavioral impacts to zooplankton from airgun discharges.[115] Still, other studies (Fields et al.,

[111] Marine Ecology Impact Assessment at 144.
[112] Marine Ecology Impact Assessment at 141.
[113] Marine Ecology Impact Assessment at 144.
[114] Robert D. McCauley *et al., Widely used marine seismic survey air gun operations negatively impact zooplankton*, 1, Nat. Ecol. Evol., 1–8 (2017).
[115] Emilie Hennes Vereide *et al., Effects of airgun discharges used in seismic surveys on development and mortality in nauplii of the copepod Acartia tonsa*, 327, Environ. Pollut., 121469 (2023).

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2019), report no measured mortality or sublethal effect on copepods at distances >10 m from a seismic blast in Norwegian waters.[116] And other studies (Richardson 2017) found "substantial impact of seismic activity on zooplankton populations on a local scale within or close to the survey area."[117] While noting that zooplankton mortality can be difficult to assess in the field (in situ) and that realistic conditions are very difficult to reproduce in a laboratory setting, nevertheless these highly contradictory results suggest that effects may be variable and highly dependent on zooplankton species and/or marine geographical area. Research should be undertaken to survey the current literature on zooplankton types in the Benguela Upwelling Zone and better link this knowledge to the airgun impacts literature available. The BAR fails to take these steps, making it impossible to assess the impacts of seismic surveys to the zooplankton communities underpinning the food webs that support fish, marine mammals, and fisheries.

108. As noted, zooplankton forms the base of many important food webs in the marine environment. Depletion of zooplankton could thus have an impact on food for their predators (such as fish) as well as impact fish eggs and larvae (ichthyoplankton) with potential local impacts on species important in fisheries. This damage to zooplankton as found by studies over 1km away (McCauley 2017) and within 15km (Richardson 2017) from the survey array raises concern that a 500m buffer for other animals that are unable to move away from the sound, is far too small to ensure that damage is not inflicted (even if they were able to evade it).[118]

The proposed mitigation measures are inadequate to prevent unacceptable harm to marine life

<u>Simultaneous Surveys</u>

109. The BAR proposes the use of a 40 km buffer between vessels during concurrent simultaneous surveys (p. 211) as a mitigation measure, relying on "advice from the US Department of Interior (2014)." The purpose of the buffer is to mitigate "the

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[116] *Id.*

[117] Rios Supporting Expert Affidavit at para. 29 (restating the conclusion from the study's authors: "We found there was substantial impact of seismic activity on zooplankton populations on a local scale within or close to the survey area, with a maximum decline of 22% in zooplankton populations in the survey area, 14% within 15 km of the survey area.").

[118] Harris Report

cumulative impacts of three potential surveys occurring concurrently."[119] The 40 km buffer mitigation measure, first proposed in the United States, originally purported to avoid harassment of marine mammals during simultaneous surveys. This was expected to be achieved through a distance between vessels that would provide a corridor where "airgun noise is below [harassment] thresholds and approaching ambient levels such that animals may pass through rather than go larger distances to go around the survey vessels."[120] However, the mitigation measure neither provides a corridor below harassing levels of acoustic noise for marine mammals between vessels seismic surveying, nor does it mitigate cumulative impacts as portrayed in the FBAR. In fact, the mitigation measure is not even used in the US, making the FBAR reliance upon this measure deeply flawed.

110. First, the 40 km buffer is based upon a threshold of 160 dB for harassment, a standard that the U.S. government has since abandoned as appropriate to provide adequate protections. For example, the US government found in 2018 in reviewing harms to marine mammals during oil and gas geophysical surveys that, "[s]tudies of marine mammals in the wild and in experimental settings do not support" use of a single 160-decibel threshold and that "that an approach reflecting a more complex probabilistic function is better reflective of available scientific information," because it "takes the fundamental step of acknowledging the potential for . . . harassment at exposures to received levels below 160 [decibels]."[121]

111. Second, as noted above, scientists recognize that this 160 decibel threshold is not supported by science. In addition, in his expert declaration Dr. Nowacek noted that "seismic surveys can disrupt important behaviors in baleen whales at exposure levels far below the 160 dB threshold".[122]

112. Third, the application of a 40 km buffer as a wholesale solution for simultaneous surveys is incompatible with even the 2014 Department of Interior document that the BAR is relying upon. In fact, the US Government prohibits the use of a 40 km buffer

[119] BAR at 211.
[120] US Department of Interior, Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas, Final Programmatic Environmental Impact Statement at 2-37 (2014).
[121] See Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Geophysical Surveys Related to Oil and Gas Activities in the Gulf of Mexico, 83 Fed. Reg. 29,212, 29,247-48 (June 22, 2018).
[122] See Nowacek Supporting Affidavit at para. 18.

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as a general mitigation measure. It instead found that new science demonstrated that "airgun noise can be detected at great distances from the sound source, such as across ocean basins," and that therefore, the mitigation measure must be considered in the site-specific context and include any new information at the time as well as "any potential aggregate effects from existing permitted surveys."[123] The BAR does none of this analysis and in fact proposes potentially reducing the buffer zone.[124]

113. This mitigation measure has been proven to be scientifically unsound and ineffective and uses an approach inapposite with the base documents upon which the BAR relies, inconsistent with the current practice of the US Government, and inconsistent with the science. Therefore, there is no basis for the BAR to conclude that a 40 km buffer will mitigate cumulative impacts of concurrent seismic surveys.

Inefficacy of Proposed Mitigation Measures

114. Several of the proposed mitigation measures are ineffective to mitigate the harms related to the impacts of the seismic surveys. Consequently, the significance of the post mitigation impacts are understated, exposing marine species, in particular marine mammals and to more injury and harm than indicated in the conclusions of the BAR.

115. Soft Starts and Ramp Ups: Harris *et al.* found that the soft starts are "are likely to reduce the impact for highly mobile large animals, this is unlikely to be adequate for the many species that are prevalent in the area over the austral summer months and are unable to avoid the array or leave the area due to their lower mobility, such as smaller turtles, penguins, invertebrates, some fish species and zooplankton."[125] Moreso, Dr. Nowacek found that soft starts or ramp ups do not protect highly mobile cataceans, finding them "inadequate to protect cetaceans present year-round or deep-diving beaked whales."[126] Dr. Nowacek further expounded "there has been no experimental confirmation that this procedure is broadly effective at reducing overall exposure."[127] In considering a situation where soft starts or ramp ups worked perfectly, Dr. Nowacek found that "this mitigation measure would reduce only the number of

[123] US Department of Interior, Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas, Final Programmatic Environmental Impact Statement at 2-38 (2014).
[124] BAR at 211.
[125] Harris Report at Summary of Findings.
[126] Nowacek Supporting Affidavit at para. 13.4.
[127] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 47 of expert declaration by reference).

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injuries incurred in the vicinity of the seismic vessel and does not address at all the larger body of effects."[128]

116. Observers: Harris *et al.* explain that visual observers, although important to mitigation, have deficiencies, which brings into question the BAR's conclusions regarding the level of impacts post-mitigation:

> *"The finding of observer efficiency (from a scientific monitoring study conducted during the 2018/19 and 2019/2020 seasons on the humpback whales on the east coast) suggests that even with trained observers up to 44% of humpback whales in an area went undetected. This casts doubt on the effectiveness and success of Marine Mammal Observer (MMO) sightings of the largest species (humpbacks) as a mitigation measure, indicating that it is most likely that whales go undetected. Furthermore, the detection rate for smaller species, such as dolphins, seals, turtles and flightless birds (penguins), would be expected to be much lower, obviating the effectiveness of visual observations to prevent harm to these species."*[129]

117. Dr. Nowacek reiterates that the mitigation measure of visual observers is "inadequate to protect cetaceans present year-round or deep-diving beaked whales."[130] Dr. Nowacek further explains that the use of visual observers to detect whales "is imperfect at best" because low light and other poor visibility conditions (such as fog or high-sea states) impair the ability to spot whales and, as Dr. Nowacek goes into further detail, even in ideal conditions it is very difficult to spot whales.[131] This is echoed by Harris et al. stating the "efficacy of a MMO is likely to be low due to the nature of the offshore marine environment in the survey area (frequent high swells and winds affecting surface visibility), putting species who are missed by MMOs and PAM operators at extreme risk, particularly at night or during adverse weather conditions."[132]

118. Passive Acoustic Monitoring (PAM): Harris *et al.* discuss how "the reliance on observers to do visual sightings to supplement the PAM monitoring during the day, as a mandated mitigation measure, necessitates questioning the acceptability of continuing with survey activities at night. If the visual observations are useful (perhaps

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[128] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 47 of expert declaration by reference).
[129] Harris Report at Summary of Findings.
[130] Nowacek Supporting Affidavit at para. 13.4.
[131] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 45 of expert declaration by reference).
[132] Harris Report at Summary of Findings.

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sighting large animals around 65% of the time) in addition to PAM, then relying on PAM alone at night cannot be an effective mitigation measure. The authors express the opinion that surveys should not occur between sunset and sunrise each day if a real attempt of maximum avoidance of cetaceans is the objective of this mitigation measure."[133]

119. Dr. Nowacek discusses as well the limited benefit of PAM. With PAM, "whales will not be detected even when present if they are quiet or not vocalizing or if background noise is too high." Dr. Nowacek also noted that "studies show that baleen whales cease vocalizing in the presence of even low levels of seismic survey noise."[134]

120. The FBAR's attempts to address this shortcoming in mitigation by equipping MMOs "with infra-red cameras in order to observe mammals at night."[135] However, this is an undeveloped technology for spotting cetaceans. It is not reliable, so much so that it is not typically used by scientists as part of their surveys. Further, there are questions with the scope of view, range/distance, as well as the impact of conditions on the ability to use the technology. In short, it is encouraging to bring new technologies to the table, however it requires more testing and improvement before it could be considered suitably reliable and certainly before it could be factored into the the mitigation of harms to cetaceans.

Lack of baseline noise assessment

121. The FBAR fails to establish an acoustic baseline assessment of the area, and furthermore fails to present a plan to conduct an adequate baseline noise assessment. As part of its recommendations to minimise impacts to marine fauna, the BAR lists:

> Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented that would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior

[133] Harris Report at Summary of Findings.
[134] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 46 of expert declaration by reference).
[135] BAR at 251.

to the commencement of the survey and then operational levels of noise during the survey.[136]

122. The FBAR provides no guidance for the recommended baseline noise measurement, including the duration of monitoring period, or a range or frequency for detection. This lack of detail means it remains impossible to assess if this mitigation step would meet best practice standards such as those put forward by the Marine Mammal Observers Association.

123. The current lack of a baseline assessment means that the ambient background noise considered in the noise modelling falls short of best practices. Best practice acoustical modelling entails collecting site-specific data to calibrate acoustic models that can then be applied to characterize acoustic exposure of marine fauna in a given study area.[137]

Chronic Noise Impacts

124. The seismic survey's airguns consist of 24 active airguns that will blast sound loud enough to penetrate the seabed floor every 6-20 seconds, 24 hours a day, for 70 days.

125. Each acute blast will create direct harms to marine species. In addition, besides the direct harm that the pulse will create, the repetitive blasting will increase ambient noise, even at a distance of 100 kilometres.[138] These two factors expose marine species to chronic noise impacts over a large distance, as the sound travels hundreds and even thousands of kilometres.[139] The BAR fails to take into account the increased stress and behavioural impacts that this chronic noise will cause on marine species in the area of seismic surveying and beyond.

Ground 3: Failure to adequately assess cumulative impacts

126. Below is a map detailing the updated categories of Oil and Gas concessions along the entire coastline of South Africa:

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[136] Final BAR, pg. 241.

[137] Alexander N. Rutenko et al., *Acoustic monitoring and analyses of air gun, pile driving, vessel, and ambient sounds during the 2015 seismic surveys on the Sakhalin shelf*, 194, Environ. Monit. Assess., 744 (2022).

[138] Nowacek Supporting Affidavit at para. 13.

[139] Rice Supporting Affidavit at paras. 16, 24 & 36; Nowacek Supporting Affidavit at paras. 9-10, 13.

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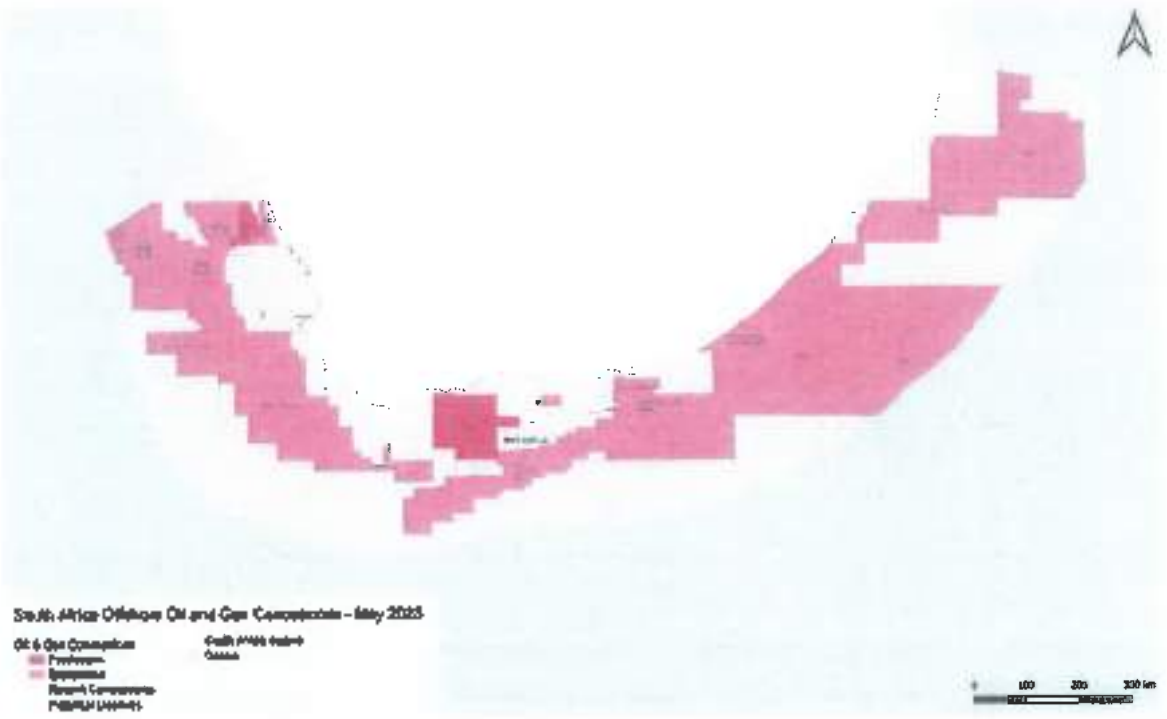

Information received from Petroleum Agency SA, in line with a PAIA Request submitted by the Legal Resources Centre on 12 October 2022

127. In addition to the abovementioned map, it is noted that the BAR acknowledges that should other seismic survey campaigns be undertaken concurrently with TGS's proposed survey programme, cumulative impacts may be likely and there would be a need for alignment in planning of such concurrent operations to reduce cumulative noise impacts to an acceptable significance.[140] The draft BAR notes that there are two current pending applications with PASA (Searcher Geodata and GX Technology Corporation) which both overlap the proposed TGS 3D seismic survey area, as depicted in the diagram below:

[140] Final BAR 1520, para 9.3.5, p234.

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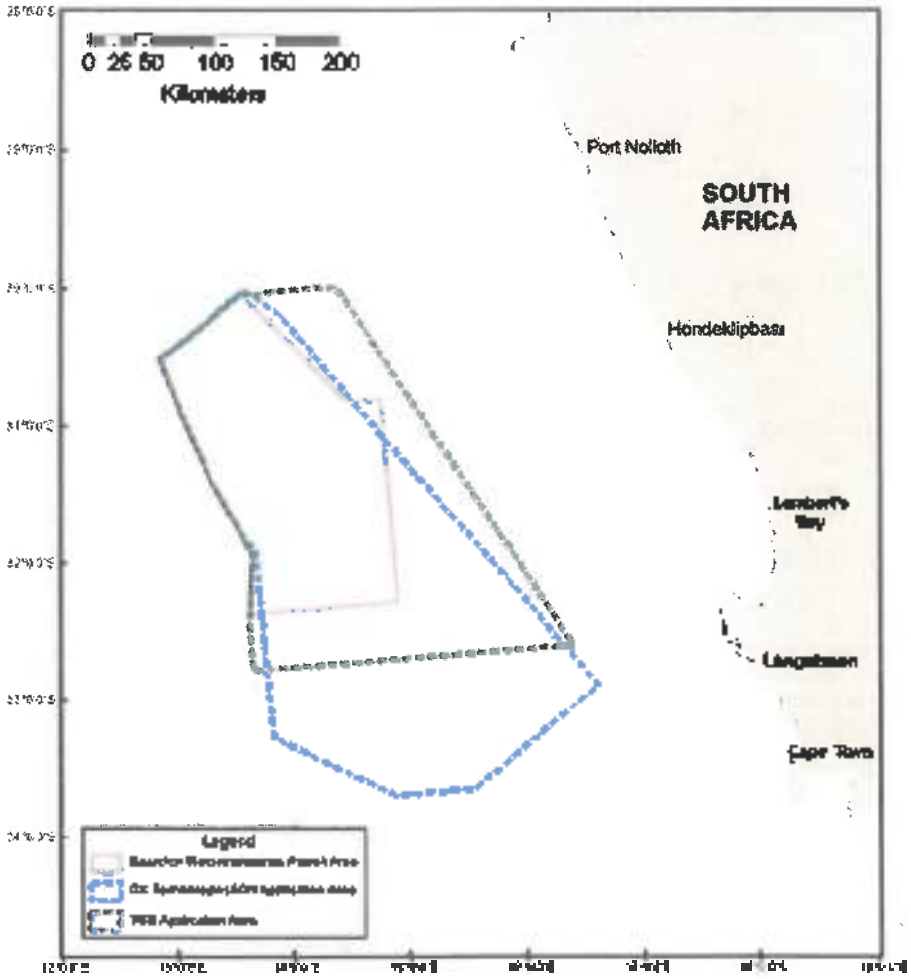

Source: TGS draft BAR, p235.

128. The BAR states that despite the difficulty in undertaking a reliable assessment of the potential cumulative environmental impacts of future seismic acquisition in the Deep Water Orange Basin (due to likely variation in the scope, extent and duration of proposed surveys), the cumulative impacts of three potential surveys occurring concurrently needs to be considered. The FBAR thus includes a cumulative assessment which assumes that the three surveys (Searcher, TGS and GX Technologies) occur simultaneously during the summer survey window in 2022/23.

In this event, the draft BAR indicates that:

129. Associated impacts to marine fauna would be of **high intensity** and extend regionally, over the short-term (assuming they take place over the same summer survey window). The impact consequence for cumulative surveys is therefore considered medium.

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130. Concurrent activities could also add to the cumulative impact on fisheries. Simultaneous survey operations would result in an increase in the extent and magnitude of the impact on the large pelagic longline sector. The impact duration would remain unchanged. Three seismic surveys of regional extent, undertaken simultaneously, could be expected to result in an impact of medium negative significance on the large pelagic longline sector, both with and without the application of mitigation measures.

131. Curiously, the BAR impact table[141] combines cumulative impacts on marine fauna and fisheries and rates the pre-mitigation environmental significance as 'medium' and the post-mitigation impact as 'low'. This does not reconcile with the preceding paragraphs which indicate with regard to cumulative impacts of three concurrent seismic surveys, an impact of medium negative significance on the large pelagic sector could be expected 'both with and without the application of mitigation measures.

132. The Final BAR states regarding confounding and cumulative effects that the assessments of impacts of seismic sounds provided in the scientific literature usually consider short-term responses at the level of individual animals only, as the understanding of how such short-term effects relate to adverse residual effects at the population level is limited. The report goes on to state that data on behavioural reactions to seismic noise acquired over the short-term could, however, easily be misinterpreted as being less significant than the cumulative effects over the long-term (i.e. what is initially interpreted as an impact not having a detrimental effect and thus being of low significance, may turn out to result in a long-term decline in the population, particularly when combined with other stressors such as temperature, competition for food, and shipping noise). The report notes that confounding effects are, however, difficult to separate from those due to seismic surveys.[142]

133. The report also states that the potential cumulative impacts on individuals and populations as a result of other seismic surveys undertaken either previously, concurrently or subsequently are difficult to assess. The report indicates that a significant adverse residual environmental effect is considered one that affects marine

[141] At p236.
[142] Final BAR 1520, para 9.3.1.4 at p209-210.

biota by causing a decline in abundance or change in distribution of a population(s) over more than one generation within an area. The report makes reference to numerous 2D and 3D seismic surveys having been undertaken off the West Coast over the past 17 years, and relies on reported increases in the southern right whale and humpback whale populations over a time when seismic surveying frequency has increased as '*suggesting that, for these populations at least, there is no evidence of long-term negative change to population size as a direct result of seismic survey activities*'.[143] The assumption made that an increase in whale populations suggests that there is no evidence of long-term negative change to population sizes as a direct result of seismic activities, is questionable. This is an assumption that cannot be inferred from the facts (the increase could be as a result of any number of other external factors).

134. It cannot simply be assumed that the lack of evidence of long-term negative population changes as a direct result of seismic survey activities means that there are no negative impacts (including potentially significant impacts). In their report relating to the TOSACO EIA appeal, Harris *et al* point out that although the humpback whale population is increasing, there is evidence to suggest that cetaceans in South African waters are being affected by changes in their ecosystem and it is not well understood yet what is driving these changes and what the long terms effects could potentially be to populations.[144] Concerns noted in the report include an observed decrease in southern right whale calving success of the South African population and a strong link between foraging success and reproduction.[145] They suggest an investigation into possible decreases and/or spatial or temporal shifts in their prey availability at higher latitudes due to environmental variability. They also highlight a concern of the continued low numbers of unaccompanied adults along the South African coast which

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[143] Final EAR 1520, para 9.3.1.4 at p210.

[144] Wilkinson, C. (2021) *Estimating population changes in humpback whales (Megaptera novaeangliae) migrating past Cape Vidal, South Africa*, MSc thesis, Cape Peninsula University of Technology, p108. Cited in Harris JM, Olbers JM, Wright K (6 April 2022) *Comments on Tosaco Energy Block 1 Exploration Right Issued to Tosaco Energy (Pty) Ltd (PASA Reference: 12/3/362)*.

[145] Vermeulen, E., Wilkinson, C., & G. van den Berg [2020] *Report of the 2019 South African southern right whale aerial survey*, Report to IWC 10.13140/RG.2.2.29556.37766. Cited in Harris JM, Olbers JM, Wright K (6 April 2022) *Comments on Tosaco Energy Block 1 Exploration Right Issued to Tosaco Energy (Pty) Ltd (PASA Reference: 12/3/362)*.

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could potentially have serious consequences for cow-calf pairs in relation to the country's whale-watching industry in the future.

135. The BAR states that in the 'unlikely' event that multiple surveys would take place at the same time within the same survey area, 'the risk of cumulative noise impact must be considered and is suggested to be managed'. The BAR suggests that mitigation should include maintaining a distance of at least 40 km between survey vessels 'until sufficient objective evidence is obtained that a reduced buffer distance is acceptable'. Where this 40 km buffer distance cannot be maintained, the FBAR suggests that each of the additional activities to those described in the technical noise report should be modelled or otherwise considered in terms of the cumulative noise level and with reference to the criteria described in the report.[146]

136. However, as referred above at paragraphs 109-1113, the US Government prohibits the use of a 40 km buffer as a general mitigation measure and therefore, the mitigation measure must be considered in the site-specific context and include any new information at the time as well as "any potential aggregate effects from existing permitted surveys. This mitigation measure has been proven to be scientifically unsound and ineffective and uses an approach inapposite with the base documents upon which the BAR relies. Therefore, there is no basis for the BAR to conclude that a 40 km buffer will mitigate cumulative impacts of concurrent seismic surveys.

137. Given the lack of certainty regarding cumulative impacts of concurrent 3D seismic survey areas, a risk averse and cautious approach should be applied by not authorising concurrent surveys and suggests that should the decision-maker ought to have refused granting the environmental authorisation.

138. In addition, the FBAR does not consider the cumulative impacts of other proposed offshore oil and gas seismic surveys, exploration and production in other Blocks within South Africa's exclusive economic zone. Having regard to the global Climate

[146] Final BAR, p236.

Emergency[147] and South Africa's international commitment[148] to *'working with others to ensure temperature increases are kept well below 2°C above pre-industrial levels, which could include a further revision of the temperature goal to below 1.5°C in light of emerging science[149]'* by reducing greenhouse gas (GHG) emissions. TGS's proposed 3D seismic survey would, if additional commercially viable resources are identified and developed through to production phase, inevitably add to South Africa's overall GHG emissions (South Africa's energy sector currently contributes an estimated 84% percent to the country's overall GHG emissions).[150] As a reasonably foreseeable future impact that may become more significant, especially in combination with impacts arising from similar offshore oil and gas exploration and production activities, it is submitted that the cumulative impacts[151] of such GHG emissions need to be identified and assessed.

Ground 4: Failure to conduct meaningful consultation with communities and local people (and in particular small-scale fishers), within the public participation process, including the Social Impact Assessment process

139. It is one of the foundational principles of NEMA that the participation of all interested and affected parties must be promoted and the participation of disadvantaged people must be ensured.[152] Section 24(4)(a)(v) of NEMA provides that interested and affected parties must be given a reasonable opportunity to participate in the environmental impact assessment process. Regulation 41(6) provides that the public participation process must be facilitated in a manner that provides all potential interest and affected parties a reasonable opportunity to comment on the proposed

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[147] https://www.unenvironment.org/explore-topics/climate-change/facts-about-climate-emergency

[148] As a party to the United Nations Framework Convention on Climate Change (UNFCC) that ratified the Kyoto Protocol and adopted the Paris Agreement.

[149] See for example South Africa's *Intended Nationally Determined Contribution (INDC)*, available online at: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/South%20Africa%20First/South%20Africa.pdf

[150] https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-south-africa

[151] 'Cumulative impact' is defined in the NEMA EIA Regulations as follows: 'in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

[152] NEMA, section 2(4)(f).

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project. Regulation 41(2) of the EIA Regulations requires that the public participation process take into account the relevant guidelines. The 2017 Public Participation Guidelines provide that:

> 137.1. The level of public participation must be informed by the characteristics of the potentially affected parties.[153]
>
> 137.2. The method of communication must be an effective method that will easily reach the intended audiences.[154]
>
> 137.3. The language used must provide all potential interested and affected parties a reasonable opportunity to comment without unnecessary difficulty.[155]

140. The court in *Sustaining the Wild Coast NPC*[156] has upheld this and stated:

> "Meaningful consultation entails providing communities with the necessary information on the proposed activities and affording them an opportunity to make informed representations"[157]

141. Coastal communities and the general public have been overwhelmed with the number of offshore oil and gas related applications running in parallel processes, particularly those which may impact the south-west and west coast of South Africa. In the month of May, I&APs have been called upon to respond to no less than four offshore oil and gas EIA processes, without taking into account legislative public participation processes for the Upstream Petroleum Resources Development Bill and the draft Marine Spatial Plans during a similar period. The EAP in the current application, SLR, has been appointed to conduct three of these parallel EIAs.

142. The table below sets out the various EIA processes, in which it is clear that multiple public meetings and submission dates are running during similar time periods:

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[153] At p. 8.
[154] At p. 9.
[155] At p. 9.
[156] Sustaining the Wild Coast NPV and Others v Minister of Mineral Resources and Energy and Others (3491/2021) [2021] ZAECGHC 118
[157] Sustaining the Wild Coast NPC, para 26.

Project	EAP	Public Participation Meeting Dates	Comment/Appeal Due Dates
TEEPSA Block 5/6/7: exploration drilling	SLR Consulting (Pty) Ltd	June – July 2022	7 December 2022 12 May 2023
TEEPSA DWOB: exploration drilling	SLR Consulting (Pty) Ltd	November 2022 May 2023	14 December 2022 12 May – 12 June 2023
TEEPSA 11B/12B: production drilling	WSP Group Africa (Pty) Ltd	January 2023	14 February 2023
TGS: reconnaissance	EIMS (Pty) Ltd	August / September 2022	25 November 2022 18 May 2023
Searcher Geodata: reconnaissance	EIMS (Pty) Ltd	July 2022	13 October 2022 9 February 2023
CGG Services SAS: reconnaissance	SLR Consulting (Pty) Ltd	April 2023	11 April – 31 May 2023
Karpowership Saldanha: power generation from gas	Triplo4 Sustainable Solutions	October / November 2022	13 December 2022

143. Many members of the public will be confused by the various applications, with different processes, slightly different due dates, slightly different applicants all being branded the same with the same EAPs conducting similar EIA processes. It is inconceivable that affected coastal communities are able to respond to each of these processes in a meaningful way. This means that fishers must fish for a living, requiring them to be out at sea daily or for extended periods of time. Even if they wish to do so, they do not have the time or resources to attend multiple public meetings, engage with voluminous technical information, provide comments, ascertain whether their comments have been addressed in comments and response reports, and thereafter proceed to draft appeals. The result, even if unintended, is that those who have less resources, who are required to be out at sea to make their livelihoods, and/or who are unable to fully understand the different proposals and processes, are not able participate and engage meaningfully. The chilling effect is that they are significantly prejudiced by the onslaught of applications

144. There are many people, particularly those such as small-scale fishing communities and co-operatives who will be impacted by the project, who do not have access to the

resources and expertise required to access, consider and comment on the records relating to the project, which are voluminous and technical in nature. The current estimate is that around 136 unitary entities could be defined as 'communities' under the proposed community based rights allocation system. In the Western Cape and Northern Cape in particular, these settlements can seldom be described as 'communities' in the sense of small, spatially defined geographic units with a homogenous social structure and shared norms.[158] This is not recognised nor considered in the BAR or SIA in that the reports appear to limit their analysis by failing to consider the intricate social structures and norms within these "communities" thereby considering these communities as homogenous and disregarding their unique characteristics.

145. We attach hereto a letter from Carmelita Mostert, marked **Annex B5**, which was also separately sent to the Appeals Authority, which clearly sets out opposition to the seismic surveys based on the impact on fisheries, and points out their difficulties associated with having to find hardcopy reports and with having to consider how her community's comments have been considered by the EAP.

146. To ensure access to a reasonable, adequate and fair public participation process, TGS and their appointed EAP should have used reasonably distinctive and appropriate alternative methods to inform and educate affected communities and small-scale fishers of the significant adverse impacts that this project could have on them. Running a public participation process during time period could not achieve meaningful and effective consultation.

147. The BAR included a Social Impact Assessment (SIA) that noted[159] that communities feel that there were significant gaps in the available data, and that from a social perspective the non-technical or social risks can potentially cause significant impacts. The report highlighted that potential social impacts identified

[158] Moenieba Isaacs and Mafaniso Hara. 2015. "Backing small-scale fishers: Opportunities and challenges in transforming the fish sector. Institute for Poverty, Land and Agrarian Studies Rural Status Report 2. University of Western Cape, at page 13. Access link here https://cer.org.za/wp-content/uploads/2016/08/Backing-Small-scale-Fishers_PLAAS.pdf

[159] Appendix 3.4 to the TGS final BAR, Social Impact Assessment, Equispectives Research and Consulting Services (Sept 2022), at p 101.

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included:

- Uncertainty;
- Further marginalisation of vulnerable groups;
- Concerns about cumulative impacts;
- Impact on livelihoods;
- Impacts on sense and spirit of place;
- Impacts on social license to operate;
- Stakeholder fatigue and disillusionment;
- Community expectations; and
- Social unrest.

148. These impacts are rated in the final BAR as being of high or medium significance prior to mitigation, and as being medium significance post-mitigation.[160]

149. The report further pointed out that seismic reconnaissance projects are controversial in South Africa, and that while for many stakeholders it is an emotional matter, for others the potential of impacting on their livelihoods is the biggest fear. The report indicates that some stakeholders feel that the exploration for fossil fuels is not in line with sustainable development and the fight against climate change, while other stakeholders feel that it is imperative for the growth and development of the South African economy to engage in these investigations. The expert describes this as a 'complex and wicked problem'.[161]

150. The report went on to state that from a social perspective, it is clear that the communities and the majority of local people are opposed to the project, and that because the project does not happen in a social vacuum, the social environment is much wider than the footprint of the project. The report states further that:

If the social risks and potential damage to cultural and indigenous rights are

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[161] Ibid, p8. In a footnote to the TGS final BAR, a 'wicked problem' is indicated as *'a problem that is difficult or impossible to solve because of incomplete, and changing requirements that are often difficult to recognise'.*

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> *considered the impact on the social fabric of already vulnerable communities may be significant. At this stage communities feel that they cannot make informed decisions.*[162] *(emphasis added)*

151. Curiously, while this TGS SIA is almost identical to the SIA submitted in the Searcher draft BAR (ref. 1518), the TGS version omits the following sentence from the above paragraph:

> *From [a] social perspective the project can only be recommended after meaningful consultation, local research, education, and awareness raising has been done in the project affected communities.*[163] *(emphasis added)*

152. An extract from the Searcher SIA is attached marked Annex B4.

153. Instead, the TGS SIA report makes the following recommendation:

> *From a social perspective it is recommended that the project proceed subject to the mitigation measures (i.e. meaningful consultation, local research, education, and awareness raising in the project-affected communities) forming part of the conditions for authorisation and being implemented prior to the commencement of the actual survey.*[164]

154. This recommendation is strikingly different to the recommendation made in the Searcher SIA, which stated as follows:

> *The recommendation is therefore that the project can only proceed once the social mitigation measures have been implemented and the community are sufficiently informed and educated to [be] able to engage in a meaningful manner.*[165] *(emphasis added)*

155. The Appellants submitted in their comments on the draft BAR that recommending that the project proceed subject to meaningful consultation being undertaken – and included as a mitigation measure in the environmental authorisation and implemented prior to the commencement of the 'actual survey' – is highly irregular within the context

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[162] Ibid, p18.
[163] Searcher 1518 draft BAR SIA, p8.
[164] TGS BAR, p8.
[165] Searcher 1518 draft BAR SIA, p14.

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of an environmental impact assessment.[166] There is no legal basis for meaningful consultation to be undertaken after an environmental authorisation is granted, and including such a recommendation as a condition of authorisation undermines the regulatory scheme for prior impact assessment that is subjected to public consultation.

156. Notwithstanding the above mentioned submissions, the environmental authorisation ("EA") approves the BAR and EMPr, and indicates that it is mandatory for the holder to implement all the recommendations and management measures stipulated in the EMPr throughout all phases of the proposed activities.[167] The EA also stipulates as a specific condition that a community engagement protocol that is based on the San Code of Research Ethics be developed, in consultation with the affected communities and must include a community strategy and grievance mechanism.[168] The EMPr in turn includes as mitigation measures various recommendations under the heading 'Socio-Economic Considerations', all of which are indicated as to be implemented 'Prior to Operation and ongoing'.

157. The Appellants submit that notwithstanding the public participation processes conducted during the BAR and the SIA processes (which the appellants submitted in paragraphs 115- 121 above, were not adequate or meaningful), it is clear from the SIA that communities and the majority of local people are opposed to the project and that seismic survey companies do not have a 'social license to operate'. The SIA indicates that *'If TGS…wants to proceed with the project, they will need to engage in meaningful conversation with the communities and try to restore relationships. From a community and social risk perspective this is not negotiable'.*[169] The inclusion of mitigation measures in the EMPr (and by reference the EA) fails to adequately take into account the needs and values of the communities (and small scale fishers) who are opposed to the seismic survey.[170] Their voices in opposition to the seismic survey remain unheard in the final BAR

[166] Para 120 at page 60 of Green Connection and Natural Justice DBAR comment submission.
[167] EA, section 5.4.1.
[168] EA, section 5.5.15.

[169] TGS SIA, p107.
[170] Section 2(4)(g) of NEMA requires that decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge.

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and EA. Furthermore, it is submitted that the mitigation measure that TGS should (prior to the operation and on an ongoing basis) *'consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in the future'*[171] cannot be a substitute for meaningful consultation with communities and local people during the EIA process. It is submitted further that such an approach violates the principles of fair administrative decision-making and the right of interested and affected communities to be meaningfully consulted prior to a decision on authorisation being made, and is inconsistent with section 2(4)(f) of NEMA, which stipulates that the participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.

158. The Appellants also note that the SIA states further that the seismic survey industry should reassess their position and social license to operate as an industry in the South African context and should conduct a strategic environmental assessment of the impact of the industry.[172] Notwithstanding this, the report makes a one-sided assumption that the discovery of commercially exploitable fossil oil or gas resources would be beneficial to the economic development of South Africa: *'Potential future benefits and the economic development of the country should the surveys find any significant resources are not disputed'*.[173] The Green Connection and Natural Justice submit that the SIA should have reflected the many negative socio-economic impacts that could or are likely to manifest should commercially exploitable reserves be found and developed through to production and use (including but not limited to the socio-economic costs of climate change[174]).

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[171] EMPr, section 13.7 Item D.

[172] Ibid p109.

[173] Ibid, p109.

[174] In 2021 an international team of scientists published their findings that economic damage from climate change could be six times higher by the end of this century than previously estimated. See: https://www.ucl.ac.uk/news/2021/sep/economic-cost-climate-change-could-be-six-times-higher-previously-thought

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159. In light of the above, the Appellants submit that the public participation process, including the SIA conducted, did not constitute meaningful consultation with communities and local people (and in particular small-scale fishers), and that the mitigation measures requiring further consultation after the EIA has been conducted and a decision on authorisation made (but prior to the operation and ongoing thereafter) does not cure this flaw in the EIA process. As a consequence, it is submitted that the EA should be overturned on appeal.

Ground 5. The FBAR does not contain a proper and objective assessment of the negative impacts of the project on people's human rights

160. Small-scale or subsistence fishers in coastal communities heavily rely on local fish populations for their livelihood and cultural practices. If seismic surveys lead to a reduction in fish stocks, it can have negative consequences for these fishers. They may experience reduced catch rates, economic losses, and disruptions to their traditional fishing practices. Furthermore, the cultural and heritage aspects tied to fishing may be undermined if fish populations decline significantly, as it can impact the intergenerational transmission of traditional knowledge and practices.

161. To better understand the correlation and potential impacts, comprehensive scientific studies and assessments are necessary. These studies would need to evaluate the specific local conditions, fish populations, and cultural contexts of the coastal communities in question.

162. Mitigation measures that are proposed within the EMPr, the specialist acoustic studies, socio-economic impact studies and heritage impact studies such as adjusting survey timing and locations, implementing exclusion zones, and using sound mitigation technologies. can help reduce the potential negative impacts of seismic surveys on marine life. However, when it comes to the cultural and heritage associations of fish and the broader marine environment, proposing the above mentioned mitigation measures which solely focus on reducing direct impacts on

fish populations, may fail to address the complex nuances and broader concerns.[175]

163. Small-scale or subsistence fishers in coastal communities often have deep cultural and heritage associations with fish and the marine environment. Their practices, traditions, and identity are intertwined with these resources. Simply mitigating the direct impact on fish populations may not adequately address the cultural and heritage significance of fishing. Preserving cultural practices, traditional knowledge, and the social fabric of coastal communities requires a more holistic approach that recognizes and respects their unique relationships with the marine environment.

164. Small-scale or subsistence fishers in coastal communities understand through their indigenous knowledge of fishing, that the marine ecosystem is capable of sensitivity to outside interferences. As fishers, they have observed that even the slightest interference with the sensitive marine ecosystem will have an impact on every fish in the ocean, and as a result their livelihoods. Plankton, for example, are the most sensitive to any interferences which indirectly have implications for the larger fish species that feed on plankton. Scientific experts have confirmed in their expert assessments that it is likely that the sound blasting in the ocean caused by seismic surveys will impact on the behaviour of plankton decreasing the number of plankton in the water.[176] Furthermore experts are of the opinion that seismic testing will have a significant adverse impact on numerous species of marine fauna, including endangered and vulnerable species located in the exploration area, and zooplankton.[177]

165. Mitigation measures that solely focus on addressing direct impacts on fish populations may not be appropriate for effectively addressing the indirect and cumulative effects on the broader ecosystem/ecocentric based cultural and

[175] Page 217-218 of the FBAR

[176] McCauley et al, *Widely used marine seismic survey air gun operations negatively impact zooplankton* (2017). https://www.nature.com/articles/s41559-017-0195

[177] Fewtrell, J.L. and McCauley R.D., 2012. Impact of air gun noise on the behaviour of marine fish and squid. Marine Pollution Bulletin 64 (2012) 984–993; Harris JM, Olbers JM, and Wright K. 2022. "Report on Scientific basis for concerns of significant harm inflicted to marine wildlife by 2D and 3D Seismic Surveys on the South and West Coasts of South Africa."

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heritage rights associated with fishing. Eco-centric based cultural and heritage rights are rights that can be defined as rights that acknowledge that ecosystems, species, and natural elements have their own rights and should be respected and preserved for their inherent worth, beyond their instrumental value to humans. Within this framework, cultural and heritage rights are understood in relation to the natural environment. Ensuring the protection of eco-centric based cultural and heritage rights involves recognizing and safeguarding the cultural practices, knowledge systems, traditions, and spiritual beliefs of indigenous and local small-scale or traditional fishing communities and other groups that have a close relationship with their surrounding ecosystems. These rights encompass the right to maintain and protect cultural landscapes, sacred sites, traditional ecological knowledge, and sustainable resource management practices.[178]

166. The examples of proposed mitigation measures formulated by the EMPr inadequately acknowledge the substantial impact on ecosystem/ecocentric based cultural and heritage rights resulting from the broader indirect and cumulative consequences on fishing populations.

166.1. Implementing exclusion zones to minimize direct impacts on fish populations and sensitive habitats does not sufficiently address the broader ecosystem/ecosystem based cultural and heritage associations of fishing. While exclusion zones can help protect specific areas from immediate harm, they may not consider the holistic connections between fish populations, migration routes, and the cultural practices of coastal communities that extend beyond specific locations.

166.2. Using sound mitigation technologies, such as acoustic deterrent devices, can help reduce the direct impacts of seismic surveys on marine life. However, these measures may not fully

[178] Akwasi-Achemfuour (2021) Balancing the interests of wildlife and humans resulting in sustainable ecotourism: the case of Boabeng-Fiema Monkeys' sanctuary, Ghana. In: McIntyre-Mills JJ, Corcoran Nantes Y (eds) From polarization to multispecies relationships: re-generation of the commons in the era of mass extinctions. Springer, New York, pp 519–536; McIntyre-Mills, J.J., Makaulule, M., Lethole, P. et al. Ecocentric Living: A Way Forward Towards Zero Carbon: A Conversation about Indigenous Law and Leadership Based on Custodianship and Praxis. Syst Pract Action Res 36, 275–319 (2023). https://doi.org/10.1007/s11213-022-09604-0

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address the indirect and cumulative effects on cultural and heritage rights. They primarily focus on reducing noise levels and immediate physical harm, but do not consider the potential disruption of fish behavior, altered migration patterns, or changes to the ecological dynamics that are crucial to the cultural and heritage aspects tied to fishing.

166.3. Temporal restrictions, such as conducting seismic surveys during specific seasons or avoiding critical reproductive periods, may help reduce direct impacts on fish populations. However, these restrictions may not fully address the indirect and cumulative effects on the cultural and heritage rights associated with fishing. Cultural practices and traditional knowledge often extend beyond specific seasons and reproductive periods, and the long-term sustainability of fishing traditions and associated rights may depend on the availability of fish populations throughout the year.

166.4. Implementing measures specifically focused on protecting certain fish species or habitats may not comprehensively address the broader cultural and heritage rights tied to fishing. While protecting specific species or habitats is important for biodiversity conservation, cultural and heritage associations with fishing often encompass a diverse range of species, ecosystems, and traditional practices that go beyond the conservation of individual components.

167. To effectively address the indirect and cumulative effects on ecosystem/ecocentric based cultural and heritage rights associated with fishing, mitigation measures should take a more holistic and inclusive approach that consider and incorporate the following aspects:

167.1. Incorporating the perspectives and insights of coastal communities into decision-making processes, ensuring their meaningful participation in the development and implementation of mitigation measures.

167.2. Recognizing and preserving cultural and heritage practices by considering the broader socio-cultural contexts,

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intergenerational knowledge transfer, and the long-term sustainability of traditional fishing practices.

167.3. Integrating traditional ecological knowledge with scientific research to inform mitigation strategies and ensure that they address the interconnectedness of fish populations, ecosystems, and cultural and heritage rights.

168. While the mitigation measures may focus on reducing direct impacts, there can be indirect and cumulative effects that are not fully addressed. Seismic surveys, even with mitigation, can still cause disturbances, alter fish behavior, or disrupt migration patterns, which may have cascading affects on the broader ecosystem.

169. Given the ecosystem impacts, seismic testing will likely result in a trophic cascade affecting all levels of the food chain and therefore indirectly impacting on small-scale fishing communities. The Fisheries Specialist failed to assess the potential impact of the seismic surveys on zooplankton in and around the survey area, as well as the knock-on effects that zooplankton die-off would have on the fish species on which small-scale and subsistence fishers rely for their sustenance and livelihood.[179] These indirect knock on and cascading effects on the dynamic and interconnected ecosystem could potentially affect not only food security for local small-scale fishing communities, but could also impact on the ecosystem/ecocentric based cultural and heritage rights associated with fishing. Counter to the requirements of NEMA and the NEM:ICMA, the BAR and the competent authority's decision does not consider impacts from an ecosystem perspective, and as a consequence, the "downstream" impacts have not been adequately assessed and presented to the DG.

170. Additionally, the cumulative impacts of multiple surveys or other anthropogenic activities in the area need to be weighed together. These indirect and cumulative impacts can have implications for cultural and heritage associations, as they may disrupt traditional practices and the functioning balance of the marine ecosystem.

171. Given the absence of a socio-economic impact assessment which adopts an ecocentric and ecosystem approach to the assessment of impacts, and which

[179] Page 77 -82 of Fisheries Specialist Study

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should have evaluated the cascading impacts on food webs, and how this will impact on the right to access of sufficient food as well as the associated connections of heritage and cultural rights to the practices of fishing, relevant information was not placed before the decision-maker. In the absence of that information, a precautionary approach should have been adopted. This omission is material – the right to food and culture and heritage are constitutionally enshrined – and consequently the authorisation should not have been granted.

172. Small-scale fishers often possess traditional ecological knowledge ("TEK"), which includes their understanding of fish behavior, spawning grounds, and the dynamics of the marine environment. This knowledge is often based on observations passed down through generations and is deeply connected to their cultural heritage. Proposing mitigation measures without considering and incorporating TEK may overlook valuable insights and alternative approaches that could better protect both the fish populations and the ecosystem/ecocentric based cultural and heritage rights of coastal fishing communities

173. Given the above, it is submitted that the proposed and authorised mitigation measures are inadequate. The mitigation measures set out in the EMPr are designed to re-assess impacts post-project.[180] This is flawed for a number of reasons, including:

173.1. The proposed measures are aimed at providing "resources and support for communities to develop and undertake safeguarding measures or plans to enhance the mitigation capacity of their intangible cultural heritage by fostering dialogue, mutual understanding and reconciliation between and within communities" which in no way holds TGS accountable for any impacts caused by the 3D seismic surveys activities.

173.2. The proposed mitigation measures fail to comprehend and mitigate any of the economic or other harms to livelihoods, and cultural and heritage practices and identity.

[180] Page 30 of the EMPr

174. The pre-mitigation significance given to the socio economic and cultural and heritage impacts are rated as Medium, and then Low post mitigation. If mitigation does not actually change the impacts, then it is implausible that the rating can change significantly as well. There is no rational connection between the results of the arbitrary, and somewhat absurd, mitigation measures and any change in significance with regards to the impacts caused by the reconnaissance activities on coastal communities.

175. The Social Impact Assessment (SIA) and Heritage Impact Assessment urges the need for dialogue and engagement with communities prior to the commencement of these activities as the Expert confirms that the oil and gas companies do not have a social license to continue currently.[181] However, there is evidence of any further dialogue with these communities with regards to addressing issues specifically relating to the indirect and cumulative effects on cultural and heritage rights associated with fishing.

176. Therefore, engaging and involving coastal communities in the decision-making process is crucial. Meaningful consultation and participation allow communities to express their concerns, share their knowledge, and contribute to the development of effective mitigation measures. Failure to include the perspectives and needs of these communities can result in measures that do not adequately address their cultural and heritage associations and may lead to further marginalization.

177. Despite the apparent expert knowledge and the level of understanding expressed in the report recommendations regarding the potential effects of the seismic survey proceeding on the communities' identity, sense of place, and spiritual, cultural, and indigenous rights, and that decisions must consider the interests, needs, and values (our emphasis) of all interested and affected parties, including acknowledging all forms of knowledge, including traditional and ordinary knowledge,[182] it is clear that necessary deep conversations with coastal communities were not conducted. Consequently, insufficient information was

[181] Page 109-110 of the SIA, and page 56, 58 of HIA.
[182] Section 2(4)(g) of NEMA.

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placed before the decision-maker, and he/she neglected to afford sufficient weight to the indigenous and cultural rights of coastal communities.

Ground 6: *Failure to consider relevant coastal management considerations or to comply with the National Environmental Management: Integrated Coastal Management Act 24 of 2008*

178. Section 63(1) of NEM:ICMA requires a competent authority to take account of specific factors when deciding whether or not to grant an environmental authorisation under NEMA for "coastal activities". By virtue of this section, the decision maker ought to have appreciated that in deciding whether to grant an environmental authorisation or not, he or she was required to consider additional factors specified in section 63 of NEM:ICMA[183] and whether or not the proposed project "would be contrary to the interests of the whole community". This required an eco-centric consideration of the impacts of the proposed project in an area that must be afforded a particularly high standard of protection given the natural functioning of the dynamic coastal processes.

179. Section 12 and 21 set out the State's obligation in relation to the management of the coastal zone, which must be taken into account in taking a decision in respect of this zone.

180. The Director-General's decision makes no mention of section 63 of NEM:ICMA, and the ESIA contains no evidence that the factors set out in section 63 was considered or assessed. Whilst the BARidentifies that section 63 of NEM:ICMA is applicable, it does not assess each of the factors set out in section 63.

181. Read together, this means that there was no factual investigation as required by section 63 of the NEM:ICMA, including a determination of whether the coastal public property and the coastal protection zone would be impacted, and if so, to what extent the proposed activity is consistent with the goal of establishing

[183] S 63(1)(c), s 63(1)(h)(i), s 63(1)(h)(iv) and s 63(1)(l) of NEM:ICMA.

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or protecting those areas.[184]The management plans that are relevant in these areas, like the Coastal Management Programme for the Western Cape Province,[185]have also not been taken into consideration.

182. The BARdoes not, at any point, consider the interests of the affected human and non-human communities in any collective way. Consequently, the interests of the whole community[186] have not been presented to the decision-maker in the BAR, and without evidence of specific consideration of these interests in the Reasons for the Decision, the decision-maker has not evaluated these interests in their decision to grant environmental authorisation.

183. As set out elsewhere in this appeal, the impacts associated with seismic surveys could have significant impacts on marine life and coastal communities. Oceans play a critical role in regulating the climate and mitigating global warming by absorbing carbon dioxide. Seismic surveys pose a significant threat to functioning marine ecosystems, to living organisms in South Africa's coastal waters,and to communities that depend upon the oceans for their livelihoods. Small-scale fishers and fishing-dependent communities are particularly vulnerable to the negative impacts on fish stocks upon which they depend for their livelihoods.

184. The Appellants submit that it is not in the interests of the whole community (from and intra- and inter-generational perspective, as well as having regard to potential

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[184] Section 63(1)(c) of NEM:ICMA.

[185] Western Cape Coastal Management Programme: 2016 available at https://cer.org.za/wp-content/uploads/2009/12/Western-Cape.pdf
Draft Western Cape Coastal management Programme 2022 – 2027 available at https://www.westerncape.gov.za/eadp/files/atoms/files/DRAFT%20Western%20Cape%20Provincial%20Coastal%20Management%20Programme%202022-2027.pdf.

[186] In terms of the National Environmental Management: Integrated Coastal Management Act 24 of 2008 (NEM:ICMA), the 'interests of the whole community' is defined as meaning the collective interests of the community determined by:

(a) prioritising the collective interests in coastal public property of all persons living in the Republic over the interests of a particular group or sector of society;

(b) adopting a long-term perspective that takes into account the interests of future generations in inheriting coastal public property and a coastal environment characterised by healthy and productive ecosystems and economic activities that are ecologically and socially sustainable; and

taking into account the interests of other living organisms that are dependent on the coastal environment.

impacts on living organisms in South Africa's coastal waters) to expose our oceans and coasts to the increased risks associated with seismic surveys, or associated with further intended exploratory drilling and/or production activities.

Ground 7 *Failure to provide adequate reasons for the decision*

185. The reasons for the DG's decision, as described in Appendix 1 of the Environmental Authorisation ("the EA"), sets out that the following were 'key findings' that resulted in the decision to approve TGS's application for environmental authorisation:

186. The decision concludes as follows:

> *In view of the above, and having taken into consideration environmental management principles as set out in section 2 of NEMA, this Department is satisfied that the proposed activity will not be in conflict with the objectives of Integrated Environmental Management set out in Chapter 5 of [NEMA] and will not result to any detrimental risks to the environment and public. The environmental authorisation is accordingly granted.*

187. These reasons, and the conclusion arising from these reasons are generic and unsubstantiated. The reasons are almost verbatim the same reasons provided by the DG in other oil and gas related applications, such as those contained in the Environmental Authorisations for Searcher Geodata UK Limited and TotalEnergies EP South Africa Block 567 (Pty) Ltd . The EA itself further fails to deal substantively with any of the main issues raised by the Appellants and other I&APs.

168. On the reasons provided, it is impossible to conclude that the DG took all relevant considerations into account, including the submissions made by the Appellants and other interested and affected parties.

169. To the contrary, it appears that the DG failed to consider all relevant information, for the reasons set out elsewhere in this appeal.

Ground 8. Decision to grant authorisation contravenes NEMA Principles, the Constitution and PAJA

190. Section 33 of the Constitution recognises that everyone has the right to administrative action that is lawful, reasonable and procedurally fair. PAJA seeks to give effect to this right.

191. From what is set out above, it is clear that the decision to grant authorisation to TGS runs contrary to at least the following NEMA principles:

> 191.1. Decision-makers must apply the precautionary principle when there is uncertainty or lack of scientific consensus regarding potential environmental harm. This principle requires taking preventive action to avoid serious or irreversible environmental damage, even in the absence of full scientific certainty.[187]
>
> 191.2. Decision-making should promote equity and fairness in the distribution of environmental benefits and burdens. This principle recognizes the rights of all individuals, particularly disadvantaged and vulnerable groups, to a healthy environment and seeks to avoid disproportionately negative impacts on these groups.[188]

[187] Section 2(4)(a)(vii).
[188] Section 2(2) and 2(4)(c).

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191.3. Decision-makers must protect and conserve ecosystems, biodiversity, and ecological processes. This principle recognizes the intrinsic value of ecosystems and the critical role they play in supporting life and maintaining ecological balance.[189]

192. It is further submitted that

192.1. irrelevant considerations were taken into account or relevant considerations were not considered;

192.2. the action itself contravenes a law or is not authorised by an empowering provision;

192.3. the action itself is not rationally connected to the information before the administrator; and

192.4. the exercise of the power or the performance of the function authorised by the empowering provision, in pursuance of which administrative action was purportedly taken, is so unreasonable that no reasonable person could have so exercised the power or performed the function.

193. The decision is consequently reviewable under section 6(2) of PAJA.

CONCLUSION

194. The Appellants have sent out in this appeal a number of grounds on which the decision to grant environmental authorisation to TGS was fatally flawed. The decision to authorise the project is consequently unlawful, in that it failed to comply with, *inter alia*, the Constitution and NEMA.

[189] Section 2(4)(b); Section 2(4)(o) and Section 2(4)(r).

195. For all the reasons set out in this appeal, Natural Justice and the Green Connection submit that the appeal should succeed and that the environmental authorisation granted to TGSby the Director General should be refused.

196. We reserve the right to supplement the grounds for review and evidence in support of each argument.

SIGNED AT CAPE TOWN ON 18 MAY 2023

Melissa Groenink-Groves
Programme Manager: Defending Rights
Natural Justice
melissa@naturaljustice.org

Liz McDaid
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The Green Connection
lziwe@mweb.co.za

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Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002

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APPEAL RESPONSE REPORT

PROJECT NAME/TITLE: TGS Orange Basin Reconnaissance Permit

PROJECT LOCATION: Offshore of the West Coast, South Africa

PROJECT REFERENCE NUMBER: 1520

DATE PROJECT/ACTIVITY AUTHORISED: April 17, 2023

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DETAILS OF THE APPELLANT	DETAILS OF THE APPLICANT
Name of appellant: Aukotowa Fisheries Primary Cooperative Ltd	Name of applicant: TGS Geophysical Company (UK) Limited
Appellant's representative (if applicable): Reethia van Wyk	Applicant's representative (if applicable): Environmental Impact Management Services (Pty) Ltd
Postal address: Joos Engelbrecht Street, Port Nolloth, 8280	Postal Address: P.O. Box 2083 PINEGOWRIE 2123
Email Address: aukotowafisheries@gmail.com	Email Address: tgs@eims.co.za
Telephone number: 063 721 9428	Telephone number: (011) 789 7179
Fax Number:	Fax number:

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GROUNDS OF APPEAL.	RESPONDING STATEMENT	COMMENT BY THE DEPARTMENT / DMR
1. Issues with the consultation process: the co-op believes the consultation process was not done correctly, we do not believe that the information that was presented is accurate. We know that the government is for oil and gas, but as a community and a small-scale fisher organization we are against it. We have seen this happen in other countries, and it has messed the whole sea life up. That's why we see foreign boats in our waters. We say no but the government says yes. In a few years time we'll be like all the other countries with nothing in our waters and nothing for the generation behind us. We strongly say no to seismic surveys and oil and gas development.		
2. It is not an open and transparent participatory process according to MEMA. We go and listen to the consultations but do not consent to a seismic survey. TGS states that a mitigation measure is to "consult with communities on potential ways in which to		

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make a positive contribution to the communities." Why isn't this part of the consultation process? The private sector and the government should be coming to affected communities such as Port Nolloth with this question, instead of coming with only one option – either seismic surveys or exploration drilling. Why has nobody asked what the Port Nolloth community wants for development? Why would we agree to something that has absolutely no benefit for us? Meaningful consultation should allow us to decide what we want, not being told something that has the potential to destroy our livelihood and that is so significant to our culture.		
3. TGS states there is a "perceived impact" of the oil/gas industry on the fishing industry, not the actual impact on catch rates. We do not believe this to be true, as there have been studies and evidence of the harms of seismic surveys and issues with oil and gas developments, e.g., blowouts, that impact fish for years to come. For example, after the Deepwater Horizon blowout in 2010 in the Gulf of Mexico, fish and dolphins are still testing positive for the chemicals found in the oil that spilled. There		

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are scientific reports that were not included in the EIA that show different impacts on species from the noise of air guns used in seismic surveys. The difference in scientific information that is presented in the consultations and EIAs is concerning. Further, we are concerned about who is going to monitor the impacts of the seismic survey, and how will fishers and other coastal livelihoods be compensated if there is harm to marine life as a result of the survey.		
4. Does not meet South Africa's climate change goals, e.g., Paris Agreement and Kyoto Protocol, and effort to achieve net zero. The push for oil and gas does not align with South Africa's climate change goals, where the country is a signatory to meeting these challenges and reducing its carbon footprint. We believe that this seismic survey violates these agreements and our Constitutional right to Section 24 on the Environment. It violates our right to health and well-being as it affects our livelihood and food security. This survey has a direct impact on pollution and ecological degredation, does not promote conservation, and is not promoting justifiable economic and social development. There are no economic benefits of oil and		

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gas to the Port Nolloth community.		
5. The government is allowing permits for activities that harm the ocean yet are diminishing quotas. We as small-scale fishers do not harm the ocean, yet are severely impacted by seismic survey activities. As TGS states, our livelihoods are "already compromised due to the fishing quota system, over-fishing, lack of employment opportunities, pollution, effects of climate change and the revent Covid pandemic." The government is not alleviating any of these challenges by allowing a seismic survey and oil and gas development. Even though this seismic survey is not in the exact boundary of our fishing grounds, we are still concerned that it will affect the migration patterns of the fish. Climate change and overfishing is already impacting those patterns and the amount of fish in the ocean, so please we do not want another activity that will harm the fish we depend on for our livelihood.		

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IN THE HIGH COURT OF SOUTH AFRICA
(EASTERN CAPE DIVISION, GRAHAMSTOWN)

Case No: 3941/2021

In the matter between:

SUSTAINING THE WILD COAST AND OTHERS Applicants

and

MINISTER OF MINERAL RESOURCES AND ENERGY AND OTHERS Respondents

---

SUPPORTING AFFIDAVIT

I, the undersigned,

AARON N. RICE, PH.D

do hereby make oath and say:

1 I am an adult male and a research scientist in the K. Lisa Yang Center for Conservation Bioacoustics (formerly the Bioacoustics Research Program) at Cornell University in Ithaca, New York.

2 The contents of this affidavit are to the best of my knowledge true and correct. Unless I indicate otherwise, or the contrary appears from the context, they are within my personal knowledge and belief.

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3 I confirm that the report annexed hereto marked "AR1" is to the best of my knowledge and belief true and correct.

4 My CV is attached marked AR2. I confirm that it is accurate.

AARON N. RICE

Thus signed and sworn to before me at 99 Sheraton Dr. Ithaca NY 14850 on this 28th day of February 2023 by the deponent who has acknowledged that he knows and understands the contents of this affidavit, that he has no objection to taking the prescribed oath and that the prescribed oath is binding on his conscience.

NOTARY PUBLIC

NAME:
CAPACITY:
ADDRESS:

ADRIAN WEISS
NOTARY PUBLIC-STATE OF NEW YORK
No. 01WE6136457
Qualified in Cortland County
My Commission Expires 11-07-2025

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Scientific Evaluation of the Transkei and Algoa Exploration Areas: Environmental Management Programme (EMPr) Final Report 2013

Aaron N. Rice, Ph.D.

Executive Summary

In my expert opinion, based on best available science, the proposed surveys have a high likelihood of both acute and chronic impacts to marine life in the proposed region surrounding the Transkei and Algoa survey areas. The Environmental Monitoring Programme (EMPr) Final Report underestimates the spatial extent and ecological impacts from seismic airgun surveys. The repeated assertion in the EMPr of negligible impact to fishes, marine invertebrates and marine mammals, is in contrast to a broad body of peer-reviewed scientific literature, though much of it has been published after the EMPr was initially drafted. For example, some species, such as scallops and zooplankton, may experience serious injury and mortality even from a single pass of a seismic vessel; others, such as pilchard and demersal fishes, are likely to experience, on large scales, sublethal harm that compromises breeding, foraging, and other biologically essential activity. At least some populations are likely to experience these effects at a population level, through mortality, injury, and large-scale adverse behavioral response. The proposed buffer zones described in the EMPr are likely not sufficient to prevent or limit adverse noise exposure to marine animals. Given the important role that many marine mammals, fishes and invertebrate species occupy in the food chain, these effects could cascade to affect other marine species. I believe that extensive seismic surveys could have profound negative consequences for the region's ocean health and marine resources.

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Reviewer Expertise

1. I am a research scientist in the K. Lisa Yang Center for Conservation Bioacoustics (formerly the Bioacoustics Research Program) at Cornell University. The Center is one of the world's preeminent research institutions in the field of marine and terrestrial bioacoustics, the study of sound in the natural world. Since 2017, I have also served as a faculty fellow at Cornell's Atkinson Center for a Sustainable Future, which supports multidisciplinary research and collaboration on topics related to environmental sustainability. I am also a graduate field faculty member in the Graduate Field of Natural Resources and the Environment at Cornell, and a courtesy faculty member in the Environmental Sciences Graduate Program at Oregon State University.

2. I hold a B.S. in biology from Davidson College (2000), an M.A. in marine biology from Boston University (2002), and an M.S. and Ph D in Organismal Biology and Anatomy from the University of Chicago (2004, 2006). I completed my postdoctoral training in the Department of Neurobiology and Behavior (2007-2009) and the Bioacoustics Research Program (2009) at Cornell University.

3. In my capacity as a university scientist and a member of the bioacoustics research community, I have collaborated on research projects and/or provided input to various federal agencies with an interest in marine bioacoustics, including the National Oceanic and Atmospheric Administration, Bureau of Ocean Energy Management, U.S. Army Corps of Engineers, U.S. Navy, Marine Mammal Commission, and National Park Service; agencies for the states of Maryland, Maine, Virginia, and New York, industry groups; and conservation organizations. I have served as a grant review panelist for the U.S National Academy of Sciences, the U.S. National Science Foundation, the Gulf of Mexico Research Initiative (through

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the Council for Ocean Leadership), and the North Pacific Research Board. I am an editor for the peer-reviewed journal, *Endangered Species Research*. In 2014, I received the Partners in Conservation Award from the Department of the Interior for my work on the acoustic ecology of fishes and whales along the Atlantic coast.

4. My career is centered on marine bioacoustics. I study sounds made by aquatic species, including fishes and aquatic mammals, to understand the dynamics of wildlife populations, the function of marine ecosystems, and the effect of human influences on the environment. I have served as author or co-author of 61 peer-reviewed journal articles, 20 technical reports for government agencies or industry, 7 scientific book chapters, and given numerous (>80) presentations at national and international scientific conferences. Much of my research has focused on the organisms and ecology of the western North Atlantic Ocean and Gulf of Mexico, but this work has global application and relevance.

5. I have experience in bioacoustics across a wide range of vertebrate species, including research and publications on sharks, fishes, frogs, rodents, whales and birds. I regularly lecture on vertebrate sensory physiology, bioacoustics, underwater acoustic communication, and conservation bioacoustics at the university undergraduate and graduate levels. I am familiar with the function of sensory systems across different vertebrate species, including the ways in which species produce, perceive, and use sound

6. In preparing this declaration, I reviewed the 2013 Environmental Management Programme (EMPr) Final Report for the Transkei and Algoa Exploration Areas and the 2020 Transkei Algoa Exploration Right Environmental Compliance Audit (2020 Compliance Audit) for the proposed seismic surveys off the southeastern South Africa coast. I also reviewed the 1998 South Africa Marine Living Resources Act, and relevant peer-reviewed scientific

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publications focusing on bioacoustics and the impacts of ocean noise on marine wildlife. A full list of the scholarly articles cited in this declaration appears in a literature cited at the end of this document.

7. The purpose of this declaration is to explain the importance of sound for marine wildlife, describe the effects that seismic airgun surveys have on marine mammals, fishes and invertebrate species, and assess the risks and possible biological impacts. For the reasons stated below, I believe that the surveys described in the EMPr (as well as in the review of the mitigation measures in the 2020 Compliance Audit) do not fully capture the risk posed to marine wildlife and ecosystems, and if approved, could have severe and wide-ranging negative impacts

Importance of Sound for Marine Wildlife

8 Sound is a critical component of the life history of many, if not most, marine organisms (Au and Hastings 2008, Montgomery and Radford 2017). The ability to make and hear sounds is fundamental to their behavior, including for courtship, reproduction, feeding, navigation, avoiding predators, marking territory, and maintaining their social groups. Many species of fishes likely produce sounds for communication (Lindseth and Lobel 2018, Rice et al. 2022), along with nearly all marine mammals that have been examined (Au and Lammers 2007), and it is recognized as being increasingly important for marine invertebrates (Buscaino et al. 2011, Staaterman 2016). This profound reliance on sound by marine animals is due to the basic physics of the aquatic environment. Because water is a dense medium, sound travels faster and farther in the ocean than it does in air.

9 In the ocean, sound can propagate at distances of up to thousands of kilometers. Noise from ships has been recorded at the bottom of the deepest areas in the ocean (6-7 km deep)

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(Dziak et al. 2017). By comparison, light from the sun (including light that is visible to humans, and ultraviolet light) only travels through the top 100-500 meters of the ocean (Losey et al. 1999).

10. Underwater, there are two physical components of sound: pressure and particle motion (Kuperman and Roux 2007, Au and Hastings 2008, Montgomery and Radford 2017). The pressure component of sound is generated through the compression and expansion of a standing wave as it propagates through a medium (in this case water). Particle motion is generated through the movement and acceleration of water molecules by the passive pressure wave. Until recently, the majority of underwater acoustics focused on the measurement of pressure and largely ignored particle motion (Popper and Hawkins 2018). Only within the last 10-15 years has particle motion been recognized as a salient acoustic cue for fishes and invertebrates (Horodysky et al. 2008, Wysocki et al. 2009, Radford et al. 2012, Zeddies et al. 2012, Popper and Hawkins 2018).

11. Hearing is an important sensory modality for most, if not all, marine vertebrates and many marine invertebrates (Hall 1967, Popper and Ketten 2008, Fay 2009). All vertebrates share a common evolutionary ancestry in the structure and function of their inner ears, and use the same anatomical and physiological mechanisms for receiving environmental sounds However, tetrapods (amphibians, reptiles, birds, and mammals) primarily detect the pressure component of sound, fishes are primarily responsive to the particle motion component of sound (Popper and Hawkins 2018, Duarte et al. 2021). While many invertebrates do not have the same ear or auditory structures that vertebrates possess, they do exhibit sensitivity to sound, particularly particle motion (Popper and Hawkins 2018), although the anatomical mechanism is

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not identified in all cases (Buscaino et al. 2011; Hawkins et al. 2015; Hawkins and Popper 2016; Mooney et al. 2010; Popper and Hawkins 2018; Vermeij et al. 2010)

12. Sound is a fundamental component of marine habitats. Different ocean environments have distinct acoustic signatures that comprise their "acoustic habitat" (Merchant et al. 2015; Radford et al. 2010, 2014; Staaterman et al. 2013). These acoustic habitats are created from the combination of biological sounds (e.g., fish chorusing, snapping shrimp, urchin movement, whale calling) and environmental sounds (e.g., waves crashing, earthquakes, rain) (Hildebrand 2009, Pijanowski et al. 2011); anthropogenic sound is also a pervasive component of most marine soundscapes (Duarte et al. 2021). The addition of anthropogenic sounds to this soundscape disrupts the ability of animals to use naturally occurring acoustic cues and has detrimental effects on individual organisms, populations, and communities (Popper et al. 2003, Nowacek et al. 2007, Weilgart 2007, Popper 2009, Popper and Hastings 2009, Radford et al. 2014, Shannon et al. 2016, Popper and Hawkins 2019, Popper et al. 2020).

13. Sound has many characteristics relevant to wildlife. Two of the most important characteristics are amplitude, or "loudness," which is typically measured in decibels (dB); and frequency, or "pitch," which is measured in Hertz (Hz). Marine organisms vary in their sensitivities to sounds of different amplitudes and frequencies. Fishes and invertebrates appear most sensitive to sounds in the lower frequencies (below 1000 Hz), which coincides with the principal frequency range of many anthropogenic noise sources, including seismic airguns. Marine mammals, by comparison, are sensitive across a wide range of frequencies.

14. Decibels represent the "loudness" or the intensity of sound as a logarithmic ratio of pressure (Au and Hastings 2008), analogous to the Richter scale for measuring earthquakes. As such, a 6 dB increase in sound level represents a doubling of the pressure, and a 20 dB

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increase represents a ten-fold increase in the pressure. Consequently, seemingly small increases in decibel levels represent large-magnitude changes in the sound that marine organisms are exposed to. Fish ears and brains are particularly sensitive to the "rise and fall" in the amplitude of a signal (Bodnar and Bass 1997, Bodnar and Bass 2001)

Noise from Seismic Airgun Surveys

15. Seismic airguns are used in geophysical exploration. They produce a series of high-amplitude underwater sounds, and the reflection of these powerful sounds off subterranean structures deep beneath the sea floor is analyzed to identify petroleum resources (Dragoset 1990, Caldwell and Dragoset 2000, Dragoset 2000). Airguns are often used in an array, typically consisting of dozens of guns that fire simultaneously, with a combination of gun sizes with volumes between 30-800 cubic inches, spread across about 200-1000 meters in area towed behind a ship (Caldwell and Dragoset 2000), to produce a better signal for detecting oil and gas resources (Dragoset 2000). A large airgun array can produce sound with effective peak amplitudes above 250 dB.

16. The sound produced by airgun arrays has a number of characteristics that heighten its potential to harm marine mammals, fishes and invertebrates. These include its frequency output and amplitude. Additionally, the potential impacts of airgun surveys are often evaluated on the basis of the sound characteristics from a single seismic airgun shot. However, industry-scale airgun surveys used for the exploration of oil and gas include dozens of airguns firing every 8-20 seconds during surveys last for months. Consequently, considerations of acute exposure from airguns to marine life fail to consider the cumulative and chronic exposure in full-scale seismic surveys.

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17. First, the sounds emanating from seismic airguns have frequencies that overlap with frequencies of greatest sensitivity for many marine mammals, fishes and invertebrates While airgun noise is described by acousticians as "broadband," meaning that it produces noise across a range of frequencies, with significant energy output at higher frequencies (Hermannsen 2015), most of the acoustic energy of the signal is concentrated between 100 and 1000 Hz. This is the range of primary sensitivity of fish hearing and energy content in fish communication sounds (Popper and Fay 2011, Popper et al. 2014, Popper and Hawkins 2019) Far less is known about marine invertebrate hearing, but experiments in squid (Mooney et al. 2010, Mooney et al. 2016) and crustaceans (Popper et al. 2001) suggest a similar frequency range (20-1000 Hz) for hearing for many of these species

18. Second, the high-intensity, low-frequency noise that airguns produce can typically travel long distances through seawater. My colleagues and I at Cornell have studied how airgun noise propagates through water in a number of ocean regions. In a 2016 study in the Gulf of Mexico, for example, we found that seismic surveys were detectable at distances greater than 500-700 km (Estabrook et al. 2016). Our colleagues at Scripps Institution of Oceanography have found similar results (Wiggins et al. 2016), and recent research from the Arctic has shown similar long-distance effects (Guan et al. 2015, Guerra et al. 2016, Keen et al. 2018). Other studies have detected seismic surveys at levels sufficient to mask, or obscure, baleen whale calls at distances of thousands of kilometers away from the source (Nieukirk et al. 2004, Nieukirk et al. 2012). Propagation distances are influenced by water depth, temperature, the composition of the sea bottom, and oceanographic conditions. In assessing impacts or establishing protective measures, regulatory agencies assume sound does not affect marine life beyond a few kilometers

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from the source, in fact, airgun noise influences and degrades the acoustic habitat of marine species over a far greater area.

19. Third, the noise produced by airgun arrays becomes virtually continuous at greater distances from the source. This happens through a combination of multipath sound propagation and reverberation, where sound waves originating from the array reflect off the ocean surface and seafloor as they travel. In one of our studies off Greenland, we found that, across distances of 40 km, airgun noise elevated ambient sound levels by more than 25 dB (approximately a 4-fold increase in noise levels), and these sound levels remained elevated even during the periods between airgun blasts (Guerra et al. 2016). Similarly, in our observation of seismic surveys in the Gulf of Mexico under open ocean conditions, the noise produced by seismic arrays spread across the interval between seismic shots, and were sustained for months at a time (Estabrook et al. 2016, Wiggins et al. 2016).

20. These results demonstrate that sounds emanating from seismic airguns do not behave as individual and finite sound sources *in situ*, but lead to a continuous increase in the sound level through reverberation. The effect has repeatedly been documented (Nieukirk et al. 2004, Nieukirk et al. 2012, Guan et al. 2015, Estabrook et al. 2016, Guerra et al. 2016). At these distances, the noise was shown to spread between seismic shots with remarkably little loss of energy. While it is difficult to compare water-borne and air-borne noise, a reasonable analogy is that an industry-scale seismic survey presents the equivalent of organisms living through a continuous 4- to 6-month thunderstorm covering a distance greater than 40 km, a phenomenon that does not occur in nature.

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Effects of Seismic Noise on Marine Wildlife

21. Marine mammals, fishes and invertebrates play a vital role in the ocean ecosystem. They are the ocean's predominant food sources both for apex predators, such as whales, sharks, and large fishes such as tuna and swordfish, and in support of human health and food security.

22. Marine invertebrates (ranging from phytoplankton to worms to crustaceans to jellyfish) are extremely diverse and numerous, and are categorized into 30 different phyla. They are the dominant group of organisms in all ocean ecosystems around the world and form the base of all ocean food chains. An increasing body of research shows that marine invertebrates are sensitive to sound (Budelmann 1992), and several recent studies reveal how marine invertebrates and their larvae exhibit adverse responses to increases in noise (Vermeij et al. 2010, Lillis et al. 2014, Lecchini et al. 2018).

23. Though marine invertebrates do not possess the same homologous ears as vertebrates, many invertebrates have anatomical structures, statocysts, that are sensitive to sounds through particle motion (Mooney et al 2010). Those invertebrates that have statocysts include species as diverse as decapod crustaceans, mollusks (including cephalopods and bivalves), cnidarians (including corals and jellyfish), and echinoderms (starfish, urchins, and sea cucumbers) (Budelmann 1992, Burighel et al. 2011). Among these taxa are a number of commercially important species such as lobster and scallop, as well as other very common marine species such as octopus. The statocysts contain a mineralized structure (the statolith) that is evolutionarily convergent with fish otoliths (a structure in the inner ears of vertebrates), function as an accelerometer, and are sensitive to the particle motion component of sound. And

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similar to vertebrate ears, it is statocysts that are injured when exposed to high-amplitude sounds (Solé et al. 2013, Solé et al 2016, Solé et al. 2017).

24. Airguns have been shown to alter whale, fish and invertebrate behavior and habitat use in ways that are biologically significant. Exposure to high-amplitude (loud) sounds can cause acute effects, which are immediate, and chronic effects, which unfold over a longer time course. Some impacts are lethal to the organism, while others are sublethal. These diverse impacts include death, injury, changes in behavior, and changes in local abundance. This holds true across all studied classes of organisms in both marine and terrestrial ecosystems.

25. In critical respects, the assumptions made in the EMPr about risks and impacts of seismic surveys to marine mammals, fishes and do not reflect the current state of scientific knowledge. Since the drafting of the EMPr in 2013, a significant body of literature has been published describing the extent of seismic airgun surveys and the possible impacts to marine life (e.g., Zeddies et al. 2012, Nowacek et al. 2015, Hawkins and Popper 2016, Carroll et al. 2017, McCauley et al. 2017, Paxton et al. 2017, Bruce et al. 2018, Przeslawski et al. 2018, Elliott et al. 2019, Slabbekoorn et al. 2019), though some studies have produced conflicting or equivocal results to the larger body of work suggesting adverse impacts (e.g., Carroll et al. 2017, Cote et al. 2020, Sivle et al. 2021).

26. An increasing number of studies demonstrate physiological impacts to marine invertebrates from seismic airguns and other intense, predominantly low-frequency sound sources. These effects, which are consistent with theoretical predictions (Kight and Swaddle 2011, Francis and Barber 2013), include increases in physiological stress levels (Day et al. 2017), auditory injury (Solé et al. 2013, Solé et al. 2016, Sole et al. 2017), changes in behavior

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(Mooney et al. 2016, Day et al. 2017), and mortality (McCauley et al. 2017). The myriad impacts to invertebrates are remarkably similar to vertebrate responses to loud anthropogenic noises.

27. Marine invertebrate larvae are particularly vulnerable to adverse impacts from exposure to seismic airgun sounds. Such impacts have been shown to cause developmental abnormalities (de Soto et al. 2013), ultimately impacting survivorship of adults. Increases in anthropogenic noise levels can also disrupt the settlement of invertebrate larvae on coral reefs or oyster reefs, which is necessary for the larvae's survival (Vermeij et al. 2010, Lillis et al. 2014, Lecchini et al. 2018).

28. Seismic surveys also cause mortality and injury in plankton and mature invertebrates. In a controlled field experiment in Australia, blasts from a single airgun killed all krill larvae and more than half of the plankton within a 1-km radius from the airgun (McCauley et al. 2017). While this was a small-scale study, it has profound implications for ocean health, as it demonstrates that seismic airgun use may lead to major decreases in the foundation of the ocean's food webs, potentially resulting in a trophic cascade affecting all levels of the food chain. A recent study, following up on the McCauley et al. (2017) paper, produced conflicting results on the impacts of airgun surveys through controlled field experiments in Norway on copepods (Fields et al. 2019). This study did not demonstrate the same spatial extent of mortality in copepods that McCauley et al. (2017) found in other zooplankton taxa, and it is unclear if this is due to the fact that copepods respond differently to airgun sounds than other zooplankton species, or due to experimental differences. Although the conflicting results suggest the need for further study, they do not negate the findings of McCauley et al. (2017).

29. A subsequent study simulating the findings extrapolated from the results of the McCauley et al. (2017) study in the Northwest Shelf in Australia using a hypothetical seismic

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airgun survey in water depths from 300-800 m (Richardson et al. 2017). In this simulation, a hypothetical zooplankton population is decreased by 32% from its initial level immediately following the seismic survey, and recovers to 95% of the original biomass in 18-41 days depending on the recovery rate. Additionally, the area of impact for plankton populations was within 15 km of the survey area. To summarize their conclusions in the beginning of the discussion section, the authors state: "We found there was substantial impact of seismic activity on zooplankton populations on a local scale within or close to the survey area, with a maximum decline of 22% in zooplankton populations in the survey area, 14% within 15 km of the survey area" (Richardson et al. 2017, pg. 26). Depending on whether oceanographic circulation was included in the simulation, plankton levels recovered within 3-57 days (Richardson et al. 2017)

30. Airgun sounds also adversely impact the survivorship, behavior, physiology, and haemolymph (analogous to vertebrate blood) biochemistry of scallops, and likely other bivalves. And, as noted above, the sound-receptive structures known as statocysts experience injury on exposure to airgun and other low-frequency sounds, indicating a mechanism of acoustic injury that exists across a range of invertebrate taxa: octopus (André et al. 2011), squid (Solé et al. 2013), cuttlefish (Solé et al. 2017), scallop (Day et al. 2017), rock lobster (Day et al. 2019), and jellyfish (Solé et al. 2016).

31. Sublethal impacts from noise exposure occur at all levels of biological organization in vertebrates and invertebrates (Kight and Swaddle 2011), including cellular and molecular processes, physiological systems, behavior, and ultimately, survivorship (Kight and Swaddle 2011, Francis and Barber 2013). Communities, ecosystems, and ecosystem services are also affected by noise (Francis et al. 2009, Francis et al. 2012). While more data are available

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about sublethal impacts from noise on terrestrial organisms (including humans), the same principles apply to marine species.

32. Sublethal impacts are often difficult to measure. Because these impacts unfold over long periods of time for both individual animals and on the population level, it is more difficult to attribute cause to effect. This is particularly true for marine species, given the challenges of monitoring them in the wild. However, sublethal impacts can have substantial consequences for the health and survival of fishes and invertebrates. These demonstrated sublethal effects include increased stress and changes in behavior, which may lead to decreased reproductive activity, decreased foraging (Magnhagen et al. 2017), decreases in predator avoidance (Simpson et al. 2015, Simpson et al. 2016), immunosuppression (Filiciotto et al. 2017, Vazzana et al. 2017), and ultimately reductions in survivorship (Simpson et al. 2016).

33. Assessing the immediate behavioral responses of fish to airgun firing is difficult, since fish frequently leave the immediate vicinity of an airgun soon after firing; thus, most studies are performed on artificially-confined fish (Pearson et al. 1992, Wardle et al. 2001). When airguns are fired between 0 to 100 meters of experimental fish cages, the fish often try to swim away from the direction of the airgun, or perform a characteristic startle response, indicative of distress (Pearson et al. 1992, Wardle et al. 2001).

34. Many studies have examined the effect of loud anthropogenic noise sources—including shipping noise and seismic airgun activity—on fish hearing and physical trauma to their ears (Popper et al. 2003). Fish exposed to broadband, high-intensity noise (about 153 dB) show decreased hearing sensitivity (Wysocki and Ladich 2005), and these effects often occur as late as 24 hours following exposure (Smith et al. 2004). Species with particularly sensitive hearing abilities may be more susceptible to auditory damage (Mann et al. 2007). A loss of

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hearing sensitivity is especially concerning when elevations in environmental noise may mask biologically important sounds (Myrberg 1990, Wysocki and Ladich 2005), such as the ability of fish to hear reproduction vocalizations, as shown for the Lusitanian toadfish (Vasconcelos et al. 2007). Anatomical studies examining the effect of airgun firing on fish ears demonstrate that substantial damage to the ears of at least some species is detectable up to 58 days following exposure, including blistering of the sensory epithelia and ablation of hair cells (either via "ripping" or "rupture") (McCauley et al. 2003). Fish exposed to five shots from airguns (a total of five seismic blasts) show a substantial and immediate decrease in hearing sensitivity (Popper et al. 2005). While the ultimate impact on fish survival is unclear, repeated or sustained airgun exposure is likely to have deleterious effects on fish health, not just limited to hearing (McCauley et al. 2003).

35. Another sublethal effect of airgun activity on fish is the physiological stress response. There are three different, well-characterized phases for the physiological responses of stress: 1) a primary stress response, characterized by an increase in stress hormones such as cortisol, which is considered to be a major "stress hormone," and catecholamines such as epinephrine; 2) a secondary stress response, characterized by a change in blood parameters (e.g., lactate); 3) and a tertiary stress response, characterized by decreased reproductive activity, immunosuppression, and ultimately, death (Santulli et al. 1999, Barton 2002, Wingfield and Sapolsky 2003). When exposed to loud (160 dB re 1µPa), broadband noise, some fish exhibit an increase in cortisol after 10 minutes (Smith et al. 2004). Another study demonstrated that some fish exhibit an increase in cortisol levels following exposure to boat engine noise (Wysocki et al. 2006).

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36. Following airgun firing, fish have been shown to exhibit characteristic primary and secondary stress responses, including changes in cortisol (immediate increase), glucose (increase), lactate (increase), ADP (increase), and ATP levels (decrease); these parameters returned to baseline values after 72 hours (Santulli et al 1999). While fish seem to recover after limited exposure to airgun activity, repeated or sustained airgun activity can lead to chronic stress, directly affecting reproduction and adult abundance (Santulli et al. 1999)

37. Studies of impacts of seismic surveys on fisheries indicate large-scale displacement of some species. In the area of seismic surveys, catch rates of different fish species decrease (Engås et al. 1996, Streever et al. 2016). Engås et al. observed average decreases in haddock and cod catches of 21% for longlines and 50% for trawling, within a roughly 3000 km^2 area around an airgun survey, and did not return to pre-survey levels during the five days of study that followed. Fish catch within the immediate survey area (104 km^2) declined by 45-70%. Arctic researchers observed sustained declines in fish catches in Alaskan waters during periods of seismic airgun activity (Streever et al. 2016). The question is whether these decreased catches were due to increased fish mortality or habitat abandonment; but either scenario would be concerning, as they could lead to longer-term declines if airgun surveys are sustained or if fish fail to return.

38. Similarly, a seismic survey caused a 78% decrease in fish abundance on an Atlantic coral reef at night, the period when reef wildlife was ordinarily most active, although the survey came no closer than about 8 km (Paxton et al. 2017). These studies suggest that seismic surveys occurring near locations of high fish abundance could lead to major disruptions in fish habitat use or abandonment of important habitats, and are consistent with the short-term behavioral responses observed in caged-fish studies.

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39 Most soniferous fish species primarily communicate in the 100-1000 Hz frequency band, the same range of maximum acoustic energy in airgun sounds. Airgun usage introduces the likelihood of large-scale masking for fish in different behavioral contexts. Some fish use contact calls to maintain school cohesion (van Oosterom et al. 2016), and these sounds are susceptible to masking from low-frequency anthropogenic noise sources (Putland et al. 2018). Additionally, the long-duration, low-frequency choruses of fish, which are critical to reproductive success, overlap with the frequency range of airguns (Parsons et al. 2016, Rice et al. 2016, Rice et al. 2017). Sustained airgun surveys have the likelihood of disrupting these choruses, which are critical for these species' reproductive success

40. It is important to note that controlled scientific experiments investigating seismic survey impacts on fishes and invertebrates are typically conducted with a single airgun (Popper et al. 2005). For example, the studies on zooplankton impacts (McCauley et al. 2017; Fields et al. 2019) used either a single airgun or two airguns (respectively), with a volume that is substantially smaller than some of the individual airguns that will be deployed during the authorized surveys as part of large, multi-airgun arrays. Thus, much of the experimental science does not accurately reflect the larger scale at which airguns are commonly used during exploration and therefore tends to underestimate the injury and behavioral responses they induce in aquatic organisms.

Possible Adverse Effects on Marine Mammals, Fishes and Invertebrates along South Africa's Eastern Coast

41. If allowed to go forward, the authorized surveys will occur in waters off the eastern of South Africa. Includes migratory routes of marine mammals, extensive fisheries, and

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habitat of high diversity and abundance of fish and invertebrate species. Such biologically important habitat includes widespread temperate reef habitats and a large amount of designated Essential Fish Habitat, supporting hundreds of different species.

42. For fish and invertebrate species, the adverse effects of the authorized surveys would not be transient, short duration, or limited in its range. The noise produced by multiple large-scale surveys would be temporally and spatially pervasive within the region, due to the nature of the large-array seismic source and the amount of authorized activity (see Estabrook et al. 2016; Wiggins et al. 2016). The surveys will expose large areas to noise that are of biological importance to fishes and invertebrates on the continental shelf, along the shelf break, and in waters further offshore for extensive portions of the year. While the survey area includes a seismic buffer zone 10 km from the coast and 2 km from nearby Marine Protected Areas, sounds from airgun surveys are likely to still saturate near-shore habitats with airgun noise, and both coastal and offshore species will experience the mortality, developmental impairment, impacts to vital function, and other harms described earlier in this declaration. The spatial extent of these proposed buffer regions are insufficient to protect these habitats from exposure from elevated sound levels due to airgun noise.

43. The mitigation measures described in the EMPr for seismic airgun surveys in the project area are unlikely to prevent serious impacts on marine life. With respect to marine mammals, fishes and invertebrates, these mitigation measures are too short in duration to account for longer-term consequences, do not fully capture the mechanisms of harm from seismic surveys, and underestimate the possible area of influence.

44. Additionally, the reliance of Marine Mammal Observers for visual detection of marine mammals are only useful for spotting marine mammals during daylight hours with good

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visibility conditions, there is a large likelihood of missing cetaceans and turtles during bad weather.

45. The EMPr further describes the use of passive acoustic monitoring to detect marine mammals, but these efforts are not described in sufficient detail to evaluate whether they would be effective or not. For example, towed arrays are commonly used for passive acoustic monitoring, but these methods are primarily effective for detecting higher-frequency vocalizations or clicks from toothed whales (e.g., Cato et al. 2010, Thode et al 2010, von Benda-Beckmann et al. 2010), as the lower frequency vocalizations from baleen whales are masked by flow noise from the moving survey vessel.

46 In evaluating the spatial extent of the influence of airgun sounds, EMPr mentions that there is a fourth spatial area with possible influence, "the zone of masking" (pg 6-16) ". . exists but is difficult to quantify." There have been numerous studies measuring or modeling the spatial area of masking for marine mammals from anthropogenic noise (Clark et al. 2009, Hatch et al 2012, Erbe 2015, Erbe et al 2016, Cholewiak et al. 2018), and this is now a relatively straightforward approach (e.g., Erbe 2015) and should be done as part of the EMPr. The EMPr states that a "safety distance" for baleen and sperm whales is the area of a 180 dB_{rms} (re: 1 µPa) and 210 dB (re: 1 µPa) for other odontocetes, yet this is approximately a 3-8x higher level of sound exposure than would be permitted under U.S. National Marine Fisheries Service regulations (NMFS 2018).

47. The EMPr asserts that impact from airgun surveys is negligible and short term (pg 6-18), but this assessment was made before the McCauley et al. (2017) study.

48. Since the EMPr was drafted, there has been a considerable amount of survey data made available. The proposed survey area does not include any quantitative data on the

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occurrence of marine mammals or sea turtles, nor does it include any predictive modeling of sound fields by seismic airgun surveys (Keen et al. 2018) or risk assessments related to the population level consequences of marine organisms from airgun surveys (Farmer et al. 2018. Slabbekoorn et al. 2019).

49. The 2020 Compliance Audit of the 2013 EMPr states that the original proposed measures "sufficiently provide for the avoidance, management and mitigation of key environmental impacts identified and no recommendation for the update of the EMPr is considered necessary." This audit recommends that sea turtles should be included in visual monitoring before airgun firing, however, the spatial distance to harm or harassment of turtles from seismic airguns likely exceeds the 500 m visual detection range of protected species observers, particularly during night time or poor visibility conditions (Popper et al 2014).

50. Additionally, the 2020 Compliance Audit presents no new ecological or environmental data on the seasonal or spatial occurrence of protected or sensitive species or any new sound modeling demonstrating a decreased likelihood of impact from elevated noise levels from the seismic survey.

51. The 2020 Compliance Audit indicates that at 46 of the EMPr mitigation measures are not currently applicable (NCA), since airgun surveys have not started, and the 2 topics deemed to be in compliance – EMPr approval by PASA and protocol for a close-out report– have nothing to do with any updated or improved environmental compliance measures, and offers no improvement on previously insufficient monitoring and mitigation measures.

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IN THE HIGH COURT OF SOUTH AFRICA
(EASTERN CAPE DIVISION, GRAHAMSTOWN)

Case No: 3941/2021

In the matter between:

SUSTAINING THE WILD COAST AND OTHERS Applicants

and

MINISTER OF MINERAL RESOURCES AND ENERGY AND OTHERS Respondents

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SUPPORTING AFFIDAVIT

I, the undersigned,

DOUGLAS NOWACEK

do hereby make oath and say:

1 I am an adult male and the Repass-Rodgers Chair of Marine Conservation Technology in the Nicholas School of the Environment and the Edmund T. Pratt School of Engineering, at Duke University in Durham, North Carolina, United States of America.

2 The contents of this affidavit are to the best of my knowledge true and correct. Unless I indicate otherwise, or the contrary appears from the context, they are within my personal knowledge and belief.

3 My CV is attached marked DN1. I confirm that it is accurate.

Background and Expertise

4 I have studied the behavioral and acoustic ecology of marine animals throughout my professional career, with particular expertise in the subject of anthropogenic noise. I have authored or co-authored more than 100 publications on marine animal ecology and acoustics, with about one quarter of those papers and reports specifically focused on ocean noise, from analyses of acoustic sources to impacts on marine animals to the mitigation of those impacts.

5 In January of 2019 I provided an expert declaration that was filed in a United States court and which provided the court with a summary of scientific evidence about the impacts of seismic airguns on marine life, and in particular on North Atlantic right whales ("Expert Declaration"). Because of the short timeframe and urgency of this matter, I attach and incorporate herein the Expert Declaration (attached marked DN2), and use this declaration to clarify the Expert Declaration's applicability to the proposed seismic survey at issue here and identify other applicable scientific evidence (attached marked DN3).

6 I continue in my role at Duke University as the Repass-Rodgers Chair of Marine Conservation Technology in the Nicholas School of the Environment and the Edmund T. Pratt School of Engineering, at Duke University. The Expert Declaration describes in more detail my experience and background. Expert Decl. ¶¶ 2- 4.

7 For this opinion, I have reviewed Shell Exploration and Production South Africa notification letter for the Transkei Survey, dated 29 October 2021. I have also reviewed sections of the 2013 Environment Management Programme (EMPr) describing the seismic survey and mitigation measures for cetaceans. I also have reviewed the chart of threatened and protected cetacean, bird and fish species present in the survey area included in the report by Simon Elwin and Tess Gridley, dated 2 December 2021.

8 It is my understanding that the EMPr for the project was completed in 2013. According to the EMPr, a vessel will tow an airgun array with up to 12 or more lines of hydrophones spaced 5 to 10 meters apart and between 3 and 25 meters below the water surface. The array can be upwards of 12,000 meters long and 1,200 meters wide. The airgun would be fired at approximately 10 to 20 second intervals, and would be expected to produce sound levels of around 220 decibels.

Expert Declaration's Conclusions May be Applied to Seismic Surveying Activities in South Africa

9 My Expert Declaration describes how seismic airgun noise travels in the ocean and discusses harms from seismic surveys to marine mammals, Expert Decl. ¶¶ 7- 15. I summarize some of the key points below.

10 Seismic airgun noise has a number of characteristics that give it a remarkably large acoustic footprint. The sounds that seismic arrays produce are among the loudest that humans regularly introduce into the ocean, exceeded only by the occasional

use of explosives. Seismic noise can also travel great distances and has been heard at distances of up to nearly 4000 kilometers (km). Seismic airgun noise also has a broad temporal scale. While airgun arrays are loudest when they are firing, they also significantly elevate background levels of noise between shots. The sound that results is said to "spread" across the interval between pulses, becoming virtually continuous at distance. Seismic airguns are, in effect, a hybrid source, producing both a powerful impulsive sound that can be damaging if the receiver is too close and a virtually continuous sound that raises ambient noise levels at much greater distances. Expert Decl. ¶¶ 37-38. Thus, marine animals exposed to noise from seismic airguns must contend with both loud individual pulses every 10 to 15 seconds and with continuous reverberating energy in the periods between the pulses.

11 In addition to describing these general harms, my Expert Declaration focuses in detail on the impacts to North Atlantic right whales from acoustic surveys, Expert Decl. ¶¶ 16 – 39, relying on, as well, studies on baleen and bowhead whales to draw informed opinions. Expert Decl. ¶ 18. North Atlantic right whales, *Eubalaena glacialis*, are the same genus as Southern right whales, *Eubalaena australis*, which are found in the Transkei seismic survey area between July and November. Because they are from the same genus, scientifically the studies and general conclusions (i.e. those that do not relate to activities or bathymetry specific to the Atlantic) may be interchangeably applied.

12 Studies on bowhead and other baleen can be relied upon to make informed opinions about other whales that are in the Shell survey area because baleen whales are all members of the sub-order *Mysticeti*, and share common features amongst themselves; this makes them appropriate proxies for assessing impacts on other baleen whales found in the seismic surveying area. According to the 2013 EMPr, the baleen whales in the seismic survey area include: Southern right whales (*Eubalaena australis*), Humpback whales (*Megaptera novaeangliae*), Minke (*Balaenoptera bonaerensis*), Dwarf minke (*Balaenoptera acutorostrata*), Fin whale (*Balaenoptera physalus*), Antarctic blue whale (*Balaenoptera musculus musculus*), Sei whale (*Balaenoptera borealis*), Bryde's (inshore) (*Balaenoptera brydei (edeni)*), and Pygmy right (*Caperea marginata*). While we have very limited data on many of the species in this list, the general conclusions about impacts (i.e. those that do not relate to activities or bathymetry specific to the Atlantic) may be applied to the baleen whales that will subject to seismic surveys taking place in the Transkei.

13 The following main findings from my Expert Declaration are applicable to the Transkei survey:

13.1 Noise from the seismic activity will likely adversely impact the cetaceans in at least three ways: 1) by inducing a physiological stress response; 2) by disrupting biologically essential behavior such as vocalizing, mating, or foraging; and 3) by masking acoustic communication, including communication between mothers and calves, Expert Decl. ¶¶ 19 – 39.

13.2 The noise from seismic surveys would be felt by cetaceans over large areas of ocean because sound travels farther and faster in water than in air and the acoustic energy from airguns can propagate hundreds to thousands of kilometers in marine environments. Expert Decl. ¶¶ 7– 15, 35 – 39.

13.3 The noise from seismic surveys experienced by sound-dependent marine animals, would not be limited to the pulse of the airgun shot and includes an increase in the median ambient noise in the ocean even at a distance of 100 kilometers. Expert Decl. ¶¶ 35 – 39.

13.4 Mitigation measures such as time-area closures, visual observers, and passive acoustic monitoring and "soft starts" or "ramp ups" are inadequate to protect cetaceans present year-round or deep-diving beaked whales. Expert Decl. ¶¶ 40 – 47.

Scientific Understanding of Acoustic Impacts on Marine Animals Has Evolved Since 2013

14 Like the ocean, science is dynamic. The field of acoustics in the marine environment has evolved substantially since 2013 when the EMPr was completed.

15 The EMPr, even prior to the consideration of the lowering effect of mitigation factors, found overall impacts to marine animals by seismic noise during the operational phase of activities that ranged from negligible (phytoplankton & zooplankton; invertebrates, including squid) to low (fish; turtles; seabirds, including penguins) to

medium (cetaceans). EMPr 6-11 to 6-42, and table 6.3 at 6-53 to 6-54. Recent scientific literature that was not considered in 2013 contradicts these findings.

16 A 2021 literature review provided a systematic assessment of 536 scientific papers relating to the "effects of impacts of anthrophony and other human alterations to ocean soundscapes on marine animals" (Duarte et al., 2021). The review examined published literature since 1970 and demonstrated that there was a significant post-2010 uptick in published papers on the subject (Duarte et al., 2021). That same review demonstrated that 74.4% of those studies statistically testing the impacts of seismic surveys on marine animals found significant negative impacts to these animals from the surveys (medium-high confidence) (Duarte et al., 2021). For another example, a 2017 study found that a single airgun blast kills over 50% of zooplankton within a 1 kilometer radius, contradicting the 2013 EMPr's assertion that the seismic surveys will have negligible impacts on phytoplankton and zooplankton (McCauley et al., 2017). As an intermediary between primary producers (plankton) and fish, marine mammals, and birds, zooplankton are vital to ocean productivity and healthy ocean ecosystems. Similarly, while the EMPr found a medium impact on cetaceans, scientists have found that even slight disturbances which result in the displacement of acoustically sensitive beaked whales may have population level effects, certainly an impact beyond medium significance. (New, 2013).

17 Lastly, important studies have taken place prior to and since 2013 that demonstrate the harms of seismic testing and anthropogenic noise on cetaceans. Post-2013

studies include examples of negative effects on cetaceans generally (Dunlap et al. 2021; Gomez et al., 2016; Castellote and Lorens, 2016; Nowacek et al. 2015) and specifically on physiological stress effects (Expert Decl. ¶¶ 20 – 23; Lemos et al., 2021 – gray whales); behavioral disruptions (Expert Decl. ¶¶ 24-31; Dunlop, 2015, 2020 – humpback whales; Bröker et al., 2015 - gray whales; Miller et al., 2015 & DeRuiter et al., 2013 – beaked whales, Pirotta et al., 2014 - porpoises), and communication disruptions (Expert Decl. ¶¶ 32-34; Tennessen and Parks 2016 - North Atlantic right whales; Cerchio et al., 2014 – humpbacks; Blackwell et al., 2013, 2015 – bowhead whales).

18 Since 2013, we have also come to understand much better how seismic gun noise is not limited to the airgun pulses themselves, but also increases ambient noise. Expert Decl. ¶¶ 35-39.

19 Lastly, presence and abundance can change in an eight-year period. Climate change for example is increasingly causing shifts in the timing and duration of migrations, changes in distribution, habitat lose, and reduced fecundity (van Weelden et al. 2021). Notably, at the time of the EMPr in 2013, humpback whales were presumed to be seasonal in the surveying area. See Table 6.4 of EMPr at 6-54. Without accurate data on which species are in the seismic survey area, how many, and when, there is a significant risk that mitigation measures could be rendered ineffectual.

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Modeling

20 It is standard practice in the United States to model the acoustic footprint of the proposed survey over appropriate time and space scales. The effects could extend over hundreds of square kilometers. The EMPr contains no such modelling.

21 In addition, such modeling must analyze the aggregate sound field, not just the specific airgun survey, to estimate the overall influences of changes in the acoustic environment at appropriate ecological scales, the potential impacts on marine life, and the potential effects on populations (Southall et al., 2013). Given our rapidly improving understanding of the spatial, temporal, and spectral scales of the acoustic footprints generated by these seismic activities, the single-source regulatory approach is no longer appropriate (Southall et al., 2021; Nowacek et al., 2015).

22 Without acoustic modeling, the EMPr could not have accurately assessed the harms that the seismic survey could cause.

Mitigation Measures

23 An assessment for the harms of a seismic surveying activity that does not use the most current science and does not contain acoustic modeling cannot accurately assess the harms that this seismic surveying will cause. This means that mitigation measures could be inutile and misdirected. The mitigation measures proposed for seismic surveying in the Transkei include measures such as using visual observers,

passive acoustic monitoring, and the use of a "ramp-up" or a "soft start." These may be ineffective. The essential point is that, without any modelling, it is simply not possible to conclude that mitigation measures are effective at either reducing or eliminating harm.

24 In discussing the residual impact on cetaceans after mitigation measures, the EMPr characterizes the duration of the surveying activities of four-five months as "short." EMPr at 6-42. Four to five months of continuous seismic in an area of 6,011 km^2 is not short, particularly in the context of seasonal use of the area by a sensitive marine mammal. This is especially true when the data relied upon are at least eight years old.

Conclusion

25 In my opinion, the Transkei seismic survey which lasts four to five months will likely cause harm to marine mammals. The EMPr assessment did not use acoustic modeling and relied upon what is now eight-year old science regarding acoustic impacts on marine species and outdated information on the presence and abundance of animals in the seismic surveying area. Therefore, the proposed mitigation measures are of unknown efficacy, because the acoustic footprint of the survey remains unknown.

DOUGLAS NOWACEK

Thus signed and sworn to before me at _____ on this _____ day of _____ 2021 by the deponent who has acknowledged that he knows and understands the contents of this affidavit, that he has no objection to taking the prescribed oath and that the prescribed oath is binding on his conscience.

_____

NOTARY PUBLIC

NAME:
CAPACITY:
ADDRESS:

"A11.2.1"

DOUGLAS NOWACEK

Thus signed and sworn to before me at 8:44 AM on this 9 day of December 2021 by the deponent who has acknowledged that he knows and understands the contents of this affidavit, that he has no objection to taking the prescribed oath and that the prescribed oath is binding on his conscience.

KATHERINE M PIVA NOTARY PUBLIC CARTERET COUNTY, NC

NOTARY PUBLIC

NAME: Katherine M. Piva
CAPACITY: Notary
ADDRESS: Carteret County, NC.

5C28

IN THE HIGH COURT OF SOUTH AFRICA
(WESTERN CAPE DIVISION, CAPE TOWN)
Case No: _____/___

In the matter between:

Applicants

CHRISTIAN ADAMS AND OTHERS

and

MINISTER OF MINERAL RESOURCES AND ENERGY AND OTHERS

Respondents

EXPERT AFFIDAVIT

I, the undersigned

JEAN MARY HARRIS

do hereby make oath and say as follows:

1. I am an adult female marine scientist, and am currently the Executive Director of WILDOCEANS, the marine programme of the Wildlands Conservation Trust (WILDTRUST), an NGO focused on biodiversity protection and building socio-ecological resilience in Southern Africa and the western Indian Ocean.

2. The facts contained in this affidavit are within my personal knowledge, except where the context indicates otherwise, and are to the best of my belief both true and correct.

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3. Together with Dr Jennifer Olbers and Dr Kendyl Wright, I have prepared the report annexed hereto marked "JHH".

4. My qualifications and experience are set out in a copy of my *curriculum vitae*, attached to this affidavit marked "JH2". I respectfully submit that I am qualified by my qualifications, training and experience to express the expert opinions which are set out in the report referred to above.

5. I further confirm that the report is to the best of my knowledge and belief true and correct.

JEAN MARY HARRIS

I hereby certify that the deponent has acknowledged that she:

(a) knows and understands the contents of this affidavit;
(b) has no objection to taking the oath;
(c) considers the oath to be binding on her conscience.

Thus signed and sworn to before me, at on January 2022.

JGR

38

L.S. Khathi

COMMISSIONER OF OATHS

NAME: L.S. Khathi
CAPACITY: Sergeant
ADDRESS: 133 Hoosen Haffajee Dr
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SOUTH AFRICAN POLICE SERVICE
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REPORT ON SCIENTIFIC BASIS FOR CONCERNS OF SIGNIFICANT HARM INFLICTED TO MARINE WILDLIFE BY 2D and 3D SEISMIC SURVEYS ON THE SOUTH AND WEST COASTS OF SOUTH AFRICA

Harris JM, Olbers JM, Wright K

14 January 2022

This report provides a summary of key findings in peer-reviewed literature on the physiological and ecological impacts of seismic survey activities on marine wildlife, with specific attention to the relevance of the information to the context of the Reconnaissance Permit Area (~297 099 km²) applied for by Searcher Geodata UK Limited, located offshore between the South African/Namibian border and Cape Agulhas, as well as with regards to vulnerable and endangered species known to occur in this area, with consideration of the proposed timing of the seismic survey operations being during the austral summer months. Having carefully considered the available information it is our opinion that seismic surveys do cause harm to both species and ecosystems, and that significant direct harm to individual animals and harm to populations of endangered species is the most likely scenario in the case of the seismic surveys off the south and west coasts of South Africa. Of specific concern is the impact on humpback whales and southern right whales which are still frequenting the west coast during the summer months (December – February), the impact on critically endangered (leatherback) turtles (migration routes in the area), the critically endangered African Penguin (changes in foraging behaviour and impacts on fitness) and the Cape fur seal (and consideration of current mass die-offs). We conclude that these seismic surveys are inadvisable in austral summer months due to the presence of these species in the area, the increasing anthropogenic pressures, and the inability of the prescribed mitigation measures preventing harm to individuals/populations. Furthermore, recent literature provides credible concern about ecosystem/food-chain impacts of seismic surveys, that may in turn have impact on fisheries, the severity and localisation of which will depend on coincidences with spawning and juvenile recruitment events. It is strongly recommended that further studies on

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these impacts, in the South African context, are carried out *in situ* before proceeding with further seismic surveys of this nature.

Summary of Findings

- Based on peer-reviewed scientific literature, it is clear that physical damage to marine animals, including soft tissue trauma damage, embolisms, damage to organs used in balance and orientation, concussions, haemorrhaging, decompression sickness and both temporary and permanent threshold shifts to hearing ability have been directly linked to the kind and level of sound emitted during this nature of seismic surveys.
- There is plausible evidence to suggest that seismic survey activity is likely to affect the conservation status and recovery of populations of vulnerable and threatened species including (IUCN Red list species such as humpback and southern right whales), because sound and the ability to hear and interpret sound is critical for many species to reproduce (both vocalisations on breeding grounds and communications across large distances for mate detection). Therefore, it must be assumed that interference in sound perception or utilisation for communication (temporarily or permanently) has the potential to impact a species at the population level.
- Some species have been shown and documented to display physiological stress responses and behavioural changes to seismic activities, such as moving away rapidly, diving or remaining still. These responses are likely to increase their energy consumption and energy costs, reduce their time to forage, and/or affect their vulnerability to predation, thus having negative impacts on the survival of individuals (especially young or compromised animals) as well as the overall population growth and survival of a species (especially for threatened species that are already at risk of extinction).
- The impacts of seismic activities are most well studied for marine mammals, and evidence suggests that there are distinct avoidance responses such as leaving the area or ceasing to undertake everyday activities such as feeding in preferred areas. This is likely to negatively impact the "fitness" of an affected animal.

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- There is genuine conservation concern for beaked whales that are particularly sensitive to anthropogenic noise, including seismic surveys. It has been demonstrated that even minor, non-lethal disturbances, resulting in changes in behaviour such as displacement from preferred habitats, could impact a population.
- The only existing field study in South Africa (that we have been able to find) on the impacts of seismic activities in our waters is illuminating in this regard. It presents clear evidence that the endangered, endemic African penguin avoided preferred feeding sites when a seismic survey was active nearby. This is particularly of concern for a species which has had a 70% decrease in numbers over the past decade, is stressed by prey depletion creating a greater demand for them to forage further afield, and for which the prospect of extinction is significant.
- The phenomenon of energy-cost (from stress and avoidance behaviour) is of particular concern for some of the species expected to be encountered in the survey area in question, particularly the humpback whales and southern right whales who are at risk of the airgun noise affecting their behaviour or interfering with the communication between mother and calf. Any impact on their energy reserves could impact on their condition (weight-loss and physiological condition) and affect survival of the animals during a vulnerable time (especially for lactating mothers and their calves) on their long migration to feeding grounds in Antarctica.
- Recent research (2017) has shown significant mortality in zooplankton up to 1.2 km from a seismic survey array. Zooplankton forms the base of many important food webs in the marine environment. Depletion of zooplankton could thus have an impact on food for their predators (such as fish) as well as impact fish eggs and larvae (ichthyoplankton) with potential local impacts on species important in fisheries. This damage to zooplankton over 1km away from the survey array raises concern that a 500m buffer for other animals that are unable to move away from the sound, is far too small to ensure that damage is not inflicted (even if they were able to evade it).
- The impact on fish assemblages is difficult to interpret, due to multiple factors at play including but not limited to the ability of a species to move from an area as well as the receiving habitat. A global review of the effect of seismic activities on fish and invertebrates acknowledged the limits

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of the current research due to experimental designs used or due to the focus on single species during investigations. A key concern is a lack of research focused on confounding effects and multiple stressors, therefore potential impacts of seismic surveys that have been previously identified may be reflective of underestimation or overestimation and would depend on the type of interaction (synergistic, additive, or antagonistic).

- In South Africa, since October 2021, thousands of dead and/or dying Cape fur seals (*Arctocephalus pusillus pusillus*), have washed ashore along the south and west coasts. The cause of these die-offs remains unknown but avian flu has been ruled out and malnourishment appears to be the most widely accepted reason. It is of concern that although the cape fur seal population within South Africa is relatively healthy, they too are under pressure from various anthropogenic pressures. Additional stress from seismic activity at this time is inadvisable.
- While "Soft starts" mitigation for seismic impacts are likely to reduce the impact for highly mobile large animals, this is unlikely to be adequate for the many species that are prevalent in the area over the austral summer months and are unable to avoid the array or leave the area due to their lower mobility, such as smaller turtles, penguins, invertebrates, some fish species and zooplankton.
- The finding of observer efficiency (from a scientific monitoring study conducted during the 2018/19 and 2019/2020 seasons on the humpback whales on the east coast) suggests that even with trained observers up to 44% of humpback whales in an area went undetected. This casts doubt on the effectiveness and success of Marine Mammal Observer (MMO) sightings of the largest species (humpbacks) as a mitigation measure, indicating that it is most likely that whales go undetected. Furthermore, the detection rate for smaller species, such as dolphins, seals, turtles and flightless birds (penguins), would be expected to be much lower, obviating the effectiveness of visual observations to prevent harm to these species.
- Also of concern, is that the efficacy of Marine Mammal Observers (MMO) is likely to be low due to the nature of the offshore marine environment in the survey area (frequent high swells and

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winds affecting surface visibility), putting species who are missed by MMO's and PAM operators at extreme risk, particularly at night or during adverse weather conditions.

- Furthermore, the reliance on Observers to do visual sightings to supplement the PAM monitoring during the day, as a mandated mitigation measure, necessitates that we question the acceptability of continuing with survey activities at night. If the visual observations are useful (perhaps sighting large animals around 65% of the time) in addition to PAM, then relying on PAM alone at night cannot be an effective mitigation measure. It is our opinion that surveys should not occur between sunset and sunrise each day if a genuine attempt of maximum avoidance of cetaceans is the objective of this mitigation measure.
- It is of our opinion that the proposed seismic survey activities are highly likely to both disturb and have an adverse effect on Marine Protected Areas (MPA), Critical Biodiversity Areas (CBA) and Ecologically or Biologically Significant Areas (EBSAs), and their associated fauna, situated adjacent to, within and surrounded by the reconnaissance permit area. The reconnaissance permit area occurs adjacent to six Marine Protected Areas and surrounds a seventh (Benguela Muds MPA). In the EMP, there is no reference or provision made regarding buffer areas around these protected areas or for areas identified with biological importance and significance. Therefore, it is assumed that the vessel can actively work within 1 km of the MPA boundaries, while ignoring EBSA's and CBA's altogether, thus giving no consideration to the biological importance of these areas or the likely impact at such close range. Although 2D surveys are proposed for these adjacent areas, the cumulative zone of impact for Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS) for physiological injury is between 500 - 5000m respectively.

Global context – impacts of seismic surveys on marine wildlife

Despite seismic surveys having been undertaken for decades in South African waters, together with the knowledge that some impact to marine fauna does indeed occur[1], there remains very little

[1] https://jncc.gov.uk/our-work/marine-mammals-and-noise-mitigation: "to reduce the risk of deliberate injury to marine mammals".

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scientific research on the effects of seismic surveys, and in addition there are no legislated guidelines for seismic surveys in South African waters (Pardon 2016). Globally, seismic surveys' environmental impacts and consequences are slightly better documented, although not uniform in results or widely accepted within all sectors. The primary mitigation measures for seismic surveys in South Africa include soft-starts, which is a gradual and systematic increase in power of the airgun array undertaken to warn and drive mobile marine species, such as cetaceans (whales and dolphins), seals, flightless birds and turtles away from the sound source before the full-power airgun blasts begin, thus attempting to minimise the negative effects of the airgun blasting activity. Various studies contest this assumption (McCauley et al. 2000; Weilgart 2013; Dunlop et al. 2016) and have revealed a growing concern for animals that are unable to avoid or out-swim the airgun arrays.

Animals use sound critical to their life cycles (Jasny et al. 2005) in three ways, by actively producing sound (Tyack 1981), by listening to sounds emitted by other living organisms (Clark et al. 2009, Van Opzeeland 2010), and taking cues from physical or non-living factors producing sounds, contributing to the ambient background noise, such as wind, waves, swell, bubbles, currents, turbulence, earthquakes, rainfall, ice cracking or breaking (Hildebrand 2005). Many marine animals produce sound for communication, reproduction, aggression, defence mechanisms, antagonistic interactions, courtship, group coordination, orientation, navigation, and prey identification (Hildebrand 2006). They rely on producing a sound that is heard while hearing a sound and interpreting the sound for their survival.

Various physical responses to acoustic disturbance have been documented, with physical responses including soft tissue damage (Balcomb and Claridge 2001), embolisms (Dolman and Simmonds 2005), damage to organs used in balance (André et al. 2011), concussions in penguins (Cooper 1982), haemorrhaging (Evans et al. 2001) and decompression sickness (Fernández et al. 2005). Hearing impairment in the form of Temporary Threshold Shift (TTS) or Permanent Threshold Shift (PTS) has also been reported (Hildebrand 2009). Threshold shift refers to an increase in the minimum sound level required for an animal to hear a sound. A TTS is followed by successful recovery to normal

hearing thresholds after a given period of time in the absence of that sound, while PTS is when the sensory hair cells in the inner ear are permanently damaged and lost making recovery impossible (Weilgart 2013).

Stress caused by disturbance is associated with a change in body chemistry (Jasny et al. 2005) and can be equally disruptive as physical damage. Stress has implications on sexual maturation, inhibits growth, reproduction and general survival ability (Pickering 1982; McCormick 1998; Constan et al. 2001). Perceptual effects can occur when there is an interference of sounds of interest to a specific animal but are being drowned out or masked by anthropogenic noise. The impact of this in the long term could have implications on breeding populations, thus on reproduction within a population (Erbe 2001). Many animals may have the ability to counteract this and make minor changes to their vocalisations and behaviour; however, these modifications may come at a cost in terms of energy expenditure (Tyack 2008) and are likely to reduce breeding productivity of the population. This is of particular concern for species that are threatened.

Behavioural responses to noise are dependent on various factors, such as age, sex, presence of offspring, location and an individual animals' previous encounter with a specific sound or noise. Behavioural responses may include modification of vocal behaviour, displacement from important habitats, and other subtle responses, including increased breathing rates, change in dive duration, time spent at the surface, rapid or erratic movements (Bowles et al. 1994; Lesage et al. 1999; Williams et al. 2002; Nieste et al. 2003; Ng and Leung 2003; Aguilar de Soto et al. 2006). These all with potentially high energetic costs (Williams et al. 2006; Koper and Plön 2012).

Most scientific research on the impacts of seismic surveys has been conducted on odontocetes, and as a result, most mitigation measures are to protect these animals. In South Africa, this is no different. However, it is becoming more and more evident that mitigation measures are not adequate (Weilgart 2013). In the Gulf of Mexico, it was recorded that ~250 male fin whales appeared to stop singing for several weeks to months during a seismic survey. These animals resumed singing within hours or

days after the survey ended (IWC 2007). The assumption is that male fin whales use vocalisations for reproduction by finding and attracting mates (Croll et al. 2002); it can only be assumed that such an effect would be biologically significant (Weilgart 2013). In addition to this, a blue whale ceased calling in the presence of a seismic survey at 10 km away (Macdonald et al. 1995). Conversely, a different group of blue whales appeared to have the opposite reaction. They changed their vocalisations (De Lorio et al. 2010) by calling consistently more on days when the seismic surveys were actively ongoing, suggesting that seismic survey noise interfered with important signals used in their social interactions and feeding (De Lorio et al. 2010).

Other reactions to seismic airguns can be subtle or hard to detect (Weilgart 2013) and it has been found that Sperm whales in the Gulf of Mexico did not appear to avoid a seismic airgun survey area but reduced their swimming effort and their tendency to reduce foraging effort (Miller et al. 2009). It has also been documented that as a result of changes in behaviour, the result could be lower reproductive rates and have negative consequences for the population (Miller et al. 2009). In comparison, bowhead whales showed no avoidance or change in vocalisations in the area of seismic surveys; however, their dive duration was shorter (Richardson et al. 1986). In Brazil, a reduction in cetacean species diversity during 2000 and 2001 was noted with the increased occurrence of seismic surveys in the area being implicated in the possible cause of these animals vacating the area (Parente et al. 2007). In other areas, marine mammals have been recorded to avoid seismic noise by leaving an area (Castellote et al. 2012; Weir 2008; Stone and Tasker 2006). The long-term impacts of various changes in behaviour is largely unknown but potentially impact their ability to feed and/or reproduce as in some species, these life-history stages are site or habitat-specific.

South Africa's south and west coasts are home to eight species of beaked whales (Ziphiidae) (Best 2007), including a new species described in 2021 (*Mesoplodon eueu*; Carroll et al. 2021), which are globally recognised as being sensitive to anthropogenic noise, and having raised conservation concerns. New et al. (2013) found that adult female beaked whales could survive but not reproduce in times or areas of lower habitat quality. They may extend the duration of lactation in mediocre

conditions to increase their chance of survival, while still reproducing. New et al. (2013) found that some beaked whale species require high-quality habitat to meet their requirements for reproduction and survival. They suggested that even minor, non-lethal disturbances, resulting in changes in behaviour such as displacement from preferred habitats, could impact a population.

McEwen and Wingfield (2003) suggested that all organisms must gather energy for growth and reproduction throughout their life cycle and that organisms must retain reserves for predictable changes such as seasons, and challenges that are less predictable such as disturbance, predation pressure, or social conflict. Often colloquially, this is referred to as the "fitness" of the animal. The accumulated cost in the balance between energy intake and demand is called the 'allostatic load', of physiological and behavioural mechanisms that enable allostasis or adaptation to these changes. McEwen and Wingfield (2003) use the word "allostasis" to signify mechanisms that allow an organism to regain equilibrium while dealing with external challenges: if energy demand is more than intake, then animals may activate a survival mode that may increase energy available, reduce energy demand, or both, to regain its energy balance. Implications on individuals and populations of this energy imbalance are unknown.

Several studies have reported negative impacts of acoustic signals from airguns on zooplankton (small, aquatic microorganisms living in the water column, including crustaceans, larvae, juvenile fish, juvenile invertebrates, eggs etc.) from more than 10m away (Kostyuchenko 1972; Kosheleva 1992; Parry *et al.* 2002) with some laboratory experiments on lobster larvae showing no impact at all (Day *et al.* 2016). However, Christian *et al.* (2003), showed retardation in some individuals in the development of snow crab eggs after being exposed to certain sound levels.

The effects of seismic noise on zooplankton were brought under the spotlight when McCauley *et al.* (2017) presented evidence from an in-situ study that suggested that seismic surveys cause significant mortality to zooplankton populations. Zooplankton, unlike vertebrates, do not have hearing structures (although they can sense pressure change) and their bodies are generally the same density as the

surrounding water, so sudden pressure changes associated with seismic activities were presumed not to cause physical damage (Parry and Gason 2006). McCauley *et al.* (2017) disputed this and has shown zooplankton mortality at distances of up to 1.2km from the sound source.

Similarly, inconsistent findings occur with fish assemblages. The impacts on fish assemblages are difficult to interpret, because of multiple factors at play including but not limited to the ability of a species to move from an area as well as the receiving habitat. We acknowledge the validity of the results presented by Meekan et al. (2021) which highlights that exposure to an experimental seismic source did not have an impact on the assemblage of tropical demersal fishes found along the northwest shelf of Western Australia. However, it must be noted that the findings have been stated to be applicable only to other habitats with similar physical environments, in particular similar water depths (50 – 70 m). The proposed reconnaissance permit area on the south and west coasts of South Africa differs significantly from those reported in the Meekan et al. (2021) research, thus highlighting the need for South African-specific and local research to be undertaken.

A global review of the effect of seismic activities on fish and invertebrates by Carroll et al. (2017) acknowledged the limits of the available research due to experimental design, or to the focus on single species which prevents extrapolation to other regions, other seismic surveys, species, or biological responses. In addition, they highlighted a serious concern, that there was a lack of research focused on confounding effects and multiple stressors. Therefore potential impacts of seismic surveys which had previously been identified may be reflective of under-estimation or over-estimation and would depend on the type of interaction (i.e. synergistic, additive, or antagonistic).

Furthermore, the indirect effects of seismic activity on cetaceans is a concern. It is well known that the productivity and health of the oceans are under-pinned by marine plankton (Raymont 1983; Alcaraz & Calbet 2009). While forming the basis of the food webs, plankton has been implicated in links to climate change via their role in iron fertilisation and carbon sequestration through whales foraging on krill and subsequent defecation (Smetacek and Nicol 2005; Smetacek 2006; Nicol et al.

2010). In 2010, Pershing et al. suggested that over-fishing of large fish and commercial whaling had compromised the ocean's ability to store and sequester carbon, thus contributing to climate change. They indicated that populations of large baleen whales now store 9.1×10⁸ tonnes less carbon than before commercial whaling and that protecting whales (and other large over-exploited species), would be a form of a carbon management scheme. The cascading and knock-on effects of seismic survey impacts between the upper (cetaceans) and lower reaches (plankton) of the food web, as each are being impacted are unknown. McCauley et al. (2017) noted that the ramifications of compromised larval recruitment could be massive for higher predators and for ocean health as a whole. While traditional feeding grounds for humpback whales are in Antarctic waters, Dey et al. (2021) has recently recorded regular feeding frenzies off the west coast in recent years (see super pods below)

South Atlantic Context

It is of concern that there are a number of 'unknowns' and 'warning bells' in terms of cetacean populations on the south and west coasts. Despite various species being recorded frequently on the coasts, the location of breeding grounds of Bel (Balaenoptera borealis) and Fin whales (*Balaenoptera physalus*) are unknown, the seasonality of pygmy (*Kogia breviceps*) and dwarf (*Kogia sima*) sperm whales are unknown and the abundance and occurrence of the offshore common dolphin (*Delphinus delphis*) is also unknown, highlighting that encounters with these animals cannot be predicted and the generic mitigation measures may be insufficient. Further to this, it is noted in the EMP submitted by Searcher that the two very well-studied and frequently observed species on the south and west coasts, the humpback and southern right whales, *are expected to be regularly encountered and have a year-round occurrence across the entire reconnaissance permit area*. The period of humpback whales in this area is between July and February, with frequent feeding encounters during the months between December to February. Barendse et al. (2010), Best & Allison (2010), and Elwen et al. (2014) highlighted that there is no existing evidence of a clear 'corridor' of migration and humpback whales appear to be spread out widely across the shelf and into deeper pelagic waters, especially during the southward migration, in the Benguela ecosystem.

Further to this, the EMP itself highlights that, "*It is highly likely that several hundreds of right whales can be expected to pass through the Reconnaissance Permit Area when migrating southwards from the feeding areas between April and June*" (page 93). Apart from this going against the spirit of avoiding whale periods by the oil and gas industry, Vermeulen et al. (2020) warned that there is an observed decrease in southern right whale calving success of the South African population and a strong link between foraging success and reproduction. They suggest an investigation into possible decreases and/or spatial or temporal shifts in their prey availability at higher latitudes due to environmental variability. They also highlight a concern of the continued low numbers of unaccompanied adults along the South African coast which could potentially have serious consequences for cow-calf pairs in relation to the country's whale-watching industry in the future.

Since 2011, South Africa has witnessed 'super-pods' of up to 200 humpback whales feeding in south and west coast waters between October to January. Research by the National DFFE, in collaboration with various academic partners, has led to the discovery of these 'feeding grounds' away from their traditional feeding grounds in the Antarctic[2]. This phenomenon requires understanding the ecosystem-wide impacts and benefits, while potential human/whale conflicts remain unknown. According to Day et al. (2021), the formation of super-groups in recent years suggests that there might be a change in oceanographic or ecological characteristics which provide the conditions for this novel feeding strategy in the Southern Benguela Upwelling System. Although the humpback whale population is increasing (Wilkinson, 2021), there is evidence to suggest that cetaceans in South African waters are being affected by changes in their ecosystem and it is not well understood yet what is driving these changes and what the long terms effects could potentially be to populations.

With other mammals, it was suggested by Thompson et al. (1998) that grey seals displayed strong avoidance behavior, altered foraging behavior and suggested an increased frequency of hauling out

[2] https://www.news24.com/news24/southafrica/news/super-pods-of-humpback-whales-spotted-off-south-africas-west-coast-20210126

onto land to possibly escape the noise, while harbor seals had slower heart rates during controlled playback experiments. In contrast, during a study in shallow arctic waters, sighting rates of ringed seals (*Phoca hispida*) from a seismic vessel showed no difference when a different number of airguns were in use, did however suggest local avoidances based on distance from the sound source (Harris et al., 2001).

In South Africa, the Cape fur seals (*Arctocephalus pusillus pusillus*), is the only resident seal along the west coast, occurring at numerous breeding and non-breeding sites on South Africa's mainland and on nearshore islands and reefs. Other vagrant seals occurring along the south and west coast include the southern elephant seal (*Mirounga leonina*), subantarctic fur seal (*Arctocephalus tropicalis*), Antarctic fur seal (*Arctocephalus gazella*), crabeater (*Lobodon carcinophagus*) and leopard seals (*Hydrurga leptonyx*). Cape fur seals are highly mobile and have large foraging areas including on the continental shelf up to 120 nautical miles offshore (Shaughnessy 1979).

According to Kirkman et al 2016, several morbillivirus epidemics have occurred in true seal (Phocid) populations in the northern hemisphere and, at the time it was agreed that no epidemic diseases were known to have infected Cape Fur Seals historically, but there was a considerable risk for disease transmission to the population through exposure to domestic or feral dogs and terrestrial carnivores, potentially resulting in mass mortality. Kirkman et al. (2016) cautioned that the health of individuals and their vulnerability to disease can be affected by feeding conditions, including the availability of prey, and that risk of disease may be exacerbated by anthropogenic pressures on the ecosystem.

In South Africa, since 10 September 2021, thousands of emaciated, dying and dead Cape fur seals (*Arctocephalus pusillus pusillus*), have washed ashore along the south and west coasts. The causes of these die-offs remains unknown but avian flu has been ruled out and malnourishment appears to be the most widely accepted reason. It is of concern that although the cape fur seal population within South Africa are healthy, they too are under pressure from various anthropogenic pressures, and the EMP failed to mention this mass die-off event.

In South Africa, only a single focused study on the impact of seismic surveys has been undertaken. This study, off Gqeberha, was within the foraging area of the endangered, endemic African Penguin (*Spheniscus demersus*). Pichegru et al. (2017) demonstrated that penguins avoided their preferred foraging areas during seismic surveys and foraged further from the survey vessel when in operation. Upon termination of seismic surveys, the penguins reverted to their normal behaviour (Pichegru et al. (2017), a behaviour which was also observed in Gray whales (*Eschrichtius robustus*) off Sakhalin Island in Russia (International Whaling Commission 2008). However, the long-term effects on populations of this temporary retreat of the area are unknown. Given the results of this study by Pichegru et al.(2017), strict management measures and decisions on seismic survey activities should have been established in South Africa. Furthermore, the cumulative effect of multiple, concurrent seismic surveys within the region may cause cumulative impacts.

Significant impacts on turtle species are a concern. Adult turtles may be less vulnerable to sound damage than cetaceans as the air spaces in their cochlear are smaller than those in cetaceans, making them less sensitive to sound shockwaves (Popper et al. 2014). However, while studies have shown that adult sea turtles have a moderate ability to move from an area being surveyed (Lenhardt 1994; O'Hara and Wilcox 1990), they are prone to TTS after exposure to sound within 1 km of a sound source, with signs of recovery only two weeks after injury (Lenhardt 1994). In a study undertaken on captive turtles, it was found that loggerhead turtles (*Caretta caretta*) responded to sound by swimming to the surface and remaining there or staying slightly submerged (Lenhardt 1994), as this area, regarded as a sound shadow, and is hypothesised as being where sound waves cancel each other out and the noise is at a minimum. Cummings et al. (2004) disputed this saying that although near the surface, could be a place where animals take refuge, they are not in a 'zone of silence'. With an increasing exposure of sound levels, the behaviour of caged green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles increased their swimming speed, potentially showing agitation to sound (McCauley et al. 2000). Turtle behaviour is difficult to interpret (DeRuiter and Doukara 2012), given that some studies have reported that turtles do not display any signs of distress (Pendoley 1997).

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Globally the Leatherback turtle (*Dermochelys coriacea*) is vulnerable, but critically endangered in the Southwestern Indian Ocean where this subpopulation is declining (Nel 2010, 2012; Nel et al. 2013). Loggerhead (*Caretta caretta*) populations are globally vulnerable but near threatened in the southwest Indian Ocean (Lombard & Kyle 2014).

The nesting grounds of the southern African loggerhead (*Caretta caretta*) and leatherback turtle (*Dermochelys coriacea*) populations are located on the east coast in iSimangaliso Wetland Park. In the Autumn months, adult turtles are moving towards their nesting beaches but stay inshore to avoid the north to south flowing Agulhas current. Once they have completed their laying of eggs, they leave the shore and into the current to be carried south once again, and by late March, they will be filtered along the east and south coast in offshore waters. Both loggerhead and leatherbacks are known to occur within the reconnaissance permit area but known migration corridors of adult leatherbacks lie within the reconnaissance permit area. Harris et al. (2018) highlighted the migration path for leatherback turtles into the southeastern Atlantic (Agulhas-Benguela Corridor), through the reconnaissance permit area. Leatherback turtles inhabit deeper waters and are considered a pelagic species, travelling within the ocean currents. However, they have a moderate ability to avoid areas with an increase of noise in the water. According to Hays et al. (2004), these animals may dive to depths over 600 m and remain submerged for up to 54 minutes. Mitigation measures for turtles in seismic surveys include observers, although it is unclear how an observer would be able to observe these animals at such a distance (especially as large animals such as whales are only observed 44% of the time at best). A second mitigation measure, although only to be used if turtles are sighted by observers (EMP page 234), is to install 'turtle-guards' to prevent them from becoming entangled in the gear. These devices are accepted as being useful in terms of entrapment but not for sound in the water. Given the sighting probability of a turtle by an observer is minimal (as explained above) and that turtle guards are not a standard measure on the gear for this survey, these two mitigation measures are hardly justifiable.

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Effectiveness of Mitigation (Marine Mammal Observers (MMO) and Passive Acoustic Monitoring (PAM))

During the 2018 and 2019 humpback whale (*Megaptera novaeangliae*) migration period along the east coast of South Africa, Wilkinson (2021) estimated the relative abundance of migrating humpback whales sighted by trained observers from two towers located 22m apart (both observers viewing the same area), located at 70m above sea level on a dune with a horizontal vantage length of approximately 20 km. Over the observation periods during the peak of migration, it was estimated that observers from both towers missed between 41-44% of whale groups while distance offshore decreased the probability of sightings. Assuming that the best percentage sighting (56%) was achieved within 1-5km of the observers' vantage point, then more than 90% of whales were missed. Given that this survey was done during the northward migration when mostly larger animals are present, the sighting success may be less when small calves are present as well (as would be the case in December). This begs the question of the efficacy and reliability of the mitigation method of Marine Mammal Observers (MMO), while assuming that whales (and other cetaceans) are thus regularly missed by MMOs and could be harmed.

Despite various organisations who provide MMO's on vessels having a zero tolerance policy of intimidation it is not uncommon for an MMO to complain that he/she has been subjected to coercion, harassment and intimidation. The EMPr states that: "*The MMO has the authority to stop the survey activities (including seismic shooting) in response to certain circumstances related to marine mammal risk. However, due to the cost associated with terminating activities (e.g. an entire survey line may need to be repeated), it is recommended that the decision to terminate firing be made by the operator in consideration of the MMO's advice. The MMOs must provide full reporting of all termination decisions (including behaviour and distance of marine mammals) in a daily close out report (Part B, p.8)*". This statement is highly problematic and reinforces the concern that "A risk-averse and cautious approach, which takes into account the limits of current knowledge about the

consequences of decisions and actions", a principle of the National Environmental Management Act, 107 of 1998, will not be applied in full.

Furthermore, bearing in mind the examples above, i.e. blue and fin whales ceasing to sing, the use of Passive Acoustic Monitoring (PAM) technology to detect cetaceans is baseless if cetaceans do not vocalise. As per best practice, in an effort to improve mitigation, PAM technology is complemented by visual searching over an area of 500m around the vessel by qualified Marine Mammal Observers (MMO). This technique is, however, also fatally flawed because it cannot be used at night, during rain and in sea states more than three on the Beaufort Sea State Scale. Therefore, both PAM and MMO's are insufficient to detect, with certainty, cetaceans within the surrounding survey area and these types of mitigation will only be effective for all affected species if airgun firing ceases between sunset and sunrise, and adverse weather conditions that limit visibility.

The cumulative and long-term effects of seismic survey sound is not entirely understood (Jasny et al. 2005); however, it is accepted that ocean noise may have ecosystem-scale effects (Hildebrand, 2005) and the "knock-on" effects on animals, their prey and their predators will have consequences within the food chain (Koper and Plön 2012). It has been suggested that research and a critical review on mitigation measures (McCauley et al. (2017) as well as a better understanding of ecosystem-scale effects of sound (Koper and Plön 2012), especially at the lower trophic levels are imperative. Considering the ecosystem services provided by the Benguela Current Marine Ecosystem and its associated diversity and biomass, mitigation and understanding should be a conservation imperative in South African marine waters. Up to now, there has been no effort in increasing the knowledge of the impact of these seismic surveys by industry or South African environmental departments despite them being known to have impacts on marine animals and having been undertaken in South African waters for a number of decades.

Proximity to Marine Protected Areas and Critical Biodiversity Areas

The reconnaissance permit area occurs adjacent to six Marine Protected Areas (MPAs) including the Orange Shelf Edge MPA, Child's Bank MPA, Benguela Muds MPA, Cape Canyon MPA, Robben Island MPA and the Southeast Atlantic Seamounts MPA and completely surrounds the Benguela Muds MPA (See EMP: Figure 7-20). It is a significant concern that there is no reference or mention of buffers-areas around the MPAs in the EMP, which allows the vessel to come within 1 km of these protected areas. This is of particular concern, given that the EMP indicates *the cumulative zone of impact for the 3D survey extends to 600 m for permanent threshold shifts (PTS) and to 8 000 m for temporary threshold shift (TTS) for physiological injury, and the cumulative zones for PTS and TTS while the 2D survey is 500 m and 5 000m, respectively.* For example, the reconnaissance permit allows the survey vessel to be active ~600 m from the edge of the Orange Shelf Edge MPA, which is designated as a sanctuary zone, at depths of 250-1500m. Therefore, this would be within the zone of TTS and very near to that of PTS for 2D surveys.

It should be noted that, according to the National Environmental Management: Protected Areas Act 57 of 2003: section 48A reads:

"*48A Restriction of activities in marine protected areas:*
Despite any other legislation, no person may in a marine protected area-
...
(e) in any manner which results in an adverse effect on the marine environment, disturb, alter or destroy the natural environment or disturb or alter the water quality or abstract sea water;
(f) carry on any activity which may have an adverse effect on the ecosystem of the area;...."

While it is acknowledged that the EMP states that only 2D seismic activities will take place near any MPAs, it cannot be ignored that the proposed seismic activity will still have potential adverse effects on the ecosystem within the area and disturb the natural environment.

Further to this, large portions of the reconnaissance permit area comprise of Critical Biodiversity Areas (CBA) both 1 and 2 (See EMP: Figure 7-21). CBA 1 areas are irreplaceable or near-irreplaceable, while CBA 2 are sites that are the best option available for representing the features in a spatial prioritisation (Harris et al. 2020). The primary of objective, and national policy, is that both CBA 1 and

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2 areas remain in natural or near-natural states for conservation management, while portions of these areas be set-marked for future MPAs.

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Curriculum Vitae

JEAN MARY HARRIS

PERSONAL DETAILS

Name	:	Jean Mary Harris
Birth date	:	28 December 1962
ID Number	:	6212280006088
Place of birth	:	Johannesburg
Nationality	:	South African
Race	:	White
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Address	:	49 Retford, Bluff, Durban, 4052, KZN South Africa
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EDUCATION

1993 PhD (Zoology), University of Cape Town. Focus: Trophic ecology in estuarine and intertidal systems.
1984 B.Sc. Hons. (Marine Biology), University of Cape Town, First Class
1982 B.Sc. (Zoology), University of Cape Town
1979 Matriculated, A-grade, Clarendon Girls High School, East London

AWARDS:

- PEW Fellowship in Marine Conservation, 2000
- Purcell Memorial Prize for best Zoology PhD thesis, 1993
- FRD Special Merit Doctoral Award, 1990

SELECTION OF PROFESSIONAL OFFICES HELD

Pew Fellow in Marine Conservation, Pew Fellows Program in Marine Conservation, 2000 - present
Trustee: South African Association for Marine Biological Research, 2016- July 2017
Member: Programme Steering Committee for the Marine Science for Management Association (MASMAA), Western Indian Ocean Marine Science Association (WIOMSA) 2004-2015.
Chair: Subsistence Fisheries Task Group 1999-2000.
Chair: SA Network for Coastal and Oceanographic Research (SANCOR) National Steering Committee 1997-2001.
Member: IUCN Species Survival Commission – Marine Conservation Committee, 2018-present
Member: IUCN SSC Red List Committee, 2018-2021
Executive Trustee: Wildlands Conservation Trust, 2015- April 2017
Member: Scientific Authority 2014-2017. Advises the SA Minister of Environment on biodiversity matters
Chair: Symposium of Contemporary Conservation Practice (SCCP) 2012- July 2017.
Member: East African Marine Ecoregion Programme Committee (EAME) 2004-2010

EMPLOYMENT RECORD

Executive Director WILDOCEANS, Wildlands Conservation Trust, August 2017 - current
Research Associate, Institute for Coastal and Marine Research, Nelson Mandela University, 2016-present
Senior General Manager: Scientific Services, Ezemvelo KZN Wildlife, October 2006 – July 2017
Ecological Advice Co-ordinator, Coast Region, Ezemvelo KZN Wildlife, 2002 - September 2006
Regional Ecologist Marine/Scientist, Scientific Services, KZN Nature Conservation Service, 1995 – 2002
Senior Scientific Officer, Terrestrial Antarctic Biology Research Programme, Ornithology, UCT, 1991-1994

SELECTION OF RESEARCH AND MANAGEMENT EXPERIENCE

Project Leader Blue Action Fund "Oceans Alive" iSimangaliso MPA Project (2019-current): This project has 3 main objectives 1) Build knowledge of the biodiversity and socio-economics of the MPA and its communities, 2) Support effective management of the iSimangaliso MPA, and 3) Ensure benefits and improved livelihoods for rural communities living alongside the iSimangaliso MPA.

Directs the following WILDOCEANS projects for the Wildlands Conservation Trust (2017-current): Ocean Stewards, WhaleTime, MPA Expansion Project, Shark and Bay Conservation Project, Comoros Fish and Benthic Biodiversity Project, iSimangaliso Oceans Alive (MPA expansion, effective management and benefits to communities) Project, Blue Crew project in the Durban bay estuarine environment (plastic pollution action).

Principle investigator and Co-ordinator for NRF-funded African Coelacanth Ecosystem Programme research projects: Biodiversity Surrogacy (2014-2017), Spatial Solutions (2016-2018) and Canyon Connections (2018-2020). Offshore biodiversity survey and sampling to test validity of modelled biozones, to refine conservation planning, and to support marine protected area expansion and the National Biodiversity Assessment (CBD).

Project leader for WWF-SA, NRF and ACEP funded project: SeaPLAN – development of a systematic conservation plan for the east coast of South Africa (2004-2012). Integrates shoreline biodiversity mapping, reef biodiversity surveys and key species and processes.

Project leader Wildlands Trust funded project: Rare and Endangered Species of the Greater St Lucia Wetland Park (2002-2005). This project aims to update the records of these species in the park and provide a management handbook. It is focussed on terrestrial and freshwater wetland species and employs a full-time researcher. This project has become entrenched and is ongoing.

Project leader for NRF funded project: KwaZulu-Natal and Transkei Indigenous knowledge of subsistence harvesters (2002-2006). Aims to document traditional knowledge and management systems of rural subsistence harvesters, compare regional differences, and integrate into current management practices.

Chairperson of Subsistence fisheries Task Team, on behalf of Marine and Coastal Management (DEAT), managed a national programme for coast-wise identification of and consultation with subsistence fishers (1999-2000). Acted as Program manager and supervisor of 8 Regional Fieldworkers (Northern Cape, West Cape (x2), South coast, Eastern Cape (x2), KwaZulu-Natal (x2), and a National Co-ordinator and project researcher. – Project leader and finance vote-holder (ca R1 mill)

Project executant (co-ordinator & researcher, and supervisor of 2 project staff) for 5-year project funded by The Green Trust, WWF-SA: The development of sustainable utilization of mussels by artisanal and subsistence gatherers along the northern KwaZulu-Natal coast – Sokhulu community alongside iSimangaliso 1995-2000.

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POST-GRADUATE STUDENT SUPERVISION:

6 MSc and 2 PhD students

PUBLICATION SUMMARY:

Papers in refereed journals:	37
Book/ book chapter	8
Reports and Popular articles	10

PUBLICATIONS AND REPORTS

Grorud-Colvert K, Sullivan-Stack J, Roberts C, Constant V, Horta e Costa B, Pike E, Kingston N, Laffoley D, Sala E, Claudet J, Friedlander A, Gill D, Lester S, Day J, Gonçalves E, Ahmadia G, Rand M, Villagomez A, Ban N, Gurney G, Spalding A, Bennett N, Briggs J, Morgan L, Moffitt R, Deguignet M, Pikitch E, Darling E, Jessen S, Hameed S, Di Carlo G, Guidetti P, Harris J, Torre J, Kizilkaya Z, Agardy T, Cury P, Shah N, Sack K, Ling Cao, Fernandez M, Lubchenco J (2021) The MPA Guide: A Framework to Achieve Global Goals for the Ocean. Science. Submitted and accepted.

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Roberson L, Lagabrielle E, Lombard A, Sink K, Harris J, Grantham H, Livingstone T (2017) Pelagic bioregionalisation using open-access remote-sensing data to inform marine protected area planning in South Africa's Exclusive Economic Zone. Ocean & Coastal Management 148:214-230

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Searcher Seismic Reconnaissance Project

Social Impact Assessment

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Prepared for:
EIMS

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Executive Summary

Searcher Geodata UK Ltd proposes to undertake a 3D seismic survey off the West Coast of South Africa. The proposed project area is located approximately 256 km offshore of St Helena Bay, extending north along the western coastline to approximately 220 km offshore of Hondeklip Bay over a number of petroleum license blocks. At the closest point the proposed survey area is approximately 218 km offshore of the coast of the Western and Northern Cape provinces. The area of interest for the proposed 3D seismic survey is approximately 30 000 km^2 in extent.

Searcher's activities for this application would be of short duration if approved, and if viewed in isolation considering only technical risks as discussed in various specialist reports conducted as part of the EIA process, the impacts will be negligible. However, communities feel that there are significant gaps in the available data and from a social perspective the non-technical or social risks can potentially cause significant impacts. The following potential social impacts have been identified:

- Uncertainty
- Further marginalisation of vulnerable groups
- Concerns about cumulative impacts
- Impact on livelihoods
- Impacts on sense and spirit of place
- Impacts on the social licence to operate
- Community expectations
- Social unrest

Seismic reconnaissance projects are controversial in South Africa and has been in the news frequently in the last year. For many stakeholders it is an emotional matter, for others the potential of impacting their livelihoods is the biggest fear. There are also

stakeholders that feel that the exploration for fossil fuels is not in line with sustainable development and the fight against climate change. Other stakeholders feel that it is imperative for the growth and development of the South African economy to engage in these investigations. It is a complex and wicked[1] problem.

Based on the findings, the following recommendations are made:

- Searcher should develop a community engagement protocol, communication strategy and grievance mechanism that is based on the San Code of Research Ethics.
- Searcher should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. Collaboration across seismic operators with holders of hydrocarbon exploration and the industry as a whole to collectively fund pro-active research would provide opportunity for the development and implementation of a structured and experimentally sound acoustic study. This would quantitatively inform the authorities and stakeholders of acoustic impacts to the various faunal groups in South African Waters.
- Consult with communities on potential ways in which to make a positive contribution to the communities.
- Engage in meaningful consultation
- The seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign.

From a social perspective it is clear that the communities and majority of local people are opposed to the project. If the project is considered in isolation, the impacts are negligible. However, the project does not happen in a vacuum, and the social environment is much wider than the footprint of the project. If the social risks and

[1] a wicked problem is a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize.

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potential damage to cultural and indigenous rights are considered the impact on the social fabric of already vulnerable communities may be significant. From as social perspective the project can only be recommended after meaningful consultation, local research, education, and awareness raising has been done in the project affected communities. At this stage communities feel that they cannot make informed decisions. Communities does not distinguish between the different role players in the seismic survey industry. Although all legal processes have been followed by Searcher, the seismic survey industry is not moving at the pace of the community, and in the long run this will be detrimental to the industry. Potential future benefits and the economic development of the country should the surveys find any significant resources are not disputed. The recommendation is therefore that the project can only proceed once the social mitigation measures have been implemented and the community are sufficiently informed and educated to able to engage in a meaningful manner.

Opsomming

Searcher Geodata UK Ltd beoog om 'n 3D seismiese opname te doen aan die Weskus van Suid-Afrika. Die voorgenome projek area is ongeveer 256 km van St Helena Baai in die diepsee geleë, en strek dan Noord teen die westelike kuslyn af tot ongeveer 220 km in die diepsee in vanaf Hondeklipbaai oor 'n aantal petroleum lisensie blokke. Die punt wat die naaste aan die land is, is ongeveer 218 km in die diepsee aan die kus van die Wes Kaap en die Noord Kaap Provinsies. Die gebied wat die voorgenome 3D seismiese opname beplan om te dek beslaan ongeveer 30 000 km^2.

Searcher se aktiwiteite vir hierdie aansoek sal van korte duur wees indien dit goedgekeur word, en wanneer dit in isolasie beskou word en slegs die tegniese risiko's oorweeg word soos wat bepreek is in die onderskeie spesialis studies wat gedoen is as deel van die omgewingsimpak assessering proses is die impakte gering. Die betrokke gemeenskappe voel egter dat daar betekenisvolle gapings in die beskikbare data is en van 'n sosiale perspektief kan die nie-tegnies of sosiale risiko's potensieel betekenisvolle impakte veroorsaak. Die volgende sosiale impakte is geïdentifiseer:

- Onsekerheid
- Verdere uitsluiting van weerbare groepe
- Bekommernisse oor kumulatiewe impakte
- Impak op vermoë om 'n lewensbestaan te maak
- Impakte op sin en gees van plek
- Impakte op die sosiale bedryfslisensie
- Verwagtinge van die gemeenskappe
- Maatskaplike onrus

Seismiese verkenningsprojekte is kontroversieel in Suid Afrika en was dikwels in die nuus die afgelope jaar. Vir baie belanghebbendes is dit 'n emosionele saak, vir ander

is die moontlikheid dat hulle lewensbestaan geaffekteer gaan word die grootste vrees. Daar is ook belanghebbendes wat voel dat die eksplorasie vir fossielbrandstowwe nie in lyn is met volhoubare ontwikkeling en die stryd teen klimaatsverandering is nie. Ander belanghebbendes voel dat dit noodsaaklik is vir die groei en ontwikkeling van die Suid Afrikaanse ekonomie om betrokke te raak by hierdie ondersoeke. Dit is 'n komplekse probleem, en 'n probleem wat moeilik of onmoontlik is om op te los.

Gebaseer op die bevindinge word die volgende aanbevelings gemaak:

- Searcher moet 'n gemeenskapsbetrokkenheid protokol, kommunikasie strategie en griefmeganisme ontwikkel wat gebaseer is op die San Kode van Navorsingsetiek.
- Searcher moet behulpsaam wees met samewerking tot onafhanklike navorsing oor hoe visspesies aan die Weskus soos snoek reageer op seismiese opnames. Samewerking tussen seismiese operateurs en houers van koolwaterstof eksplorasie regte en die industrie as 'n geheel om kollektief pro-aktiewe navorsing te befonds sal die geleentheid bied vir die ontwikkeling en implementering van 'n gestruktureerd en eksperimenteel sollede akoestiese studie. Dit sal die owerhede en belanghebbendes kwantitatief inlig omtrent die akoestiese impakte op die verskeie fauna groepe in die Suid Afrikaanse waters.
- Konsulteer met die gemeenskap op maniere waarop 'n positiewe bydrae tot die gemeenskappe gelewer kan word.
- Raak betrokke by betekenisvolle konsultasie.
- Die seismiese opname bedryf moet hulle posisie en sosiale bedryfslisensie as 'n industrie in die Suid-Afrikaanse konteks heroorweeg en 'n strategiese omgewingsassesserling van die impak van die bedryf uitvoer en 'n bewusmakings- en opvoedkundige veldtog van stapel stuur.

Vanuit 'n sosiale perspektief is dit duidelik dat die gemeenskappe en die meerderheid van die plaaslike mense gekant is teen die projek. As die projek in isolasie beskou word, is die impakte gering. Die projek vind egter nie in 'n vakuum plaas nie, en die sosiale

omgewing is heelwat breër as die voetspoor van die projek. Indien die sosiale risiko's en potensiële skade aan die kulturele en inheemse regte oorweeg word, kan die impak op die sosiale weefsel van die reeds weerlose gemeenskappe betekenisvol wees. Vanuit 'n sosiale perspektief kan die projek slegs aanbeveel word na betekenisvolle konsultasie, plaaslike navorsing, opvoeding, en bewusmaking gedoen is in die gemeenskappe wat deur die projek geraak is. Tans voel die gemeenskappe dat hulle nie ingeligte besluite kan neem nie. Gemeenskappe onderskei nie tussen die verskillende rolspelers in die seismiese opname industrie nie. Alhoewel al die wetlike prosesse deur Searcher gevolg is, beweeg die seismiese opname bedryf nie teen die pas van die gemeenskap nie, en op die lange duur sal dit tot nadeel van die industrie wees. Moontlike toekomstige voordele en ekonomiese ontwikkeling van die land indien die opnames betekenisvolle hulpbronne vind, word nie betwyfel nie. Die aanbeveling is gevolglik dat die projek slegs kan voortgaan sodra die mitigasie maatreëls geïmplementeer is en die gemeenskappe genoegsaam ingelig en toegerus is om op 'n betekenisvolle manier betrokke te raak.

Declaration of Independence

Equispectives Research and Consulting Services declare that:

- All work undertaken relating to the proposed project was done as independent consultants;
- They have the necessary required expertise to conduct social impact assessments, including the required knowledge and understanding of any guidelines or policies that are relevant to the proposed activity;
- They have undertaken all the work and associated studies in an objective manner, even if the findings of these studies were not favourable to the project proponent;
- They have no vested interest, financial or otherwise, in the proposed project or the outcome thereof, apart from remuneration for the work undertaken under the auspices of the above-mentioned regulations;
- They have no vested interest, including any conflicts of interest, in either the proposed project or the studies conducted in respect of the proposed project, other than complying with the relevant required regulations; and
- They have disclosed any material factors that may have the potential to influence the competent authority's decision and/or objectivity in terms of any reports, plans or documents related to the proposed project as required by the regulations.

Record of Experience

Ilse Aucamp and San-Marié Aucamp compiled this report.

Ilse Aucamp holds a D Phil degree in Social Work obtained from the University of Pretoria in 2015. She also has master's degree in environmental management (Cum Laude) from the Potchefstroom University for Christian Higher Education, which she obtained in 2004. Prior to that she completed a BA degree in Social Work at the University of Pretoria. She is frequently a guest lecturer in pre- as well as post-graduate programmes at various tertiary institutions. Her expertise includes social impact assessments, social management plans, social and labour plans, social auditing, training as well as public participation. She is a co-author of the newly published *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects* document published by the International Association for Impact Assessment.

San-Marié Aucamp is a registered Research Psychologist with extensive experience in both the practical and theoretical aspects of social research. She has more than 20 years' experience in social research and she occasionally presents guest lectures on social impact assessment. Her experience includes social impact assessments, social and labour plans, training, group facilitation as well as social research. She is a past council member of the Southern African Marketing Research Association (SAMRA).

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1 Introduction

Searcher Geodata UK Ltd proposes to undertake a 3D seismic survey off the West Coast of South Africa. The proposed project area is located approximately 256 km offshore of St Helena Bay, extending north along the western coastline to approximately 220 km offshore of Hondeklip Bay over a number of petroleum license blocks. At the closest point the proposed survey area is approximately 218 km offshore of the coast of the Western and Northern Cape provinces. The area of interest for the proposed 3D seismic survey is approximately 30 000 km^2 in extent.

Marine seismic surveys are the primary tool for locating hydrocarbon deposits and are thus a key component of offshore oil and gas exploration. Hydrocarbon deposits occur in reservoirs in sedimentary rock layers. Being lighter than water they accumulate in traps where the sedimentary layers are arched or tilted by folding or faulting of the geological layers. It is currently envisaged that the survey lines would have a NE-SW or a SE-NW orientation. The 3D survey will take in the order of 127 days including downtime.

A single survey vessel equipped with seismic sources and streamers will be used which will be supported by one escort vessel. The escort vessel will assist in monitoring for and alerting of other vessels (e.g. fishing, transport, etc) about the survey and the lack of manoeuvrability of the survey vessel. At a minimum one Fisheries Liaison Officer (FLO) that speaks English and Afrikaans will be on board either the survey or escort vessel to facilitate communication in a local language with the fishing or other vessels that are in the area. In addition, there will be two Marine Mammal Observers (MMO's) on board the survey vessel to monitor for marine mammals and fauna visually and ensure that the survey is conducted in compliance with the specified guidelines as stated in the Environmental Management Programme.

Crew changes will occur by the support or survey vessel calling to port. If necessary, a helicopter maybe used to transfer personnel to and from the survey vessel and Cape Town or Saldanha Bay. However, due to the helicopter's low carrying capability this is

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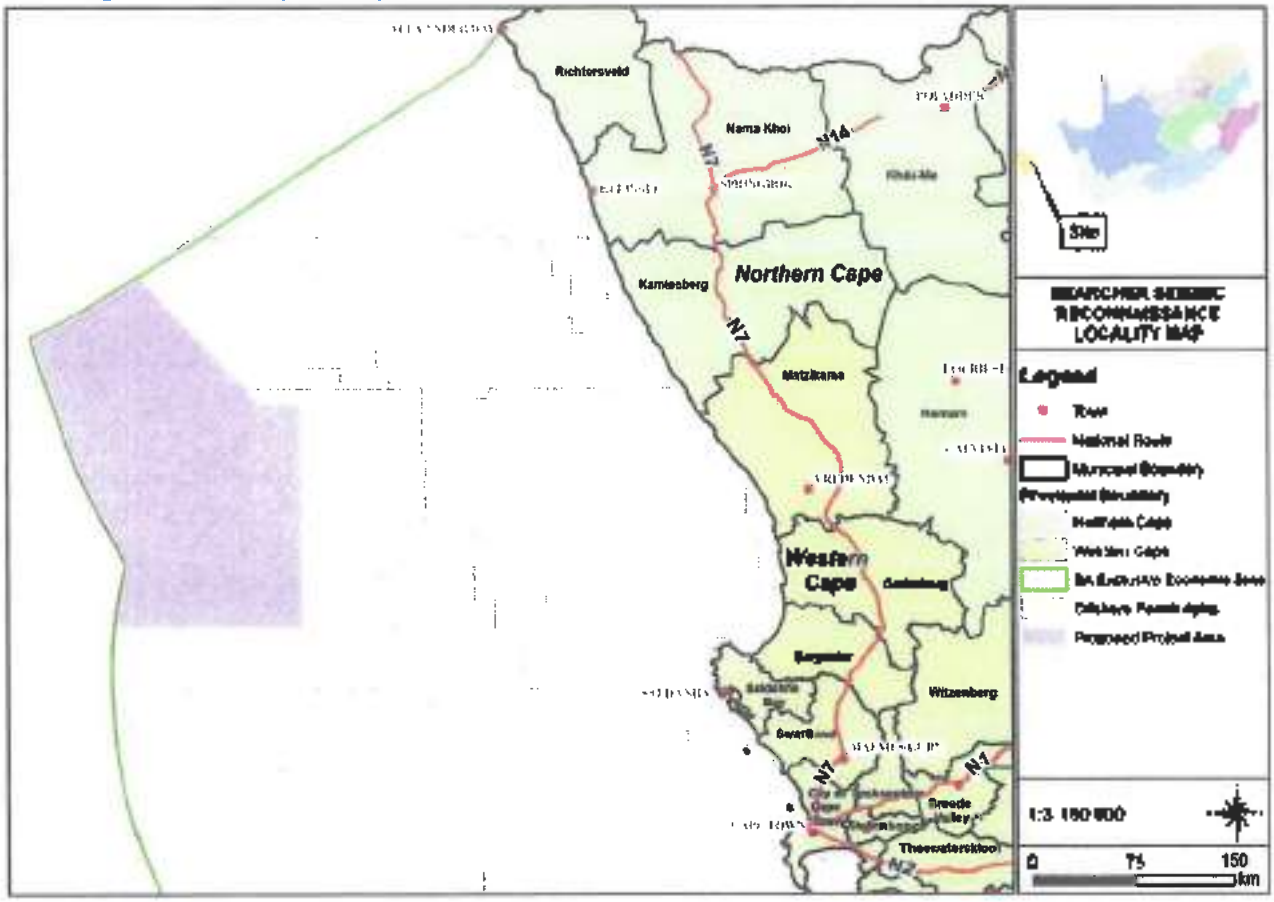
unlikely to occur. The onshore logistics base will be either in the Port of Cape Town or the Port of Saldanha Bay. The preferred alternative is Cape Town. The service infrastructure required to provide the necessary onshore support is already in place in Cape Town and Saldanha Bay and as such no additional onshore infrastructure should be necessary for the project.

Figure 1 shows the location of the proposed project area.

Figure 1: Locality of proposed Searcher Seismic Reconnaissance Project.



The purpose of this report is to provide baseline information regarding the socio-economic environment, to identify possible social and economic impacts and to suggest ways in which these impacts can be mitigated. This will assist decision-makers on the project in making informed decisions by providing information on the potential or actual consequences of their proposed activities. The process entailed the following:

- A baseline socio-economic description of the affected environment;

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- Identification of potential social and economic change processes that may occur as a result of the project; and
- Identification of potential social and economic impacts.

One of the ways in which social risk can be managed is by conducting a social impact assessment (SIA). Such an assessment can assist with identifying possible social impacts and risks. Disregarding social impacts can alter the cost-benefit equation of development and in some cases even undermine the overall viability of a project. A proper social impact assessment can have many benefits for a proposed development (UNEP, 2002) such as:

- Reduced impacts on communities of individuals;
- Enhanced benefits to those affected;
- Avoiding delays and obstruction – helps to gain development approval (social license);
- Lowered costs;
- Better community and stakeholder relations; and
- Improved proposals.

More detail on the scope of each of these phases is included in the section below.

2 Scope of Work

The purpose of the SIA is to provide input in the Environmental Impact Assessment (EIA)/ Environmental Management Programme (EMPr) Report for the proposed seismic reconnaissance study.

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3 Methodology

Scientific social research methods were used for this assessment. To clarify the process to the reader, this section will start with a brief explanation of the processes that have been used in this study.

3.1 Information base

The information used in this report was based on the following:

- A literature review (see list provided in the References);
- Data from Statistics South Africa;
- The public participation records provided by EIMS;
- Professional judgement based on experience gained with similar projects; and
- Consultation with affected stakeholders in August and September 2022. It must be noted that not every individual in each community could be consulted. Consultations took place in Hout Bay, Steenberg's Cove, Lamberts Bay and Port Nolloth. Due to other commitments the meeting with the Guriqua leadership could not take place. The meeting in Hondeklip Bay got cancelled at the last minute by the stakeholders.

3.2 Assumptions and limitations

The following assumptions and limitations were relevant:

1. Not every individual in the community could be interviewed therefore only key people in the community were approached for discussion. Additional information was obtained using existing data.
2. The social environment constantly changes and adapts to change, and external factors outside the scope of the project can offset social changes, for example changes in local political leadership, droughts or economic conditions. It is therefore difficult to predict all impacts to a high level of accuracy, although

care has been taken to identify and address the most likely impacts in the most appropriate way for the current local context within the limitations.

3. Given that the survey will be conducted over a short period of time, the the impacts will be short term and from an outsiders perspective may appear as inconsequential. However, the outcomes of the survey will introduce new social impacts, and the potential of these impacts occuring is already causing fear and uncertainty amongst coastal communities. Communities view the survey as the beginning of potentially significant changes in their socio-economic environment.

4. Social impacts can be felt on an actual or perceptual level, and therefore it is not always straightforward to measure the impacts in a quantitative manner.

5. Social impacts commence when the project enters the public domain. Some of these impacts will occur irrespective of whether the project continues or not, and other impacts have already started. These impacts are difficult to mitigate and some would require immediate action to minimise the risk.

6. There are different groups with different interests in the community, and what one group may experience as a positive social impact, another group may experience as a negative impact. This duality will be pointed out in the impact assessment phase of the report.

7. Social impacts are not site-specific, but take place in the communities surrounding the proposed development.

8. Limited time was available for conducting the assessment.

3.3 Social Impact Assessment Model

The theoretical model used for this impact assessment was developed by Slootweg, Vanclay and Van Schooten and presented in the *International Handbook of Social Impact Assessment* (Vanclay & Becker, 2003). This model identifies pathways by which social impacts may result from proposed projects. The model differentiates between social change processes and social impacts, where the social change process is the

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pathway leading to the social impact. Detail of how the model works is not relevant to this study, but it is important to understand the key concepts, which will be explained in the following paragraphs.

Social change processes are set in motion by project activities or policies. A social change process is a discreet, observable, and describable process that changes the characteristics of a society, taking place regardless of the societal context (that is, independent of specific groups, religions etc.) These processes may, in certain circumstances and depending on the context, lead to the experience of social impacts (Vanclay, 2003). If managed properly, however, these changes may not create impacts. Whether impacts are caused will depend on the characteristics and history of the host community, and the extent of mitigation measures that are put in place (Vanclay, 2003). Social change processes can be measured objectively, independent of the local context. Examples of social change processes are an increase in the population, relocation, or the presence of temporary workers.

For the purpose of this report, the following social change process categories were considered:

- Demographic processes;
- Economic processes;
- Geographic processes;
- Institutional and legal processes;
- Emancipatory and empowerment processes;
- Socio-cultural processes; and
- Other relevant processes.

The *International Association for Impact Assessment* (2003) states that Social Impact Assessment includes the processes of analysing, monitoring, and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes

invoked by these interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment.

A social impact is something that is experienced or felt by humans. It can be positive or negative. Social impacts can be experienced in a physical or perceptual sense. Therefore, two types of social impacts can be distinguished:

- **Objective social impacts** – i.e. impacts that can be quantified and verified by independent observers in the local context, such as changes in employment patterns, in standard of living or in health and safety.
- **Subjective social impacts** – i.e. impacts that occur "in the heads" or emotions of people, such as negative public attitudes, psychological stress or reduced quality of life.

It is important to include subjective social impacts, as these can have far-reaching consequences in the form of opposition to, and social mobilisation against the project (Du Preez & Perold, 2005).

For the purpose of this SIA, the following Social Impact Assessment categories were investigated:

- Health and social well-being;
- Quality of the living environment;
- Economic impacts and material well-being;
- Cultural impacts;
- Family and community impacts;
- Institutional, legal, political and equity impacts; and
- Gender impacts.

Relevant criteria for selecting significant social impacts included the following:

- Probability of the event occurring;
- Number of people that will be affected;

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- Duration of the impact;
- Value of the benefits or costs to the impacted group;
- Extent to which identified social impacts are reversible or can be mitigated;
- Likelihood that an identified impact will lead to secondary or cumulative impacts;
- Relevance for present and future policy decisions;
- Uncertainty over possible effects; and
- Presence or absence of controversy over the issue.

The model was adapted to suit the South African context, and where processes and impacts were not relevant to the study, it was omitted. Each category has a number of sub-categories, which also have been investigated. The Equator Principles, International Finance Corporation Performance Standards and World Bank Environmental, Health and Safety guidelines were consulted in the writing of this report and the mitigation suggested adheres to these requirements.

3.4 Literature study

A literature search was undertaken to obtain secondary data for the baseline description of the socio-economic environment. The information in this report was acquired via statistical data obtained from Statistics South Africa, SIA literature (see References), previous studies conducted in the area, EIMS's public consultation process and information from reputable sources on the World Wide Web.

3.5 Research approach

Traditionally there are two approaches to SIA, a technical approach, and a participatory approach. A technical approach entails that a scientist remains a neutral observer of social phenomena. The role of the scientist is to identify indicators, obtain objective measures relevant to the situation and provide an expert assessment on how the system will change (Becker, Harris, Nielsen & McLaughlin, 2004). A participatory approach uses the knowledge and experiences of individuals most affected by the proposed changes as the basis for projecting impacts. In this case the

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role of the scientist is facilitator of knowledge sharing, interpretation, and reporting of impacts (Becker et al, 2004). A combination of these approaches was used for this study.

The findings presented in this report are based on primary and secondary (desk) research. A qualitative approach was followed for the primary research, while qualitative and quantitative data were used for the secondary research.

The layperson sometimes criticises qualitative research as "subjective" or "not really that scientific". For this reason, it is vital to understand the distinction between qualitative and quantitative research and their respective areas of application.

Qualitative research as a research strategy is usually characterised by the inference of general laws from particular instances, forms theory from various conceptual elements, and explains meaning (David & Sutton, 2004). It emphasises words rather than quantification in the collection and analysis of data. Data collection takes place by using methods such as unstructured or semi-structured interviews, focus groups, observations, etc. Data is not recorded in any standardised coding format but is usually reported according to themes. Qualitative data express information about feelings, values, and attitudes. This approach is used where insight and understanding of a situation is required (Malhotra, 1996). Participants are selected based on their exposure to the experience or situation under review. The aim of qualitative research is to understand, not to quantify and as such it is extremely suitable for assessing social impacts. A potential impact must be understood before it can be assessed appropriately.

Quantitative research as a research strategy usually makes inferences of particular instances by reference to general laws and principles and tends to emphasize what is external to or independent of the mind (objective) and incorporates a natural science model of the research process (David & Sutton, 2004). This makes it easier for a person with a natural or physical sciences background to relate to. This approach emphasises quantification in the collection and analysis of data. Data collection take place by using methods such as structured questionnaires and data is recorded in a numeric or some

other standardised coding format. Data is expressed in numerical format and statistical techniques are usually used to assist with data interpretation. This approach is used when information needs to be generalised to a specific population and participants are usually selected using probability sampling techniques (although non-probability methods can be used depending on the characteristics of the target population).

Although in theory the qualitative phase of this project could be followed by a quantitative phase, for a number of reasons it was not done. A quantitative phase would be more resource intensive in terms of labour, time and cost and the incremental precision obtained in terms of generalisability would not warrant the additional investment. Due to the strong emotional component relating to the perceived impacts, respondents may intentionally magnify the intensity of the impacts or indicate all impacts are equally severe in an attempt to bias the results in their favour, which will reduce the utility of quantitative results as part of the primary research process.

3.6 Ethical issues

The most basic principle of research is that participants should not be harmed by participation in the research project. It is important that research not only does no harm, but also potentially contributes to the wellbeing of others. At times this might place a researcher in a difficult position – what is beneficial to one group may not be beneficial to another (Bless, Higson-Smith & Kagee, 2006). Furthermore, an individual has the autonomy to decide whether to participate in research or not. No person should be forced, either overtly or covertly, to participate in research. Other important principles include justice (based on the assumption that all people are equals), fidelity (keeping promises or agreements, specifically between the researcher and the participant) and respect for participants' rights and dignity. In addition to these overarching ethical principles, important ethical principles that should be met are informed consent, confidentiality, anonymity, and discontinuance. This is in line with international as well as national research practice such as the World Association for Market, Social and Opinion Researchers (ESOMAR) and Southern African

Marketing Research Association (SAMRA) codes of conduct. The researcher has an ethical obligation to develop well-designed projects and execute them with care. Researchers are not allowed to change their data or observations and should report on technical shortcomings, failures, limits of the study, negative findings, and methodological constraints. The honest and accurate reporting of data is also an essential component of scientifically accurate and ethically legitimate research and conclusions should be supported by data.

4 Legislative and Policy Framework

Although there are no explicit acts referring directly to SIA, there are many acts and policies that require specific social outcomes that can be related to this project, and these are discussed in the section below.

4.1 The Constitution of the Republic of South Africa 1996

The current Constitution of the Republic of South Africa 1996 can be regarded as one of the most progressive constitutions in the world. Human rights are enshrined in the South African Constitution, which forms the basis of all the country's legislation. Chapter 2 consists of a Bill of Rights, which explicitly spells out the rights of every South African citizen. Human rights and dignity are fundamental to SIA and it recognises fundamental human rights and the prerogative to protect those rights as core values (Vanclay, 2003). The human rights relevant to the environmental management field that are safeguarded by the Constitution of the Republic of South Africa 1996 in the Bill of Rights, include:

- Right to a healthy environment;
- Right of access to land and to security of tenure; and
- Right to adequate housing and protection against evictions and demolitions.

The right to a protected biophysical environment, the promotion of social development and trans-generational equity is explicitly included in the Constitution of the Republic of South Africa 1996, which states:

"Everyone has the right -

1. To an environment that is not harmful to their health and wellbeing, and
2. To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:
    1. *Prevent pollution*
    2. *Promote conservation, and*

3. *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*

When considering an environment that is not harmful to peoples' health and wellbeing, it is important to reflect on the interconnectedness of biophysical, economic, and social aspects. The impact of development on people, and the true cost of development, as well as the consideration of "who pays the price?" versus "who reaps the benefits?" cannot be ignored in a discussion about human rights and the environment.

The right to a generally satisfactory environment is increasingly seen as a human right in Africa (Du Plessis, 2011), and South Africa's environmental legislation supports this.

4.1.1 The National Environmental Management Act 107 of 1998

The National Environmental Management Act (NEMA) 107 of 1998 states that the State must respect, protect, promote and fulfil the social, economic and environmental rights of everyone and strive to meet the needs of previously disadvantaged communities. It states further that sustainable development requires the integration of social, economic and environmental factors in the planning, evaluation and implementation of decisions to ensure that development serves present and future generations.

Chapter 1 of NEMA contains a list of principles and states clearly that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests (NEMA, 1998). It states further that negative impacts on the environment and on peoples' environmental rights must be anticipated and prevented, and if they cannot be prevented, they should be minimised and remedied. It elaborates further on the equity of impacts, and the fact that vulnerable communities should be protected from negative environmental impacts. It refers to the principle that everyone should have equal access to environmental resources, benefits and services to meet their basic

human needs (NEMA, 1998). Therefore there is a clear mandate for environmental and restorative justice in the act, something that must be considered in this project.

Another important aspect of NEMA is the principle of public participation. It states that people should be empowered to participate in the environmental governance processes, and that their capacity to do so should be developed if it does not exist. All decisions regarding the environment should take the needs, interest and values of the public into account, including traditional and ordinary knowledge (NEMA, 1998). There are also specific environmental management acts that fall under NEMA, such as the National Environmental Management, Air Quality Act 39 of 2004 (NEM: AQA), and the National Environmental Management, Waste Act 59 of 2008 (NEM: WA). These acts require similar public participation processes to NEMA and the principles of NEMA also apply to them (Department of Environmental Affairs & Development Planning [DEA&DP], Provincial Government of the Western Cape, 2010).

Chapter 6 of NEMA elaborates on the public participation requirements. This is supplemented by the EIA regulations published in GN 982 of 4 December 2014, which contained requirements for public participation (GN 982 in GG 38282 of 4 December 2014). It provides requirements for the public participation, the minimum legal requirements for public participation processes, the generic steps of a public participation process, requirements for planning a public participation process and a description of the roles and responsibilities of the various role players. A compulsory Public Participation Guideline that was published in 2012 (GN 807 of 10 October 2012) in terms of section J of NEMA (NEMA, 1998) complements these requirements. According to the guidelines, public participation can be seen as one of the most important aspects of the environmental authorisation process. Public participation is the only requirement of the environmental impact assessment process for which exemption cannot be given unless no rights are affected by an application. This stems from the requirement in NEMA that people have a right to be informed about potential decisions that may affect them and that they must be given an opportunity to influence those decisions.

The principles of the National Environmental Management Act 107 of 1998 declare further that community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, sharing of environmental knowledge and experience and any other appropriate means. It states that the social, environmental and economic impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions taken must be appropriate given the assessment and evaluation. NEMA 107 of 1998 recognises that the environment is held in public trust for the people, and therefore the beneficial use of environmental resources must serve the peoples' interest and protect the environment as the peoples' common heritage.

NEMA takes a holistic view of the environment, and promotes the consideration of social, economic, and biophysical factors to obtain sustainable development and achieve effective management of the biophysical environment.

4.1.2 The Mineral and Petroleum Resources Development Act 28 of 2002

The Mineral and Petroleum Resources Development Act (MPRDA) 28 of 2002 is the only environmental act that explicitly requires a social development output, in addition to a public participation process, in the form of a Social and Labour Plan (SLP). In the preamble to the Act it recognises the need to promote local and rural development and the social upliftment of communities affected by resource development. In Section 2 it states that some of the objectives of the act are:

- To substantially and meaningfully expand opportunities for historically disadvantaged persons, including women, to enter the mineral and petroleum industries and to benefit from the exploitation of the nations' mineral and petroleum resources;
- To promote economic growth and mineral and petroleum resources development in the Republic;
- To promote employment and advance the social and economic welfare of all South Africans, and

- To ensure that holders of mining and production rights contribute towards the socio-economic development of the areas in which they are operating.

The MPRDA acknowledges that mineral and petroleum resources are the common heritage of all the people of South Africa and that the State is the custodian thereof for the benefit of all. It states that the Minister of Mineral Resources must ensure the sustainable development of South Africa's mineral and petroleum resources within a framework of national environmental policy, norms and standards while promoting economic and social development (MPRDA, 2002).

In Section 37 of the Mineral and Petroleum Resources Development Act 28 of 2002 it endorses the principles set out in Chapter 1 of the National Environmental Management Act 107 of 1998. In Section 39 of the MPRDA the act explicitly requires a social impact assessment as well as an environmental impact assessment when it states that applicants must:

"...investigate, assess and evaluate the impact of his or her proposed prospecting or mining operations on:

(i) The environment;

(ii) The socio-economic conditions of any person who might be directly affected by the prospecting or mining operation..."

Section 3, Chapter 2, Part I, of the regulations (Government Notice 527, 23 April 2004) published under the MPRDA refers to the public participation process, which must be followed according to the Act. It includes advertising and an invitation to comment on the process.

Sections 40 to 46, Chapter 2, Part II, of the regulations published under the MPRDA deal with the Social and Labour Plan (SLP) requirements (Government Notice 527, 23 April 2004). The Department of Mineral Resources provided guidelines for the development of the SLP (Department of Mineral Resources, 2010). The guidelines specify the objectives of the SLP as:

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- Promote economic growth and mineral and petroleum resources development in the Republic;
- Promoting employment and advancing the social and economic welfare of all South Africans;
- Ensuring that holders of mining or production rights contribute towards the socio-economic development of the areas in which they are operating as well as the areas from which the majority of the workforce is sourced, and
- To utilise and expand the existing skills base for the empowerment of Historically Disadvantaged South Africans and to serve the community (Department of Mineral Resources, 2010).

The crux of this section is that the SLP requires applicants for mining and production rights to develop and implement comprehensive Human Resources Development Programmes including Employment Equity Plans, Local Economic Development Programmes and processes to save jobs and manage downscaling and/or closure (MPRDA 28 of 2002). According to the regulations, the above programmes are aimed at promoting employment and advancement of the social and economic welfare of all South Africans whilst ensuring economic growth and socio-economic development. The management of downscaling and/or closure is aimed at minimising the impact of commodity cyclical volatility, economic turbulence and physical depletion of the mineral or production resources on individuals, regions, or local economies. All mines in South Africa are required to compile an SLP, and they must report compliance on a yearly basis (MPRDA, 2002). Compiling an SLP must be done in a participatory manner, and local economic development initiatives must be aligned with the municipal integrated development planning processes. An SLP is not a social impact management plan per se, although it does aim to manage some negative social impacts. The guideline is very clear about the fact that measures put in place for the mitigation of impacts cannot be seen as mine community development projects (Department of Mineral Resources, 2010).

4.1.3 The National Heritage Resources Act 25 of 1999

Although the National Heritage Resources Act (NHRA) 25 of 1999 is not an environmental act per se, it is relevant in the field of environmental management. The

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NHRA affirms that every generation has a moral responsibility to act as trustee of the national heritage for later generations and that the State is obliged to manage heritage resources in the interest of all South Africans. The general principles for heritage management in Chapter 5 of the Act state that in order to ensure that heritage resources are effectively managed, the skills and capacities of persons and communities involved in heritage resources management must be developed. The Act further elaborates on the fact that heritage resources form an important part of the history and beliefs of communities and must be managed in a way that acknowledges the right of affected communities to be consulted and to participate in their management.

The general principles (Chapter 5) state that the identification, assessment and management of the heritage resources of South Africa must:

- Take account of all relevant cultural values and indigenous knowledge systems;
- Take account of material or cultural heritage value and involve the least possible alteration or loss of it;
- Promote the use and enjoyment of and access to heritage resources, in a way consistent with their cultural significance and conservation needs;
- Contribute to social and economic development, and
- Safeguard the options of present and future generations.

The National Heritage Resources Act 25 of 1999 therefore protects the cultural rights and heritage of the people of South Africa. It does not require explicit public participation, or give any guidelines on how the public should participate. It does refer, like the National Environmental Management Act 107 of 1998 and the National Water Act 36 of 1998, to social and economic development. Public participation processes may be requested by the South African Heritage Resources Agency if it deems it necessary for a specific project.

4.1.4 Promotion of Administrative Justice Act 3 of 2000

The Bill of Rights in the Constitution of the Republic of South Africa 1996 states that everyone has the right to administrative action that is legally recognised, reasonable, and procedurally just. The Promotion of Administrative Justice Act (PAJA) 3 of 2000

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gives effect to this right. The PAJA applies to all decisions of all State organisations exercising public power or performing a public function in terms of any legislation that negatively affects the rights of any person. The Act prescribes what procedures an organ of State must follow when it takes decisions. If an organ of State implements a decision that impacts on an individual or community without giving them an opportunity to comment, the final decision will be illegal and may be set aside. The Promotion of Administrative Justice Act 3 of 2000 also forces State organisations to explain and give reasons for the manner in which they have arrived at their decisions and, if social issues were involved, and how these issues were considered in the decision-making process.

The Promotion of Administrative Justice Act 3 of 2000 therefore protects the rights of communities and individuals to participate in decision-making processes, especially if these processes affect their daily lives.

4.1.5 Traditional and Khoi-San Leadership Act

The Traditional and Khoi-San Leadership Act 3 of 2019 aims:

- to provide for the recognition of traditional and Khoi-San communities, leadership positions and for the withdrawal of such recognition;
- to provide for the functions and roles of traditional and Khoi-San leaders;
- to provide for the recognition, establishment, functions, roles and administration of kingship or queenship councils, principal traditional councils, traditional councils, Khoi-San councils and traditional sub-councils, as well as the support to such councils;
- to provide for the establishment, composition and functioning of the National House of Traditional and Khoi-San Leaders;
- to provide for the establishment of provincial houses of traditional and Khoi-San leaders;
- to provide for the establishment and composition of local houses of traditional and Khoi-San leaders;
- to provide for the establishment and operation of the Commission on Khoi-San Matters;

- to provide for a code of conduct for members of the National House, provincial houses, local houses and all traditional and Khoi-San councils;
- to provide for regulatory powers of the Minister and Premiers;
- to provide for transitional arrangements;
- to amend certain Acts;
- to provide for the repeal of legislation; and
- to provide for matters connected therewith.

4.1.6 Protection, Promotion, Development and Management of Indigenous Knowledge Act 6 of 2019

The Protection, Promotion, Development and Management of Indigenous Knowledge Act 6 of 2019 intends:

- to provide for the protection, promotion, development and management of indigenous knowledge;
- to provide for the establishment and functions of the National Indigenous Knowledge Systems Office;
- to provide for the management of rights of indigenous knowledge communities;
- to provide for the establishment and functions of the Advisory Panel on indigenous knowledge;
- to provide for access and conditions of access to knowledge of indigenous communities;
- to provide for the recognition of prior learning;
- to provide for the facilitation and coordination of indigenous knowledge-based innovation; and
- to provide for matters incidental thereto.

4.1.7 Marine Living Resources Act 18 of 1998

The Marine Living Resources Act 18 of 1998 intends:

- to provide for the conservation of the marine ecosystem, the long-term sustainable utilisation of marine living resources and the orderly access to exploitation, utilisation and protection of certain marine living resources; and

- for these purposes to provide for the exercise of control over marine living resources in a fair and equitable manner to the benefit of all the citizens of South Africa; and
- to provide for matters connected therewith.

4.2 Additional governance tools

Legislation is not the only tool that authorities can use to achieve sustainable development and social development outcomes. There are several tools, policies and strategic planning instruments that can contribute to this.

4.2.1 Integrated Development Plans

For the purpose of this project, Integrated Development Plan (IDP) documents of the following municipalities need to be considered:

4.2.1.1 Namakwa District Municipality

In its IDP the Namakwa District Municipality states that its strategic objectives are:

- Monitoring and support local municipalities to deliver basic services which include water, sanitation, housing, electricity and waste management
- Support vulnerable groups in the district
- Improve administrative and financial viability and capability
- Promote and facilitate Local Economic Development (include tourism)
- Enhance good governance (include IGR) (IGR - intergovernmental relations)
- Promote and facilitate spatial transformation and sustainable urban development
- To render municipal health services
- To coordinate the disaster management and fire management services in the district
- Caring for the environment.

4.2.1.1.1 Richtersveld Local Municipality

The Richtersveld Local Municipality indicated in its IDP that its strategic goals/objectives are:

- For every household to have access to clean water, electricity, and sanitation

- To treat all their residents with pride and dignity
- To be an effective and efficient local government
- To be an effective instrument of change within its community
- To be a local government that is accountable with community driven development
- To be the gateway for local economic development and tourism in the north-western coast of the Northern Cape.

4.2.1.1.2 Nama Khoi Local Municipality

The key performance areas of the Nama-Khoi Local Municipality are:

- Basic services delivery
- Municipal financial viability and management
- Local economic development
- Municipal transformation and institutional development
- Good governance and community participation.

4.2.1.1.3 Kamiesberg Local Municipality

The Kamiesberg Local Municipality identified its key performance areas in its IDP as:

- Service delivery – to provide and maintain superior decentralised customer services (water, sanitation, roads, storm water, waste management and electricity)
- Local economic development
- Financial viability
- Municipal transformation
- Good governance.

4.2.1.2 West Coast District Municipality

The West Coast District Municipality stated in its IDP that its objectives are to:

- Care for the social well-being, safety and health of all our communities
- Promote regional economic growth and tourism
- Coordinate and promote the development of bulk and essential services and transport infrastructure

- Foster sound relationships with all stakeholders, especially local municipalities
- Maintain financial viability and good governance.

4.2.1.2.1 Matzikama Local Municipality

The Matzikama Local Municipality identified the following strategic objectives in its IDP:

- Provide municipal basic services to meet demands of growing population and development challenges
- Maintain sufficient revenue resources to enable the municipality to meet its constitutional obligations
- Coordinate, facilitate and stimulate sustainable economic development through strategy, policy and programme development
- Reduce poverty levels as measured by SAMPI
- Maintain sufficient organisation resources, enhance the involvement of the public in the development and decision making processes and provide ethical and professional services to support the needs of the communities
- Provide opportunities to officials and councillors for the development of professional and leadership skills and enhance employment equity in the organisation
- Develop and sustain our spatial, natural and built environment.

4.2.1.2.2 Cederberg Local Municipality

The Bergriver Local Municipality identified the following strategic goals:

- Strengthen financial sustainability and further enhancing good governance
- Sustainable service delivery
- Facilitate an enabling environment for economic growth to alleviate poverty
- Promote safe, healthy, educated and integrated communities
- A sustainable, inclusive and integrated living environment

4.2.1.2.3 Bergrivier Local Municipality

The Cederberg Local Municipality identified the following strategic objectives:

- Improve and sustain basic service delivery and infrastructure development
- Financial viability and economically sustainability

- Good governance, community development and public participation
- Facilitate, expand and nurture sustainable economic growth and eradicate poverty
- Enable a resilient, sustainable, quality and inclusive living environment and human settlements i.e. housing development and informal settlement upgrade
- To facilitate social cohesion, safe and healthy communities
- Development and transformation of the institution to provide a people-centred human resources and administrative services to citizens, staff and council.

4.2.1.2.4 Saldanha Bay Local Municipality

The Saldanha Bay Local Municipality identified the following strategic actions to create additional growth:

- **Retaining large existing exporting businesses**
- **Promote Aquaculture-, Fishing-, and Food processing sectors**
- Tourism growth
- **Attract new industrial investors by creating a more enabling environment**
- **Maximise the competitive advantages for ports**
- **Support local SME to access more opportunities**
- **Availability of credible vocational skills development and tertiary education**

4.2.1.2.5 Swartland Local Municipality

The strategic goals of the Swartland Local Municipality are:

- Improved quality of life for citizens
- Inclusive economic growth
- Quality and sustainable living environment
- Caring, competent and responsive institutions, organisations, and business
- Sufficient, affordable and well-run services.

4.2.1.3 City of Cape Town Metropolitan Municipality

The City of Cape Town has sixteen objectives linked to its priorities and foundations:

- Economic growth

- Increased jobs and investment in the Cape Town economy

- Basic services
  - Improved access to quality and reliable basic services
  - End load-shedding in Cape Town over time
  - Well-managed and modernised infrastructure to support economic growth
- Safety
  - Effective law enforcement to make communities safer
  - Strengthen partnerships for safer communities
- Housing
  - Increased supply of affordable, well-located homes
  - Safer, better-quality homes in informal settlements and backyards over time
- Public space, environment and amenities
  - Healthy and sustainable environment
  - Clean and healthy waterways and beaches
  - Quality and safe parks and recreational facilities supported by community partnerships
- Transport
  - A sustainable transport system that is integrated, efficient and provides safe and affordable options for all
  - Safe and quality roads for pedestrians, cyclists and vehicles
- A resilient city
- A more spatial integrate and inclusive city
- A capable and collaborative city government.

4.2.2 Provincial Growth and Development Strategies

The Provincial Growth and Development Strategies of the Northern Cape and Western Cape Provinces need to be considered.

4.2.2.1 Northern Cape Strategic Plan 2020-2035

The four drivers of the Northern Cape Provincial Growth and Development Plan:

- Economic transformation, growth and development

  To ensure economic growth and development that will lead to job creation and radical economic transformation for the people of the Northern Cape Province, ten economic drivers or development paths have been identified:

  - Agriculture and agro-processing
  - Mining and mineral beneficiation
  - Tourism market development
  - Rural development and land reform
  - Development of energy sector
  - Manufacturing and trade
  - Competitive infrastructure development
  - Employment and skills development
  - Innovation and knowledge economy
  - Marine economy

- Social transformation and human welfare

  To sustainably address the social injustices and inequalities in the province, social transformation must be accelerated and deepened towards human development and welfare. The following six drivers have been identified:

  - Quality basic education
  - Quality health care
  - Social cohesion and community participation
  - Social protection and safety
  - Sustainable human developments
  - Employment and skills development

- Environmental sustainability and resilience

  The Northern Cape Province has an abundance of natural resources and environmental assets. While these present a wide range of economic opportunities, a concerted effort must be made to ensure that these are protected and enhance to support the developmental objectives of the

province. As the province is an arid region, it must be ensured that enough is done to mitigate the real threat of climate change.

- Effective, efficient, and accountable governance

  A capable and accountable government based on strong inter-governmental cooperation and participatory governance with civil society will be better positioned and capable to perform seamless services based on the needs of those on whose behalf they govern. Three drivers have been identified to facilitate effective, efficient, and accountable governance:

  - Developmental and democratic state
  - Effective local government
  - International relations

4.2.2.2 Western Cape Provincial Strategic Plan 2019-2024

Vision has five strategic priorities with the following problem areas and focus areas:

- Safe and cohesive communities – a place where residents and visitors feel safe
  - Problem areas
    - Violence and violent crime
    - Police capacity and public trust
    - Cohesive communities
  - Focus areas
    - Enhanced capacity and effectiveness of policing and law enforcement
    - Strengthened youth-at-risk referral pathways and child- and family centred initiatives to reduce violence
    - Increased social cohesion and safety in public places
- Growth and jobs – an enabling environment for the private sector and markets to drive growth and create jobs
  - Problem areas
    - Weak economic performance persists
    - Unemployment persists
    - Climate change impacts and resource pressures

- Focus areas
  - Increasing investment
  - Building and maintaining infrastructure
  - Growing the economy through export growth
  - Creating opportunities for job creation through skills development
  - Creating an enabling environment for economic growth through resource resilience

- Empowering people -residents have opportunities to shape their lives and the lives of others, to ensure a meaningful and dignified live
  - Problem areas
    - Children and families live in unhealthy, violent, neglectful and dysfunctional environments that impede proper development
    - Children have unequal access to quality holistic education and extended learning opportunities, which limits post-schooling success
    - Youth engage in unhealthy and risky behaviours, have few educational and economic opportunities, and become disconnected from productive society
    - Health outcomes are uneven between rich and poor and, despite successes in areas like HIV treatment and sexual and reproductive health, there is an inability to fulfil the growing demand for health services
  - Focus areas
    - Children and families
    - Education and learning
    - Youth and skills
    - Health and wellness

- Mobility and spatial transformation – residents live in well-connected, vibrant, and sustainable communities and move around efficiently on safe, affordable, low-carbon public transport
  - Problem areas
    - Poor communities far from social and economic opportunities

- Inadequate public transport
- Infrastructure backlogs and challenges

- Focus areas
  - Create better linkages between places through safe, efficient, and affordable public transport
  - Inclusive places of opportunities
  - More opportunities for people to live in better locations
  - Improving the places where people live

- Innovation and culture – government services are delivered to the people in an accessible, innovative, and citizen-centric way
  - Problem areas
    - Inward-focused organisational culture
    - Western Cape Government innovation exists, but is not fully embedded
    - Limited integration across the spheres of government and with external partners
    - Good governance is primarily driven by compliance processes
    - Talent and staff development is not responsive to the changing world of work
  - Focus areas
    - Citizen-centric culture
    - Innovation for impact
    - Integrated service delivery
    - Governance transformation
    - Talent and staff development

4.2.3 National Development Plan

On 11 November 2011 the National Planning Commission released the National Development Plan: Vision for 2030 (NPC, 2012) for South Africa and it was adopted as government policy in August 2012. The National Development Plan (NDP) was undertaken to envision what South Africa should look like in 2030 and what action

steps should be taken to achieve this (RSA, 2013). The aim of the NDP is to eliminate poverty and reduce inequality by 2030. The report identifies nine central challenges to development in South Africa:

1. Too few people work.
2. The standard of education for most black learners is of poor quality.
3. Infrastructure is poorly located, under-maintained and insufficient to foster higher growth.
4. Spatial patterns exclude the poor from the fruits of development.
5. The economy is overly and unsustainably resource intensive.
6. A widespread disease burden is compounded by a failing public health system.
7. Public services are uneven and often of poor quality.
8. Corruption is widespread.
9. South Africa remains a divided society (NPC, 2012).

The plan focuses on creating an enabling environment for development and wants to shift from a paradigm of entitlement to a paradigm of development that promotes the development of capabilities, the creation of opportunities and the involvement of all citizens (NPC, 2012). The National Development Plan (NPC, 2012) wants to achieve the following:

1. An economy that will create more jobs.
2. Improving infrastructure.
3. Transition to a low-carbon economy.
4. An inclusive and integrated rural economy.
5. Reversing the spatial effects of apartheid.

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6. Improving the quality of education, training, and innovation.
7. Quality healthcare for all.
8. Social protection.
9. Building safer communities.
10. Reforming the public service.
11. Fighting corruption.
12. Transforming society and uniting the country.

Each of the points above is a chapter in the plan and contains a range of targets and proposals. Some are general statements of policy intent, while others are specific policy proposals, actions or processes that should take place (NPC, 2012).

4.2.4 Sustainable Development Goals

All 189 Members States of the United Nations, including South Africa, adopted the United Nations Millennium Declaration in September 2000 (UN, 2000). The commitments made by the Millennium Declaration are known as the Millennium Development Goals (MDGs), and 2015 was targeted as the year to achieve these goals. The United Nations Open Working Group of the General Assembly identified seventeen sustainable development goals, built on the foundation of the MDGs as the next global development target (UN, 2014). The sustainable development goals include aspects such as ending poverty, addressing food security, promoting health, wellbeing and education, gender equality, water and sanitation, economic growth and employment creation, sustainable infrastructure, reducing inequality, creating sustainable cities and human settlements, and addressing challenges in the physical environment such as climate change and environmental resources (UN, 2014). These aspects are included in the NPD, and it can therefore be assumed that South Africa's development path is aligned with the international development agenda.

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4.3 National and international standards

National and international industry standards aimed at sustainable development and social justice specifically have become abundant in the last decade. Many industries use these standards as indicators for best practice. The discussion below highlights only a few of these standards.

4.3.1 ISO 26000:2010/SANS 26000:2010

Performance standards have long been a voluntary tool used by industry to achieve certain outcomes. The first standard on social responsibility, ISO 26000 was published on 1 November 2010 (ISO, 2010). It was developed using a multi-stakeholder approach involving experts from more than 90 countries and 40 international or broadly based regional organisations involved in different aspects of social responsibility (ISO, 2010).

The South African Bureau of Standards (SABS), a statutory body that is mandated to develop, promote and maintain South African National Standards (SABS, [sa]) adopted the ISO 26000 Standard as a South African National Standard (SANS) 26000:2010.

Social responsibility is defined in the standard as the responsibility of an organisation for the impacts of its decisions and activities on society and the environment, through transparent and ethical behaviour that contributes to sustainable development, including health and welfare of society; takes into account the expectations of the stakeholders; complies with applicable law and is consistent with international behaviour norms, and is integrated throughout the organisation and practiced in its relationships (ISO, 2010).

The document identifies seven principles for social responsibility and seven core subjects that should be addressed by organisations. The seven principles for social responsibility are accountability, transparency, ethical behaviour, respect for stakeholder interests, respect for the rule of law, respect for international norms of behaviour and respect for human rights (ISO, 2010). The core subjects that should be addressed include organisational governance, human rights, labour practices, environment, fair operating practices, consumer issues and community involvement

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and development (ISO, 2010). Economic aspects, health and safety and the value chain are dealt with throughout the seven core subjects, and gender issues are considered.

ISO 26000 is a good introduction to what social responsibility is and what measures should be taken to move towards being a more socially responsible company. It deals with equity issues and can encourage social development initiatives by companies through activities such as social investment projects, employment creation, skills development and income creation. Any company operating in area where people are affected by their activities has a social responsibility towards the affected community, and as such it would be in the interest of Searcher to address the core subjects as suggested by ISO 26000:2010.

4.3.2 International Social Performance Standards/Initiatives

There is a profusion of global initiatives aiming at assisting companies to make their operations more sustainable. Human rights, environmental protection and social justice are gaining support from industry. The social agenda forms an important part of this trend. Only a few relevant initiatives will be mentioned in this section.

The Global Reporting Initiative (GRI) is a leading organisation in the sustainability field that promotes sustainability reporting as a way for companies to become more sustainable and contribute to sustainable development. A company publishes a sustainability report to report the economic, social and environmental impacts of its everyday activities, present its values and governance model and explain the link between its strategy and its commitment to sustainable development (GRI, [sa]). The GRI have strategic partnerships with the United Nations Environment Programme, the United Nations Global Compact, the Organisation for Economic Co-operation and Development and the International Organisation for Standardisation, amongst others (GRI, [sa]). The social category relates to the impact of the company on the social systems in which it operates. The social category consists of four subcategories namely labour practices and decent work; human rights; society; and product responsibility. Each of the categories is unpacked by using a number of aspects that should be considered (GRI, [sa]). GRI Focal Points are national offices that drive the initiatives in

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particular countries and regions. On 26 February 2013 the GRI Focal Point South Africa was launched. South Africa is one of the countries with the largest number of GRI reporters in the world. The GRI Focal Point South Africa aims to work with multi-national companies to expand and share best practices across the continent (GRI, [sa]).

Many of the multi-lateral funding agencies such as the World Bank have social standards that they must uphold. The most frequently used in the EIA industry is the International Finance Corporation's (IFC) principles (IFC, 2012). The IFC is a member of the World Bank group, and as a part of their sustainability framework they created performance standards on environmental and social sustainability (IFC, 2012). The standards relevant to the social environment are the following:

1. Environmental and Social Standard 1. Assessment and Management of Environmental and Social Risks and Impacts
2. Environmental and Social Standard 2: Labour and Working Conditions
3. Environmental and Social Standard 4: Community Health and Safety
4. Environmental and Social Standard 5 Land Acquisition, Restrictions on Land Use and Involuntary Resettlement
5. Environmental and Social Standard 8: Cultural Heritage
6. Environmental and Social Standard 10. Stakeholder Engagement and Information Disclosure (World Bank, 2016)

Issues such as gender, climate change, water and human rights are addressed across the standards. A guidance note accompanies each standard (IFC, 2012:4). Environmental and social risks and impacts must be managed by using an Environmental and Social Management System. The standard applies to all the activities funded by the IFC for the duration of the loan period. A number of private banks adopted most of the IFC standards in an initiative known as the Equator Principles (Esteves, Franks & Vanclay, 2012).

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4.3.3 International Principles for SIA

The practice of SIA is guided by a set of *International Principles* that defines the core values, fundamental principles for development and principles specific to SIA practice (Vanclay, 2003). When the *International Principles* are considered, it is clear that SIA aspires to more than just assessing the impact of development on people and includes sustainable outcomes. The following specific principles refer to these sustainable outcomes (Vanclay, 2003):

1. Development projects should be broadly acceptable to the members of those communities likely to benefit from, or be affected by, the planned intervention.
2. The primary focus of all developments should be positive outcomes, such as capacity building, empowerment, and the realisation of human and social capital.
3. The term "environment" should be defined broadly to include social and human dimensions, and in such inclusion, care must be taken to ensure that adequate attention is given to the realm of the social.
4. Equity considerations should be a fundamental element of impact assessment and of development planning.
5. There should be a focus on socially sustainable development, with the SIA contributing to the determination of best development alternative(s) – SIA (and EIA) has more to offer than just being an arbiter between economic benefit and social cost.
6. In all planned interventions and their assessments, avenues should be developed to build the social and human capital of local communities and to strengthen democratic processes.
7. Local knowledge, experience and acknowledgement of different cultural values should be incorporated in any assessment.
8. Development processes that infringe the human rights of any section of society should not be accepted.

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In addition to the *International Principles*, the international SIA community produced a document titled: *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects* (Vanclay, Esteves, Aucamp & Franks, 2015) in April 2015. The purpose of this document is to provide advice to various stakeholders (including proponents) about good practice SIA and social impact management (Vanclay et al., 2015). This document aspires to provide a much-needed benchmark for SIA practice across the globe.

5 Receiving environment

According to the National Environmental Management Act (NEMA, 1998) environment refers to the surroundings in which humans exist. When viewing the environment from a socio-economic perspective the question can be asked what exactly the social environment is. Different definitions for social environment exist, but a clear and comprehensive definition that is widely accepted remains elusive. Barnett & Casper (2001) offers the following definition of human social environment:

> *"Human social environments encompass the immediate physical surroundings, social relationships, and cultural milieus within which defined groups of people function and interact. Components of the social environment include built infrastructure; industrial and occupational structure; labour markets; social and economic processes; wealth; social, human, and health services; power relations; government; race relations; social inequality; cultural practices; the arts; religious institutions and practices; and beliefs about place and community. The social environment subsumes many aspects of the physical environment, given that contemporary landscapes, water resources, and other natural resources have been at least partially configured by human social processes. Embedded within contemporary social environments are historical social and power relations that have become institutionalized over time. Social environments can be experienced at multiple scales, often simultaneously, including households, kin networks, neighbourhoods, towns and cities, and regions. Social environments are dynamic and change over time as the result of both internal and external forces. There are relationships of dependency among the social environments of different local areas, because these areas are connected through larger regional, national, and international social and economic processes and power relations."*

Environment-behaviour relationships are interrelationships (Bell, Fisher, Baum & Greene, 1996). The environment influences and constrains the behaviour of people, but behaviour also leads to changes in the environment. The impacts of a project on

people can only be truly understood if their environmental context is understood. The baseline description of the social environment will include a description of the area within a provincial, district and local context that will focus on the identity and history of the area as well as a description of the population of the area based on a number of demographic, social and economic variables.

5.1 Description of the area

The proposed project area for the Searcher Seismic Reconnaissance project is located on the edge of the South African exclusive economic zone in the Atlantic Ocean. The people potentially affected by the proposed project are those living in the areas adjacent to the ocean whose activities could potentially be affected. The following areas are included in the baseline description of the social environment:

- Northern Cape Province
  - Namakwa District Municipality
    - Richtersveld Local Municipality (Wards 2, 3, 4)
    - Nama Khoi Local Municipality (Ward 8)
    - Kamiesberg Local Municipality (Wards 1, 2)
- Western Cape Province
  - West Coast District Municipality
    - Matzikama Local Municipality (Wards 2, 5, 8)
    - Cederberg Local Municipality (Ward 5)
    - Bergrivier Local Municipality (Wards 6, 7)
    - Saldanha Bay Local Municipality (Wards 1, 3, 5, 6, 11, 12, 14)
    - Swartland Local Municipality (Ward 5)
  - City of Cape Town Metropolitan Municipality (Wards 4, 23, 29, 32, 54, 55, 74, 107, 113, 115)

Figure 2 shows the location of the proposed project area in relation to these municipal areas.

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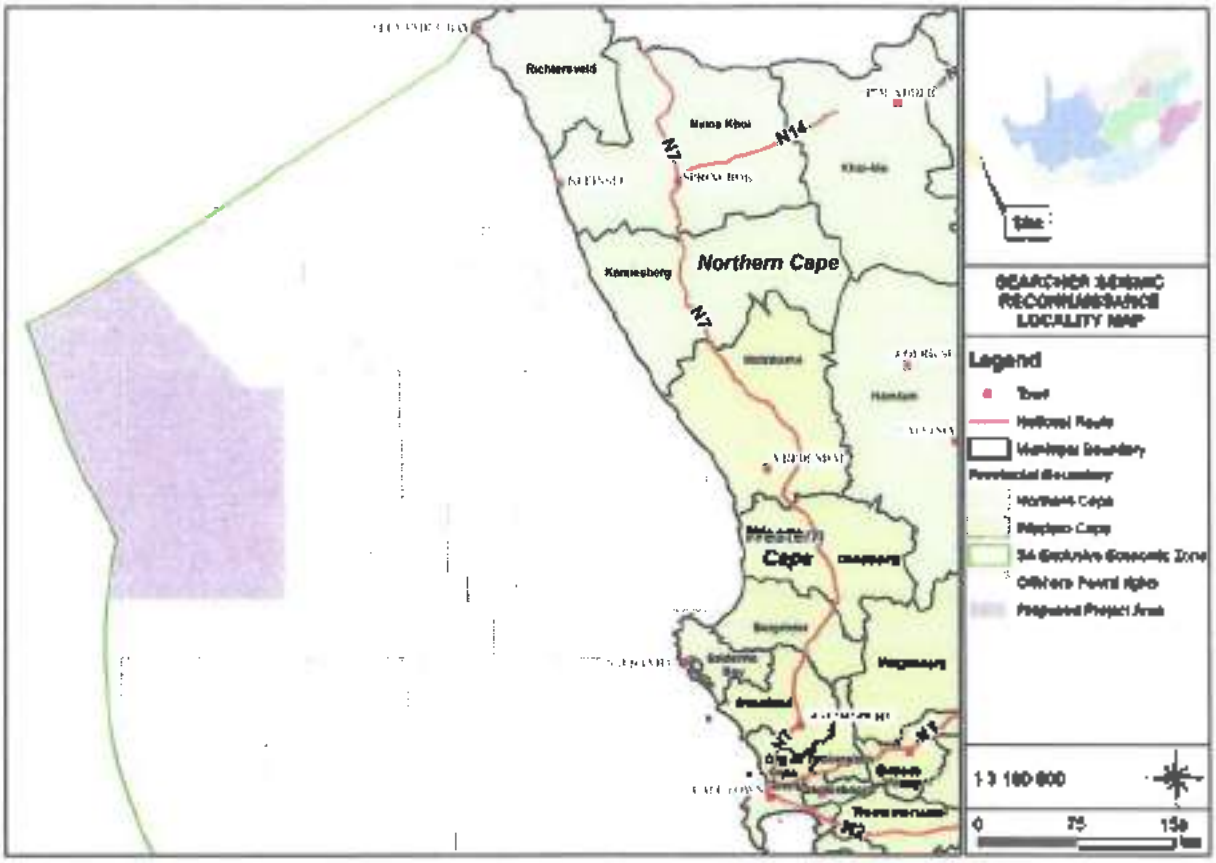
Figure 2: Location of the proposed project area.



5.1.1 Northern Cape Province

The Northern Cape Province is South Africa's largest province. It takes up almost a third of the country and covers an area of 372 889 km² (www.municipalities.co.za). It is bordered by the provinces of North West, Free State, Eastern Cape and Western Cape as well as the countries of Namibia and Botswana and the Atlantic Ocean. It consists of the Frances Baard, John Taolo Gaetsewe, Namakwa, Pixley Ka Seme and ZF Mgcawu District Municipalities.

The capital of the province is Kimberley and other towns in the province include Springbok, Kuruman, De Aar, Sutherland, Alexander Bay, Port Nolloth, Kathu, Okiep, Springbok, Aggeneys, Upington, Kakamas, Keimoes and Warrenton.

The economy of the province relies mainly on mining and agriculture. Commodities being mined include iron ore, copper, asbestos, manganese, fluorspar, semi-precious stones, and marble. Alluvial diamonds are being extracted from the beaches and sea

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in the area around Alexander Bay and Port Nolloth. Agricultural products include sheep, wheat, fruit, grapes, wheat, peanuts, maize, and cotton. The province is known for its dried fruit, wine, and karakul pelt.

The spring-flowers in Namakwaland is a popular tourist attraction. The province also houses the southern hemisphere's largest astronomical observatory at Sutherland.

5.1.1.1 *Namakwa District Municipality*

The Namakwa District Municipality is the largest district municipality in the province and covers an area of 126 836 km² (www.municipalities.co.za). It is bordered by the ZF Mgcawu Local Municipality, the Cape Winelands, West Coast, Pixley Ka Seme and Central Karoo District Municipalities, the country of Namibia and the Atlantic Ocean. It is the largest district in the province, making up almost a third of the province.

The district consists of six local municipalities, namely the Hantam, Kamiesberg, Karoo Hoogland, Khai-Ma, Nama Khoi, and Richtersveld Local municipalities. The capital of the province is Springbok and other towns include Aggeneys, Alexander Bay, Brandvlei, Bulletrap, Calvinia, Carolusberg, Concordia, Eksteensfontein, Fraserburg, Garies, Hondeklip Bay, Kamieskroon, Kleinzee, Koingnaas, Komaggas, Kuboes, Leliefontein/Kamiesberg, Loeriesfontein, Middelpos, Nababeep, Nieuwoudtville, O'Kiep, Onderste Doorns, Pella, Pofadder, Port Nolloth, Richtersveld, Sanddrift, Springbok, Steinkopf, Sutherland, and Williston.

The main economic sectors are tourism and agriculture.

5.1.1.1.1 Richtersveld Local Municipality

The Richtersveld municipality is the smallest municipality in the district and covers an area of 9 608 km² (www.municipalities.co.za). The municipality borders the Atlantic Ocean and the main towns are Alexander Bay, Eksteensfontein, Kuboes, Port Nolloth, Richtersveld and Sanddrift. The main economic sectors are mining, agriculture, fishing and tourism.

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5.1.1.1.2 Nama Khoi Local Municipality

The Nama Khoi Local Municipality covers an area of 17 990 km² (www.municipalities.co.za). It is home to Nama, Khoe and San people who have occupied the area for hundreds of years. The municipality borders the Atlantic Ocean, and the main towns are Bulletrap, Carolusberg, Concordia, Kleinzee, Komaggas, Nababeep, O'Kiep, Springbok, Steinkopf. The main economic activities are mining and tourism, but there are also some government departments.

5.1.1.1.3 Kamiesberg Local Municipality

The Kamiesberg Local Municipality covers an area of 14 208 km² (www.municipalities.co.za). The municipality borders the Atlantic Ocean and the main towns are Garies, Hondeklip Bay, Kamieskroon, Koingnaas, and Leliefontein/Kamiesberg.

5.1.2 Western Cape Province

The Western Cape Province is located on the southern tip of Africa between the Atlantic and Indian Oceans and is bordered by the Northern Cape and Eastern Cape Provinces. It covers an area of 129 462 km² (www.municipalities.co.za). The province is divided into one metropolitan municipality and five district municipalities. The capital of the province is the city of Cape Town and other major cities and towns include George, Knysna, Paarl, Swellendam, Oudtshoorn, Stellenbosch, Worcester, Mossel Bay and Strand.

The province has a well-established industrial and business base. Main economic activities include finance, real estate, ICT, retail, and tourism. Fishing is the most important industry along the west coast and sheep farming in the Karoo. In terms of agriculture main produce include grapes, fruit, vegetables, and wheat. A number of vineyards are located in the Western Cape Province.

5.1.2.1 West Coast District Municipality

The West Coast District Municipality covers an area of 31 118 km² (www.municipalities.co.za) and is bordered by the Namakwa and Cape Winelands District Municipalities, the City of Cape Town, and the Atlantic Ocean. The municipality

consists of five local municipalities, namely the Swartland, Bergrivier, Matzikama, Cederberg and Saldanha Bay Local Municipalities.

The capital of the district is Moorreesburg and other main towns include Abbotsdale, Aurora, Bitterfontein, Chatsworth, Citrusdal, Clanwilliam, Darling, Doring Bay, Ebenhaezer, Eendekuil, Elands Bay, Graafwater, Grotto Bay, Hopefield, Jacobs Bay, Kalbaskraal, Klawer, Kliprand, Koekenaa, Koringberg, Lamberts Bay, Langebaan, Leipoldtville, Lutzville, Malmesbury, Moisvlei, Moorreesburg, Nuwerus, Paternoster, Piketberg, Porterville, Putsekloof, Redelinghuys, Riebeeck Kasteel, Riebeeck West, Rietpoort, Riverlands, Saldanha, St Helena Bay, Stofkraal, Strandfontein, Vanrhynsdorp, Velddrif, Vredenburg, Vredendal, Wupperthal, and Yzerfontein.

5.1.2.1.1 Matzikama Local Municipality

The Matzikama Local Municipality borders the Northern Cape Province and the Atlantic Ocean. It is the largest of the five municipalities in the district, making up almost half of the district. It covers an area of 12 981 km² (www.municipalities.co.za). There are 18 towns and villages in the municipal area with most of the population being concentrated along the Olifants River and its canal system. The main towns and villages include Bitterfontein, Doring Bay, Ebenhaezer, Klawer, Kliprand, Koekenaa, Lutzville, Moisvlei, Nuwerus, Putsekloof, Rietpoort, Stofkraal, Strandfontein, Vanrhynsdorp,aand Vredendal.

5.1.2.1.2 Cederberg Local Municipality

The Cederberg Local Municipality covers an area of 8 007 km² (www.municipalities.co.za). It is bordered by the Atlantic Ocean and the Cederberg Mountains and is located on the Cape-Namibia corridor. The main towns in the area include Citrusdal, Clanwilliam, Elands Bay, Graafwater, Lamberts Bay, Leipoldtville, and Wupperthal.

5.1.2.1.3 Bergrivier Local Municipality

The Bergrivier Local Municipality covers an area of 4 407 km² (www.municipalities.co.za). The main towns in the area include Aurora, Eendekuil, Piketberg, Porterville, Redelinghuys, and Velddrif.

5.1.2.1.4 Saldanha Bay Local Municipality

The Saldanha Bay Local Municipality is the smallest of the five municipalities in the district and covers an area of 2 015 km² (www.municipalities.co.za). The main towns in the area are Hopefield, Jacobs Bay, Langebaan, Paternoster, Saldanha, St Helena Bay, Vredenburg.

5.1.2.1.5 Swartland Local Municipality

The Swartland Local Municipality covers an area of 3 708 km² (www.municipalities.co.za). It is home to the town of Malmesbury that fulfils an important niche in the region due to its high development potential that can be attributed to factors like its relative accessibility along the N7 road/rail corridor; proximity to Cape Town; a diversified economic base that not only accommodates agriculture, but also well-developed industrial and commercial sectors; and supportive infrastructure. A number of people moved here and commute to jobs in Cape Town because of the high property rates in the Cape Town Metropolitan area and the tranquil environment that it offers.

Main towns in the area include Abbotsdale, Chatsworth, Darling, Grotto Bay, Kalbaskraal, Koringberg, Malmesbury, Moorreesburg, Riebeeck Kasteel, Riebeeck West, Riverlands, and Yzerfontein.

5.1.2.2 City of Cape Town Metropolitan Municipality

The City of Cape Town Metropolitan Municipality is situated in the southern peninsula of the Western Cape Province and covers an area of 2 441 km² (www.municipality.co.za). It is South Africa's second largest economic centre and the second most populous city after Johannesburg. It is the provincial capital as well as the legislative capital of South Africa. The city is known for its harbour, floral kingdom and well-known landmarks like Table Mountain and Cape Point.

Main towns and cities in the area include Athlone, Atlantis, Belhar, Bellville, Blackheath, Bloubeg, Blue Downs, Brackenfell, Cape Point, Cape Town, Delft, Durbanville, Elsies Rivier, Fish Hoek, Goodwood, Gordon's Bay, Grassy Park, Gugulatu, Hout Bay, Khayelitsha, Kommetjie, Kraaifontein, Kuils River, Lange, Macassar,

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Matroosfontein, Melkbosstrand, Milnerton, Mitchells Plain, Muizenberg, Noordhoek, Nyanga, Parow, Philadelphia, Philippi, Robben Island, Scarborough, Simon's Town, Sir Lowry's Pass, Somerset West, Southern Suburbs, Strand, and Table View.

5.2 Description of the population

The baseline description of the population will take place on three levels, namely provincial, district and local. Impacts can only truly be comprehended by understanding the differences and similarities between the different levels. The baseline description will focus on the municipal areas along the west coast that are most likely to be affected by the proposed project. Where possible, the data will be reviewed on a ward level. The data used for the socio-economic description was sourced from Census 2011. Census 2011 was a *de facto* census (a census in which people are enumerated according to where they stay on census night) where the reference night was 9-10 October 2011. The results should be viewed as indicative of the population characteristics in the area and should not be interpreted as absolute.

The following points regarding Census 2011 must be kept in mind (www.statssa.co.za):

- Comparisons of the results of labour market indicators in the post-apartheid population censuses over time have been a cause for concern. Improvements to key questions over the years mean that the labour market outcomes based on the post-apartheid censuses must be analysed with caution. The differences in the results over the years may be partly attributable to improvements in the questionnaire since 1996 rather than to actual developments in the labour market. The numbers published for the 1996, 2001, and 2011 censuses are therefore not comparable over time and are different from those published by Statistics South Africa in the surveys designed specifically for capturing official labour market results.

- For purposes of comparison over the period 1996–2011, certain categories of answers to questions in the censuses of 1996, 2001 and 2011, have either been merged or separated.

- The tenure status question for 1996 has been dropped since the question asked was totally unrelated to that asked thereafter. Comparisons for 2001 and 2011 do however remain.

- All household variables are controlled for housing units only and hence exclude all collective living arrangements as well as transient populations.

- When making comparisons of any indicator it must be considered that the time period between the first two censuses is five years and that between the second and third census is ten years. Although Census captures information at one given point in time, the period available for an indicator to change is different.

5.2.1 Population and household sizes

According to the Community Survey 2016, the population of South Africa is approximately 55,7 million and has shown an increase of about 7.5% since 2011. The household density for the country is estimated on approximately 3.29 people per household, indicating an average household size of 3-4 people (leaning towards 3) for most households, which is down from the 2011 average household size of 3.58 people per household. Smaller household sizes are in general associated with higher levels of urbanisation.

The greatest increase in population since 2011 has been in the Swartland and Saldanha Bay Local Municipalities (Table 1) and the increases were well above the national average. The Richtersveld Local Municipality where Port Nolloth is located is the only one of the coastal municipalities in the Northern Cape that showed an increase in population. The Kamiesberg Local Municipality where Hondeklip Bay is located, saw the greatest decrease in population between 2011 and 2016. Population density refers to the number of people per square kilometre and the population density on a national level has increased from 42.45 people per km^2 in 2011 to 45.63 people per km^2 in 2016. The City of Cape Town had the highest population density in 2016, and the Kamiesberg Local Municipality the lowest.

5429

Figure 3 gives a comparison of the population density. The municipalities in the rural areas in the Northern Cape are the least densely populated, while the metropolitan areas in Cape Town have the highest population density.

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Figure 3: Population density (source: Community Survey 2016)

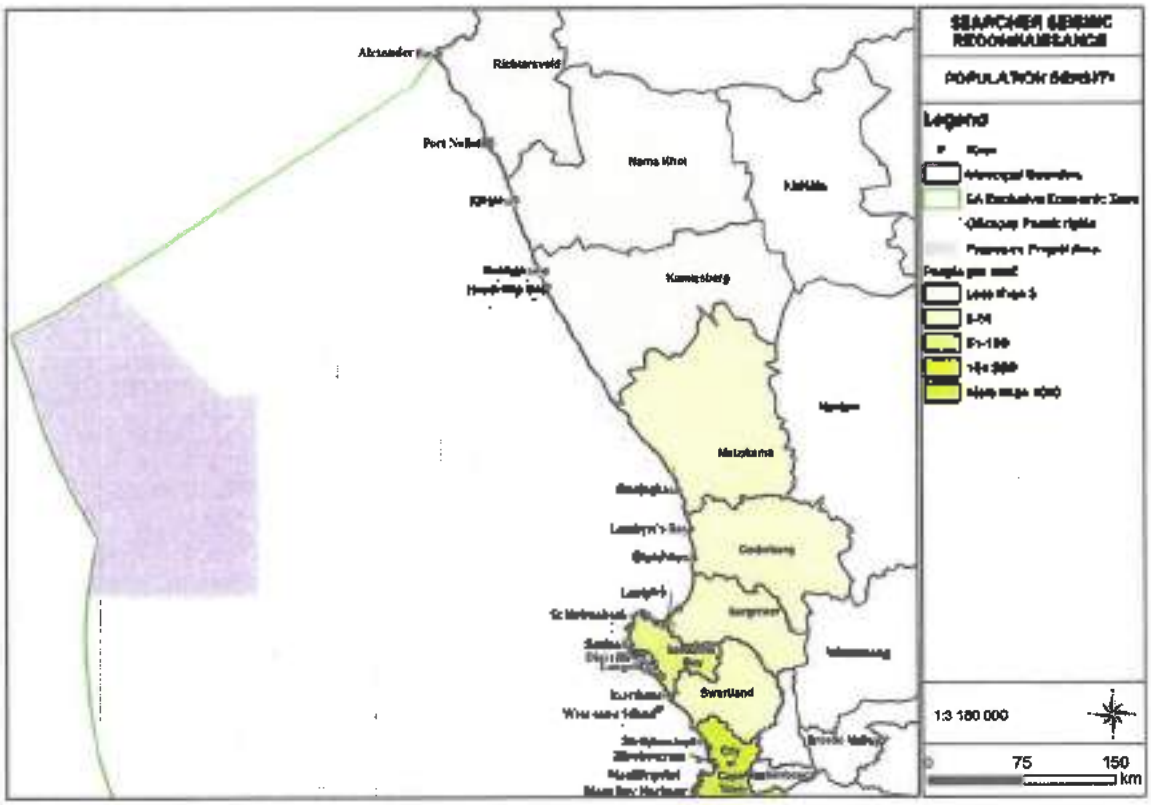

Figure 4 shows the number of people per ward. The wards in the rural areas tend to have less people spread over a greater area, while in the urban areas there are more people in a much smaller area.

Table 1: Population density and growth estimates (sources: Census 2011, Community Survey 2016)

Area	Size in km²	Population 2011	Population 2016	Population density 2011	Population density 2016	Growth in population (%)
Northern Cape	372,889	1,145,861	1,193,780	3.07	3.20	4.18
Namakwa DM	*126,836*	*115,842*	*115,488*	*0.91*	*0.91*	*-0.31*
Richtersveld LM	9,608	11,982	12,487	1.25	1.30	4.21
Nama Khoi LM	17,990	47,041	46,512	2.61	2.59	-1.12
Kamiesberg LM	14,208	10,157	9,605	0.72	0.68	-5.71
Western Cape	129,462	5,822,734	6,279,730	44.96	48.51	7.85
West Coast DM	*31,118*	*391766*	*436,403*	*12.59*	*14.02*	*11.39*
Matzikama LM	12,981	67147	71,045	5.17	5.47	5.81
Cederberg LM	8,007	49,768	52,949	6.22	6.61	6.39
Bergrivier LM	4,407	61,897	67,474	14.05	15.31	9.01
Saldanha Bay LM	2,015	99,193	111,173	49.23	55.17	12.08
Swartland LM	3,708	113,762	133,762	30.68	36.07	17.58
City of Cape Town Metropolitan	*2,441*	*3,740,026*	*4,004,793*	*1,532.17*	*1,640.64*	*7.08*

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Figure 3: Population density (source: Community Survey 2016)

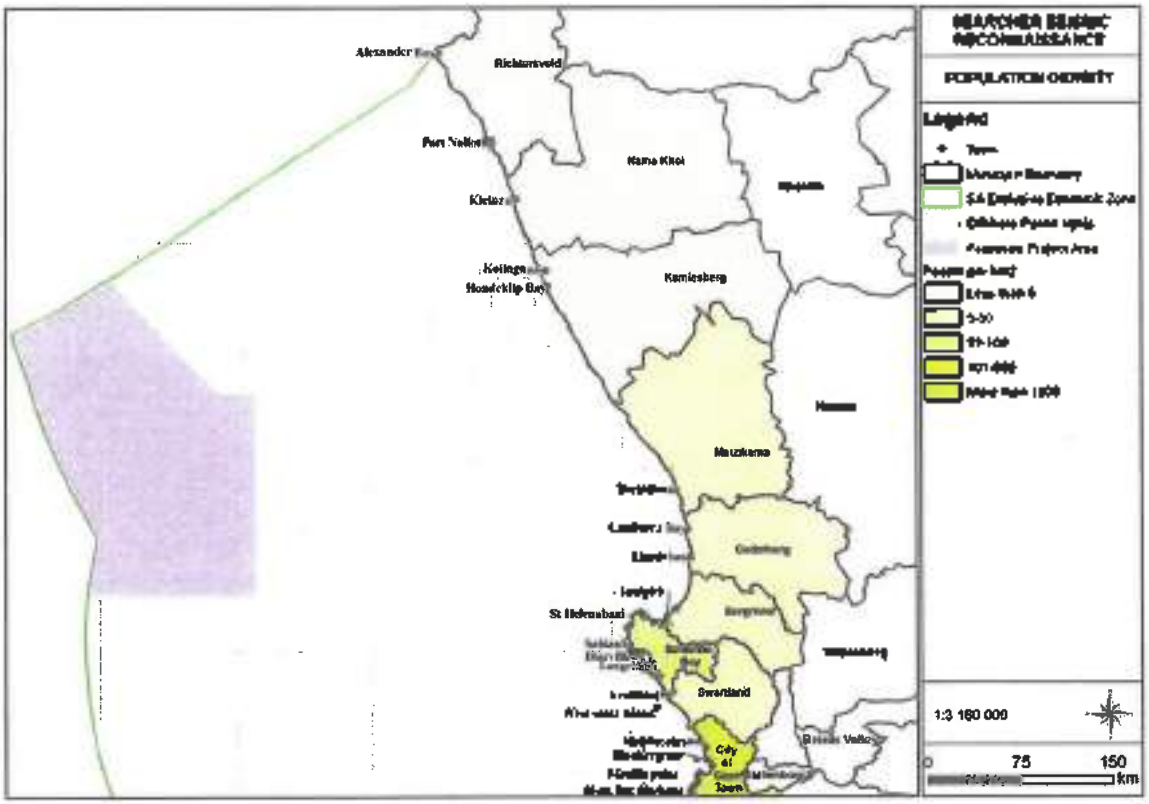
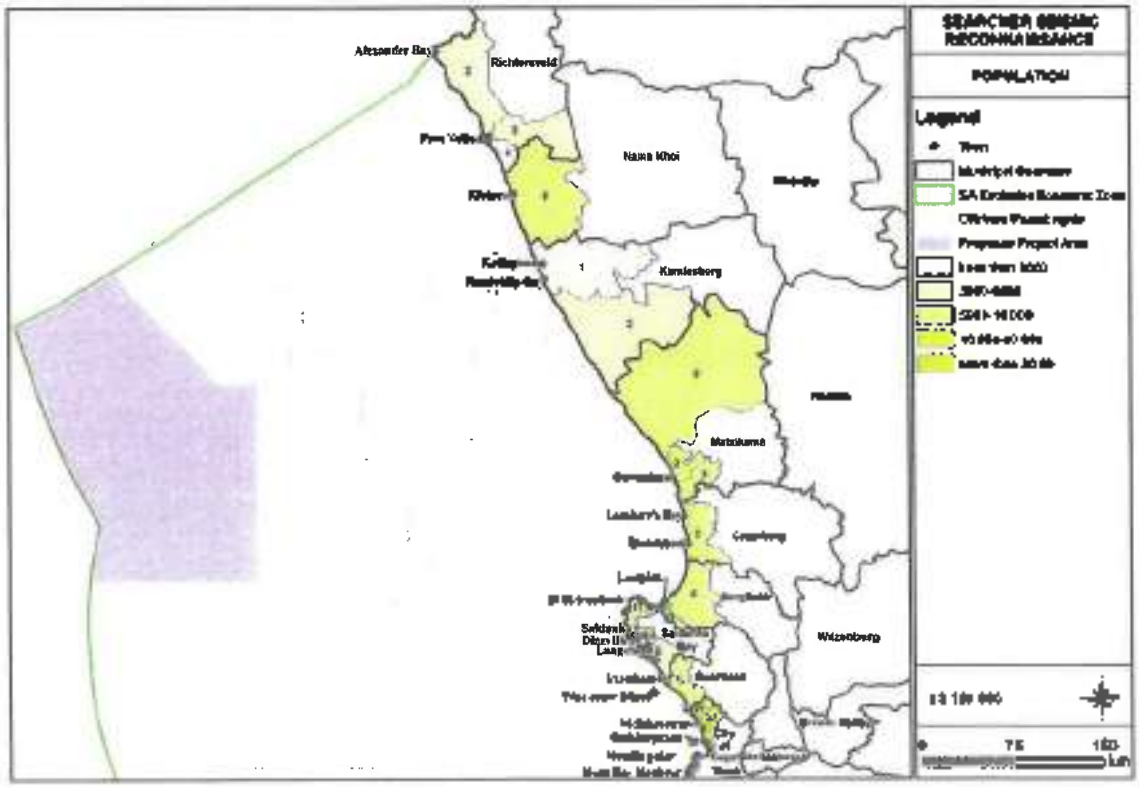


Figure 4: People per ward (source: Census 2011)



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The number of households in the study area has increased on all levels (Table 2). The proportionate increase in households were greater than the increase in population on all levels. The greatest proportional increases in households were in the Swartland and Saldanha Bay Local Municipalities. The average household size has shown a decrease on all levels, which means there are more households, but with less members.

Table 2: Household sizes and growth estimates (sources: Census 2011, Community Survey 2016)

Area	Households 2011	Households 2016	Average household size 2011	Average household size 2016	Growth in households (%)
Northern Cape	301,495	353,709	3.80	3.38	17.35
Namakwa DM	*33,856*	*37,669*	*3.42*	*3.07*	*11.26*
Richtersveld LM	3,543	4,211	3.38	2.97	18.85
Nama Khoi LM	13,193	14,546	3.57	3.20	10.26
Kamiesberg LM	3,143	3,319	3.24	2.89	5.60
Western Cape	1,634,000	1,933,876	3.56	3.25	18.35
West Coast DM	*206,781*	*129,867*	*3.67*	*3.36*	*27.62*
Matzikama LM	16,835	20,821	3.57	3.41	10.54
Cederberg LM	13,513	15,279	3.68	3.47	13.07
Bergrivier LM	16,275	19,072	3.80	3.54	17.19
Saldanha Bay LM	28,835	35,550	3.44	3.13	23.29
Swartland LM	29,324	39,139	3.88	3.42	33.47
City of Cape Town Metropolitan	*1,068,573*	*1,264,849*	*3.50*	*3.17*	*18.37*

Figure 5 shows the number of households per ward. The wards in the Kamiesberg Local Municipality have the fewest people per ward.

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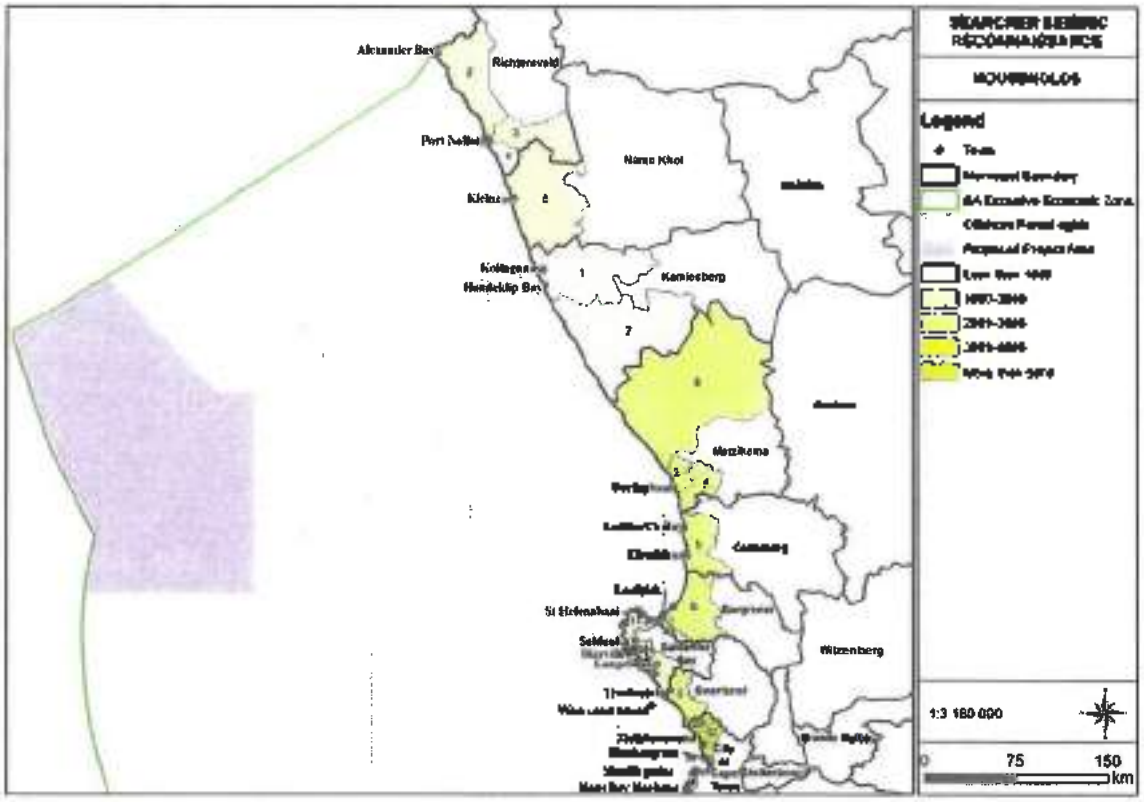
Figure 5: Households per ward (source: Census 2011)



The total dependency ratio is used to measure the pressure on the productive population and refer to the proportion of dependents per 100 working-age population. As the ratio increases, there may be an increased burden on the productive part of the population to maintain the upbringing and pensions of the economically dependent. A high dependency ratio can cause serious problems for a country as the largest proportion of a government's expenditure is on health, social grants and education that are most used by the old and young population.

The Kamiesberg Local Municipality has the highest total dependency ratio (Table 3), while in the Richtersveld Local Municipality have the lowest. Employed dependency ratio refers to the proportion of people dependent on the people who are employed, and not only those of working age. The employed dependency ratio for the Kamiesberg and Nama Khoi Local Municipalities are the highest. This suggests high levels of poverty in these areas. Figure 6 and Figure 7 show the total and employed dependency ratios on a ward level.

Table 3: Total dependency ratios (source: Census 2011).

Area	Total dependency	Youth dependency	Aged dependency	Employed dependency
Northern Cape	55.75	46.94	8.80	75.32
Namakwa DM	*51.23*	*39.01*	*12.22*	*70.92*
Richtersveld LM	*42.51*	*33.96*	*8.55*	*61.38*
Ward 2	36.82	32.89	3.93	56.70
Ward 3	39.54	32.95	6.59	64.57
Ward 4	48.60	35.93	12.67	63.98
Nama Khoi LM	*49.45*	*37.16*	*12.29*	*73.74*
Ward 8	45.05	35.42	9.63	76.99
Kamiesberg LM	*57.89*	*41.84*	*16.05*	*78.37*
Ward 1	54.81	40.19	14.62	79.04
Ward 2	48.90	33.04	15.86	69.06
Western Cape	44.96	36.44	8.52	65.67
West Coast DM	*45.92*	*37.14*	*8.78*	*63.98*
Matzikama LM	*49.39*	*40.05*	*9.34*	*64.55*
Ward 2	48.60	38.35	10.24	67.26
Ward 5	46.38	33.96	12.41	59.32
Ward 8	52.71	41.14	12.57	71.99
Cederberg LM	*46.99*	*37.59*	*9.40*	*62.75*
Ward 5	51.76	38.06	13.70	69.48
Bergrivier LM	*46.89*	*36.62*	*10.27*	*61.61*
Ward 6	46.60	37.11	9.49	65.08
Ward 7	55.44	23.94	31.50	68.70
Saldanha Bay LM	*43.96*	*36.41*	*7.54*	*65.36*
Ward 1	39.71	36.79	2.91	68.76
Ward 3	29.02	23.68	5.35	74.04
Ward 5	39.28	27.63	11.66	54.59
Ward 6	59.99	25.93	34.06	61.44
Ward 11	44.91	32.19	12.73	63.50
Ward 12	45.16	41.60	3.56	67.57
Ward 14	42.82	34.92	7.90	54.68
Swartland LM	*44.68*	*36.21*	*8.47*	*64.27*
Ward 5	50.76	33.31	17.44	58.03
City of Cape Town Metropolitan	*43.61*	*35.65*	*7.97*	*65.39*
Ward 4	35.95	31.80	4.16	52.38
Ward 23	38.49	26.83	11.66	47.23
Ward 29	47.25	40.95	6.30	69.98
Ward 32	44.89	41.04	3.85	68.39
Ward 54	39.01	16.17	22.84	51.04
Ward 55	41.65	26.22	15.41	56.16
Ward 74	40.68	33.04	7.63	58.62
Ward 107	40.60	28.96	11.64	46.90
Ward 113	36.71	26.07	10.64	47.93
Ward 115	26.32	14.33	12.00	60.94

Figure 6: Total dependency ratios (source: Census 2011)

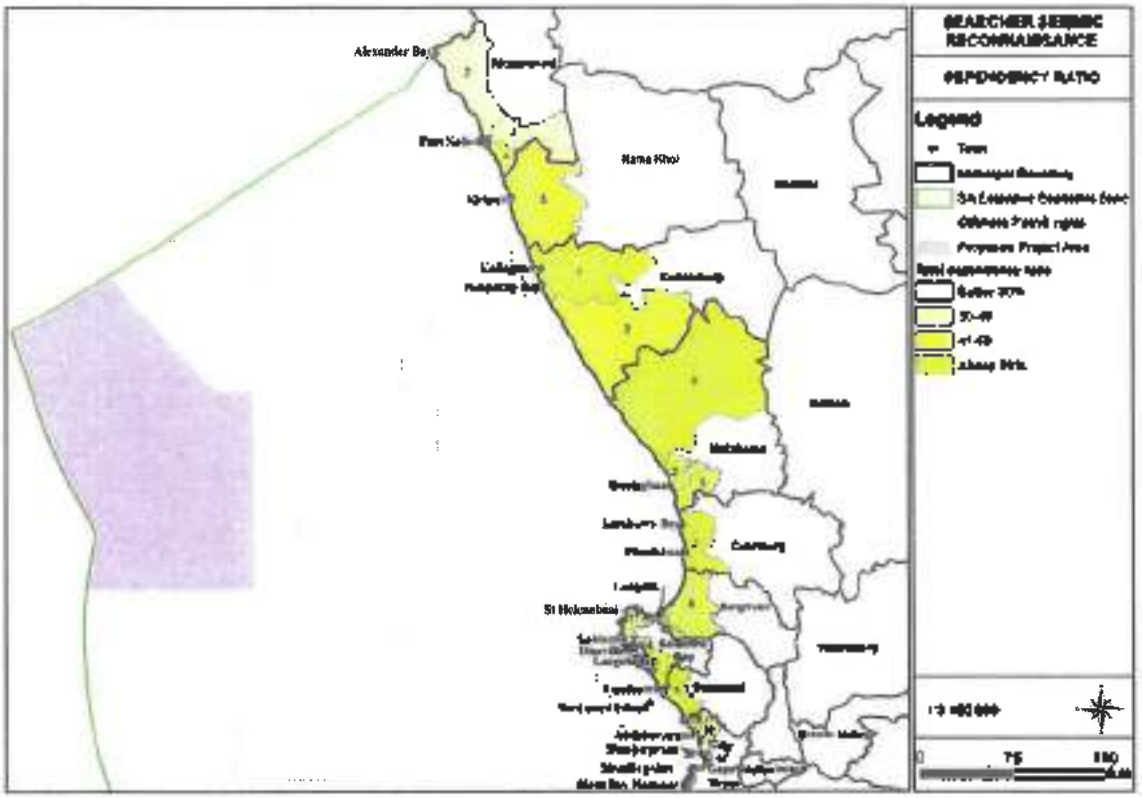
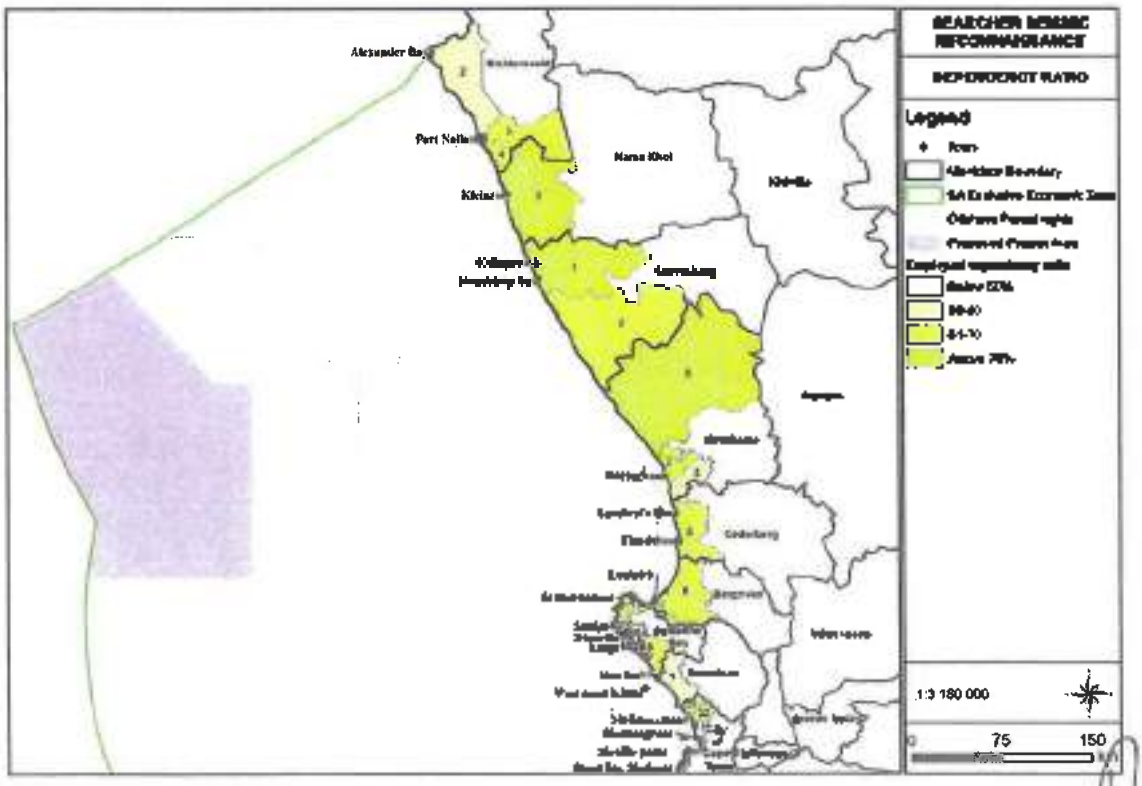


Figure 7: Employed dependency ratio (source: Census 2011).



Poverty is a complex issue that manifests itself in economic, social, and political ways and to define poverty by a unidimensional measure such as income or expenditure would be an oversimplification of the matter. Poor people themselves describe their experience of poverty as multidimensional. The South African Multidimensional Poverty Index (SAMPI) (Statistics South Africa, 2014) assess poverty on the dimensions of health, education, standard of living and economic activity using the indicators child mortality, years of schooling, school attendance, fuel for heating, lighting, and cooking, water access, sanitation, dwelling type, asset ownership and unemployment.

The poverty headcount refers to the proportion of households that can be defined as multi-dimensionally poor by using the SAMPI's poverty cut-offs (Statistics South Africa, 2014). The poverty headcount has increased on all levels since 2011 (Table 4), indicating an increase in the number of multi-dimensionally poor households.

The intensity of poverty experienced refers to the average proportion of indicators in which poor households are deprived (Statistics South Africa, 2014). The intensity of poverty has increased slightly on all levels. The intensity of poverty and the poverty headcount is used to calculate the SAMPI score. A higher score indicates a very poor community that is deprived on many indicators. The SAMPI score has decreased in the Northern Cape (Table 4) as well as the Northern Cape municipalities included in the study. In the Nama Khoi Local Municipality, the score remained the same although there was a slight increase in the intensity of the poverty. In the Western Cape the SAMPI score decreased on a provincial level, but in the West Coast District Municipality it has increased.

Table 4: Poverty and SAMPI scores (sources: Census 2011 and Community Survey 2016).

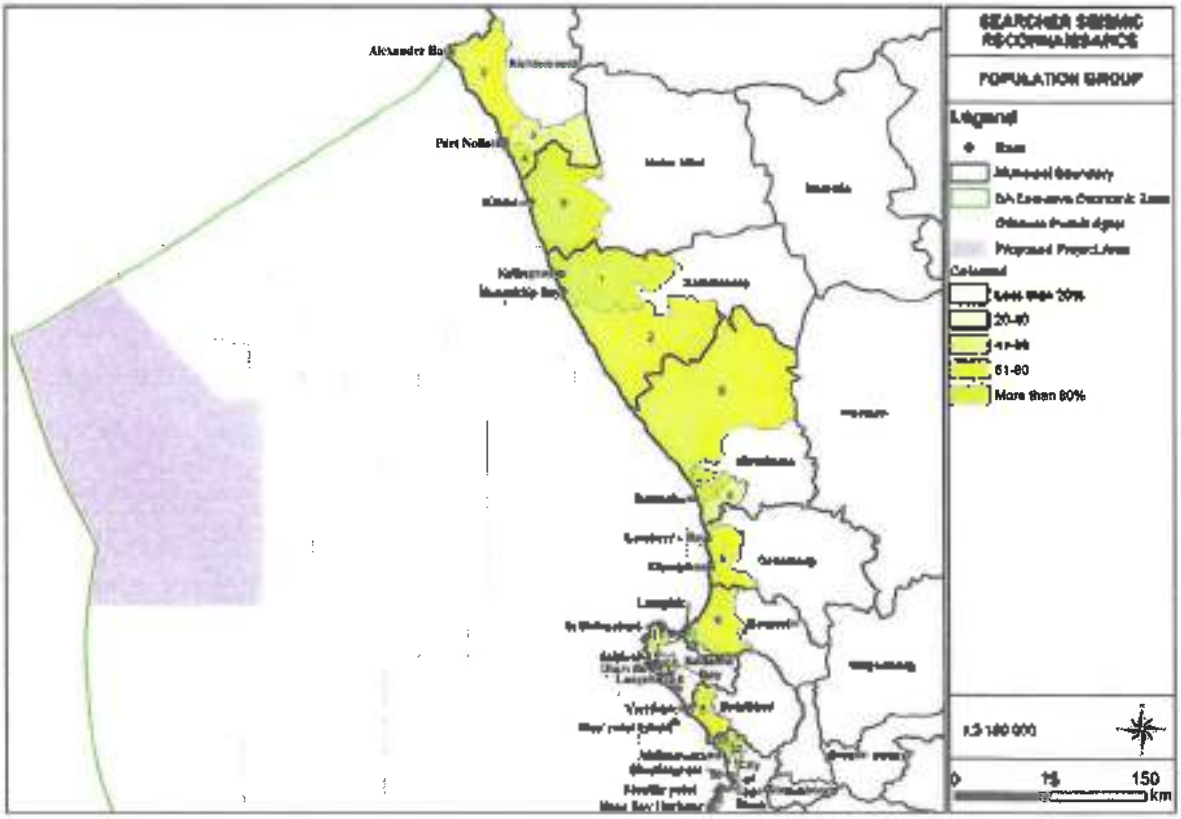
Area	Poverty headcount 2011 (%)	Poverty intensity 2011 (%)	SAMPI 2011	Poverty headcount 2016 (%)	Poverty intensity 2016 (%)	SAMPI 2016
Northern Cape	**7.1**	**42.1**	**0.030**	**6.6**	**42**	**0.028**
Namakwa DM	*3.2*	*40.2*	*0.013*	*2.8*	*41.6*	*0.012*
Richtersveld LM	3.1	39.9	0.012	1.9	38.3	0.007
Nama Khoi LM	2.5	40.4	0.010	2.5	41.7	0.010
Kamiesberg LM	5.1	40	0.020	3	39	0.012
Western Cape	**3.6**	**42.6**	**0.015**	**2.7**	**40.1**	**0.011**
West Coast DM	*2*	*41.9*	*0.008*	*2.9*	*44.5*	*0.013*

Matzikama LM	3.4	42.4	0.014	0.8	42.5	0.003
Cederberg LM	2.8	42.9	0.012	3.6	45.7	0.016
Bergrivier LM	1	43.7	0.004	1.6	41.5	0.007
Saldanha Bay LM	2.2	41	0.009	6.7	45.4	0.030
Swartland LM	1	40.6	0.004	0.9	39.9	0.004
City of Cape Town Metropolitan	3.9	42.8	0.017	2.6	39.3	0.010

5.2.2 Population composition, age, gender and home language

The majority of the people living in wards adjacent to the ocean are classified as belonging to the Coloured population group (Figure 8). The Coloured population group include Khoe and San people who in general find this classification offensive and they do not identify as such.

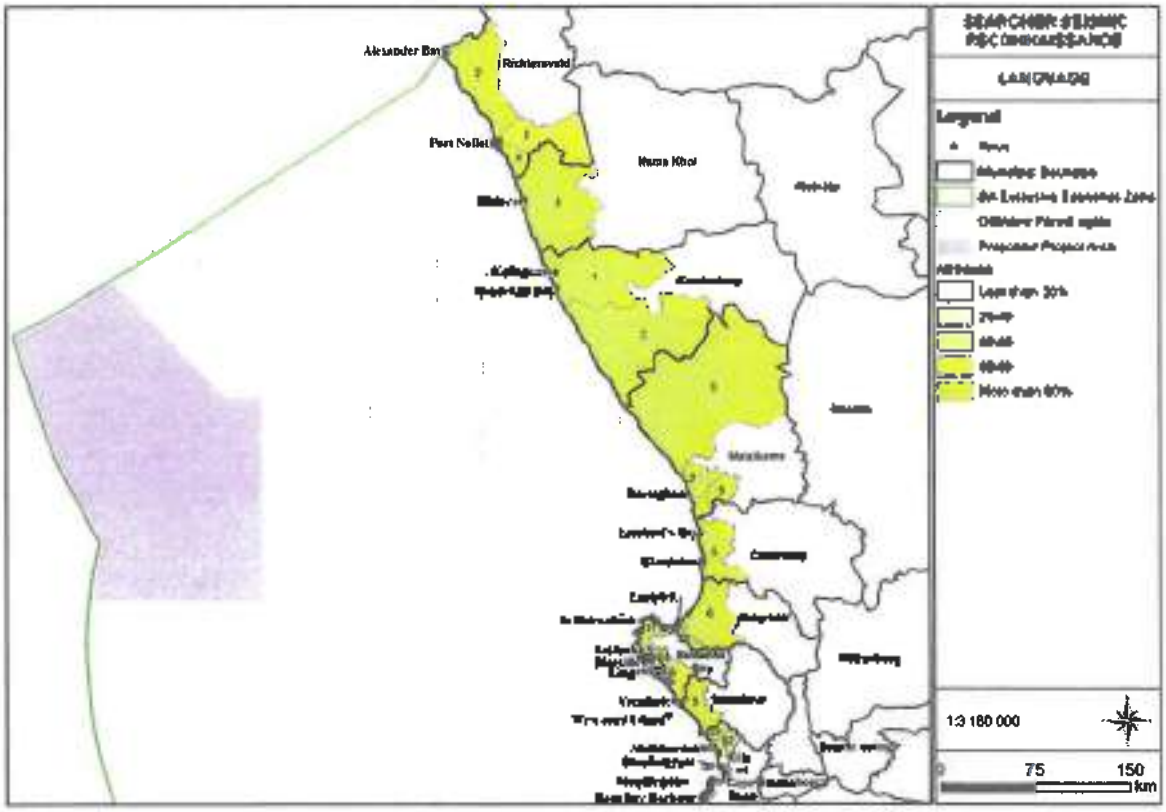
Figure 8: Classified as Coloured (shown in percentage, source: Census 2011)



The Kamiesberg Local Municipality has the highest average age (33.17 years) while the Saldanha Bay Local Municipality has the lowest (29.86 years). Average age varies on a ward level.

The gender distribution is more or less equal in most municipal areas, except for the Richtersveld Local Municipality where there is a bias towards males. This is most likely due to mining activities that are taking place in the area. On a ward level, most people have Afrikaans as home language (Figure 9).

Figure 9: Home language Afrikaans (shown in percentage, source; Census 2011)

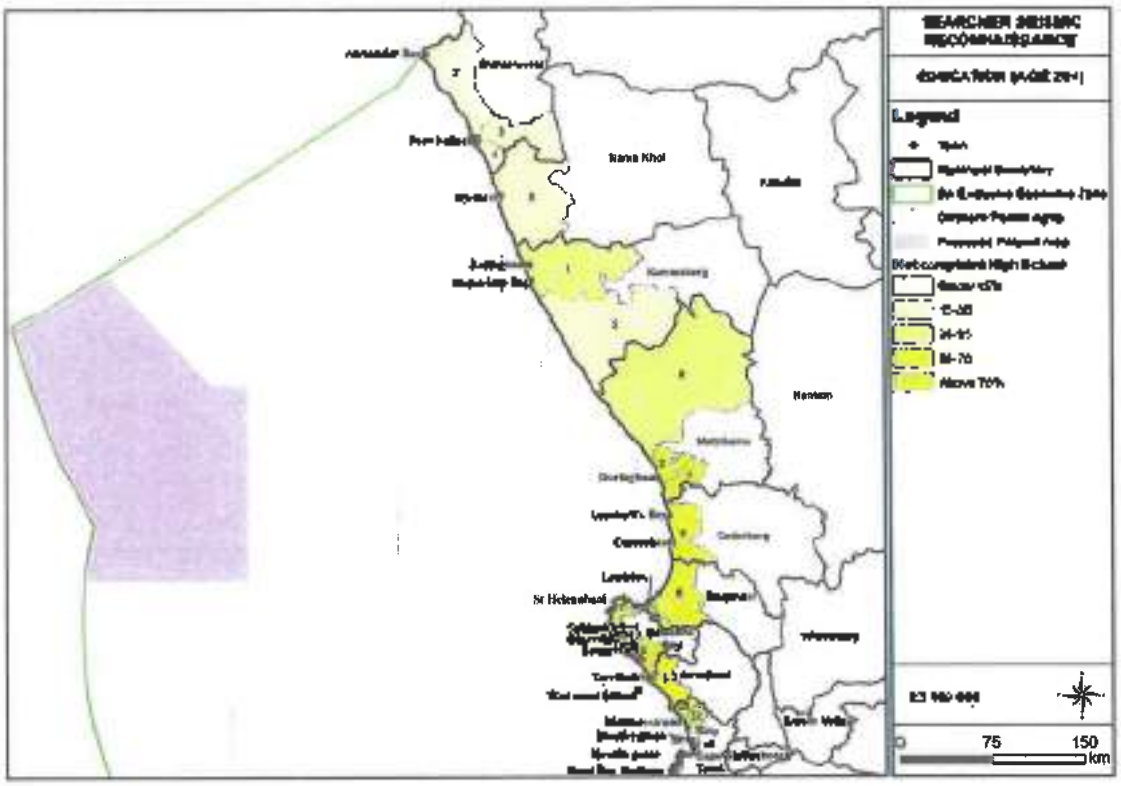


5.2.3 Education

The highest proportion of people who did not complete high school is in the Saldanha Bay (73.59%) and the Swartland (72.83%) Local Municipalities while the Matzikama (32.7%) and Nama Khoi (37.37%) Local Municipalities have the lowest proportion of people that did not complete high school (Figure 10).

508

Figure 10: Proportion of people that did not complete secondary school (shown in percentage, source: Census 2011).



5.2.4 Employment

In 2011 the area with the highest proportion of unemployed people was ward 1 in the Kamiesberg Local Municipality where Hondeklip Bay is located (

Figure 11). The proportion of unemployed people include those actively seeking for work as well as discouraged work seekers. The majority of people who are working, is employed in the formal sector.

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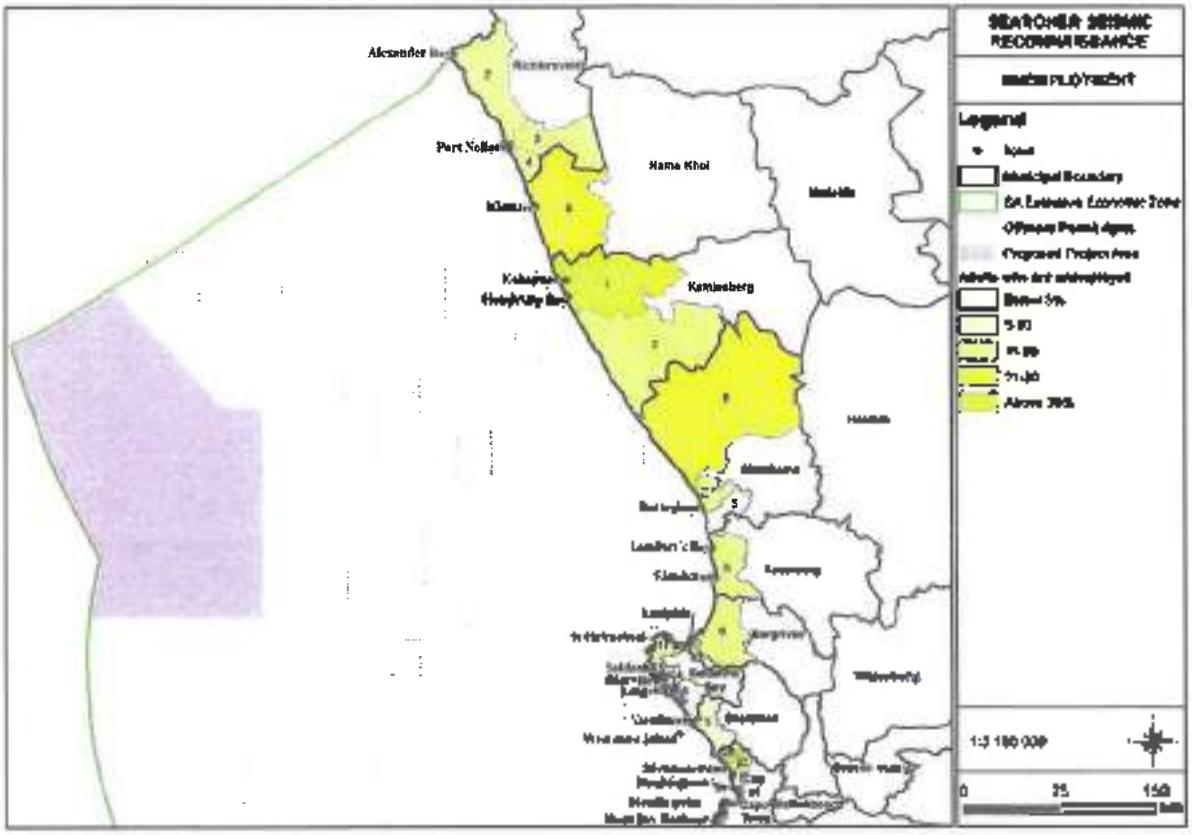
Figure 11: Proportion of adults that are unemployed (shown in percentage, source: Census 2011).

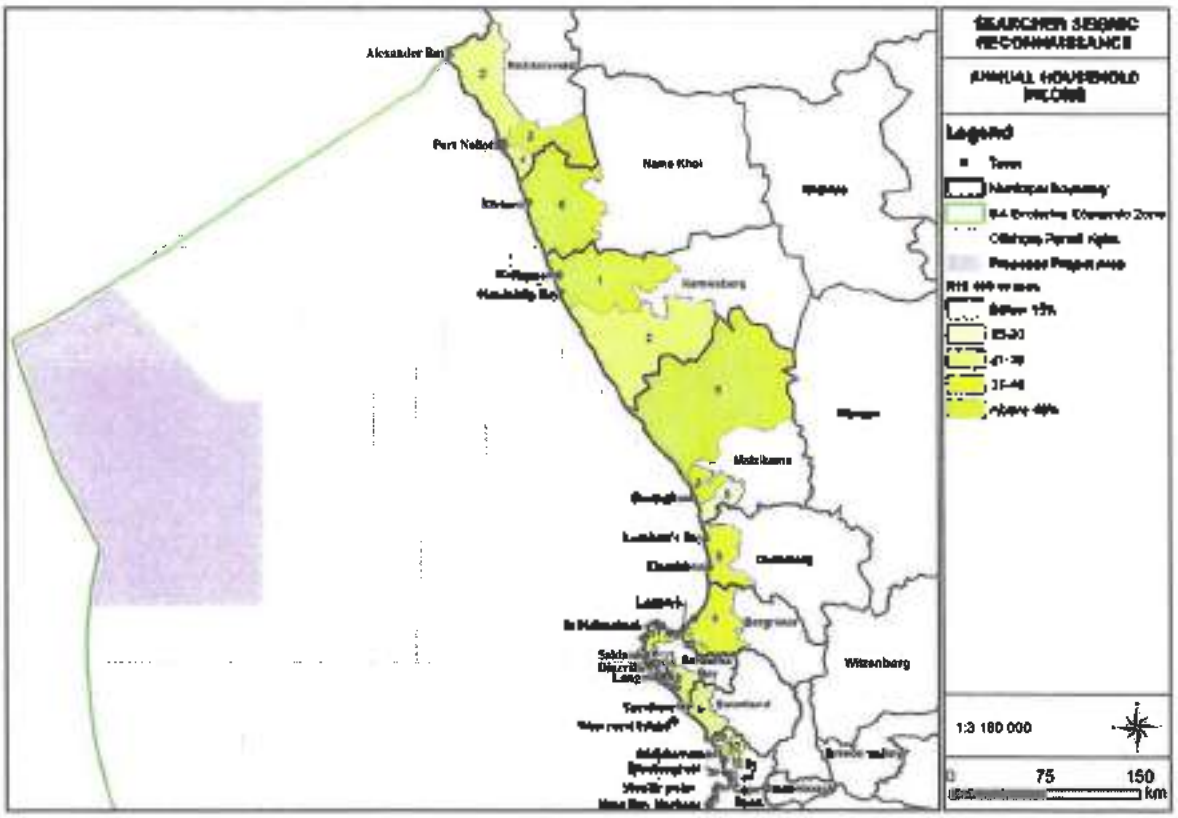


5.2.5 Household income

In 2011 almost a third of households on municipal level had an annual household income of R19 600 or less, with great variation between wards (Figure 12). Statistics South Africa (2015) has calculated the Food Poverty Line (FPL) for the Northern Cape Province as R310 per capita per month for 2011 where the FPL is the Rand value below which individuals are unable to purchase or consume enough food to supply them with the minimum per-capita-per-day energy requirement for good health. The FPL is one of three poverty lines, the others being the upper bound poverty line (UBPL) and the lower bound poverty line (LBPL). The LBPL and UBPL both include a non-food component. Individuals at the LBPL do not have enough resources to consumer or purchase both adequate food and non-food items and are forced to sacrifice food to obtain essential non-food items, while individuals at the UBPL can purchase both adequate food and non-food items. The LBPL for the Northern Cape Province was R457 per capita per month in 2011 and the UBPL R705 per capita per month

respectively. The FPL for Western Cape was R352 per capita per month, the LBPL was R545 and the UPL was R804. Based on this, a household with four members needed an annual household income of approximately R17 000 in 2011 to be just above the FPL. When comparing this with the SAMPI data it seems as if there are more households below the poverty lines in the area than who are multi-dimensionally poor. This is due to the poverty lines using a financial measure and do not take into consideration payment in kind and livelihood strategies such as subsistence farming. If these were to be converted into a Rand value, the poverty line picture may have a closer resemblance to the SAMPI data.

Figure 12: Proportion of households with an annual income of R19 600 or less in 2011 (shown in percentage, source: Census 2011).



5.2.6 Housing

The majority of households live in areas that are classified as urban, except in the Matzikama Local Municipality (Figure 13). The majority of people live in formal dwellings that that are houses or structures that are on a separate stand or yard. The incidence of informal dwellings is relatively low (

Figure 14), except for Ward 1 of the Saldanha Bay Local Municipality where the majority of people live in informal dwellings. Wards 32 and 74 also have a relatively large proportion of households living in informal dwellings.

Figure 13: Proportion of households that live in urban areas (shown in percentage, source: Census 2011).

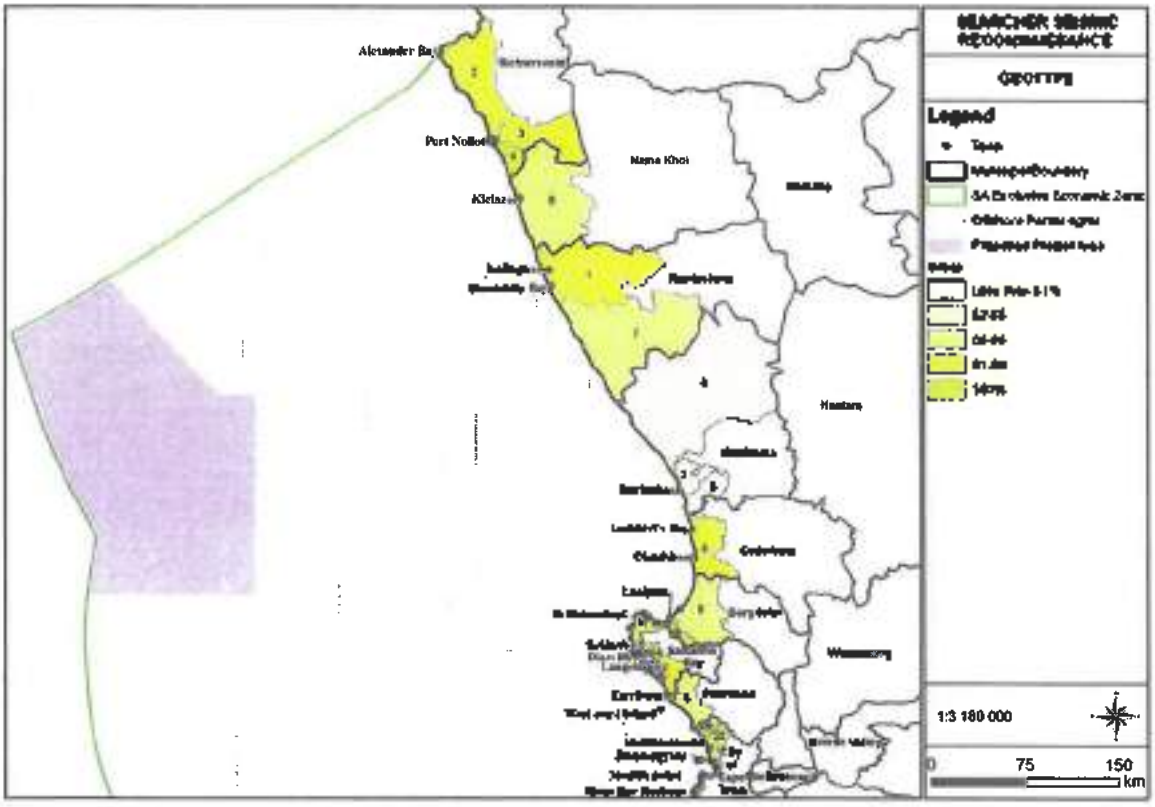
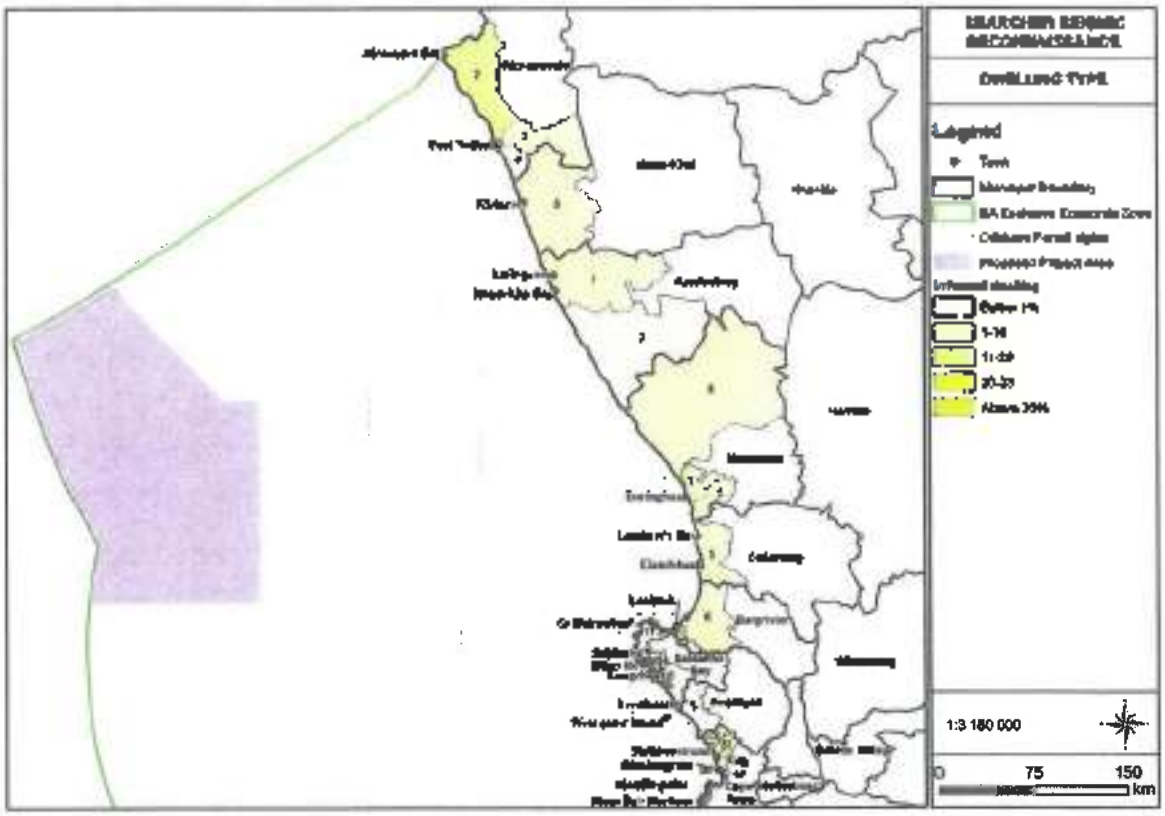


Figure 14: Proportion of households that live in informal dwellings (shown in percentage, source: Census 2011).



5.2.7 Household size

The average household size in the wards vary between 1.96 people per household and 4.86 people per household (

Figure 15).

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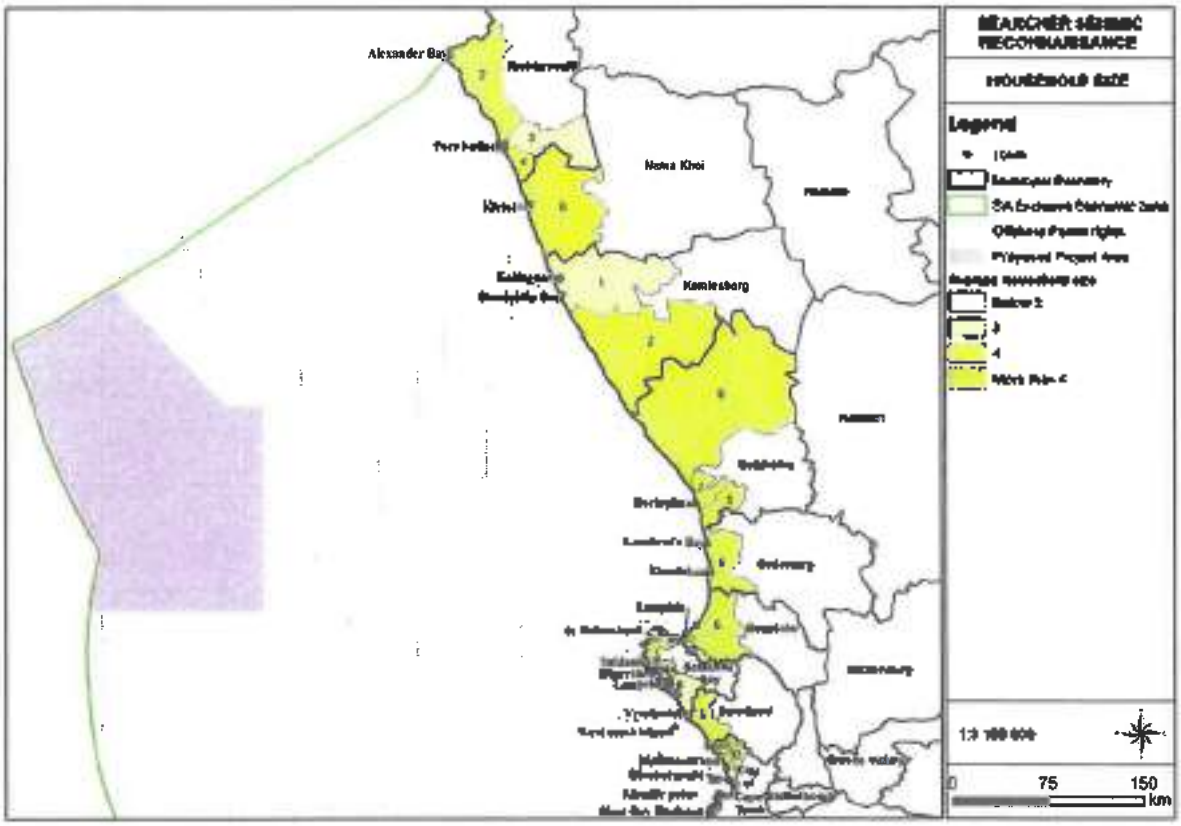
Figure 15: Average household sizes (source: Census 2011).

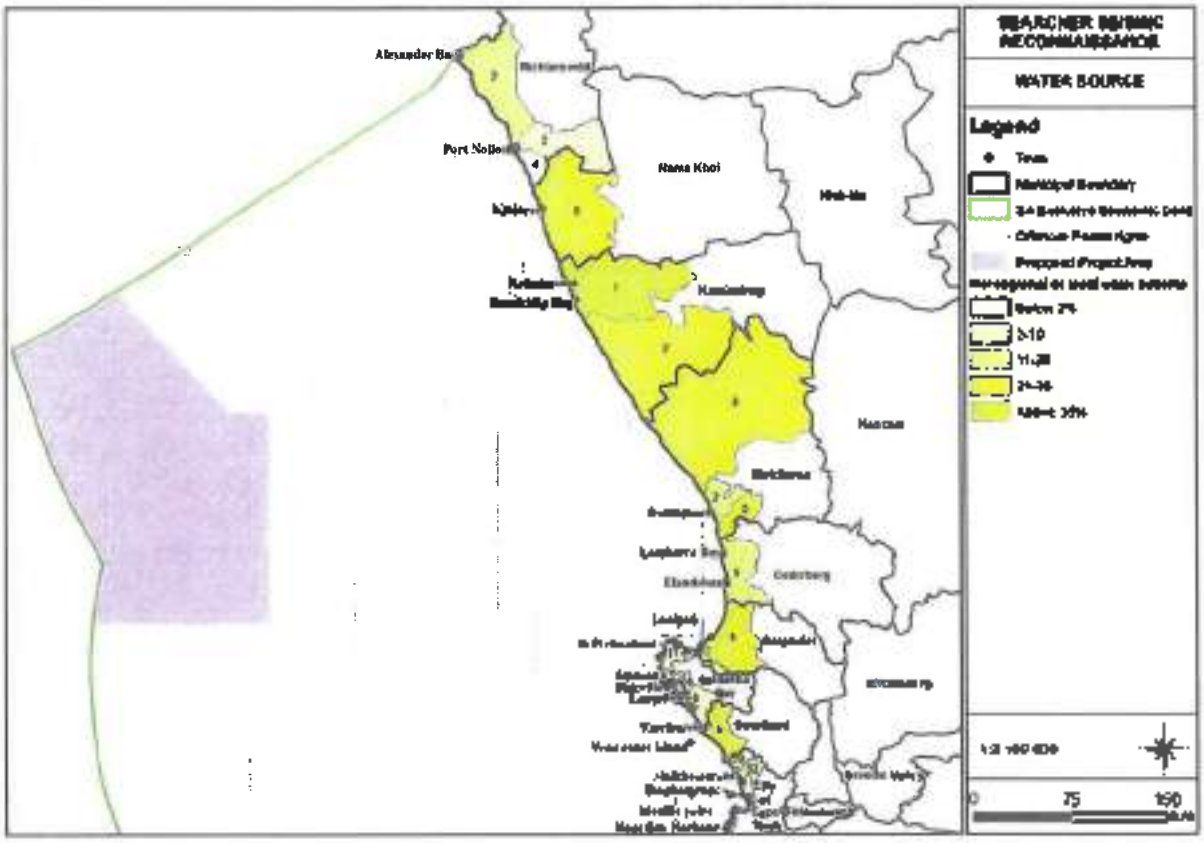


5.2.8 Access to water and sanitation

Access to piped water, electricity and sanitation relate to the domain of Living Environment Deprivation as identified by Noble et al (2006). Most households get their water from a regional or local water scheme, with the lowest incidence in Ward 1 of the Kamieskroon Local Municipality where Hondeklip Bay is located |

Figure 16).

Figure 16: Proportion of households that does not get water from a regional or local water scheme (shown in percentage, source: Census 2011).



The incidence of access to piped water inside the dwelling varies and tend to be lower in the Northern Cape municipalities (

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Figure 17).

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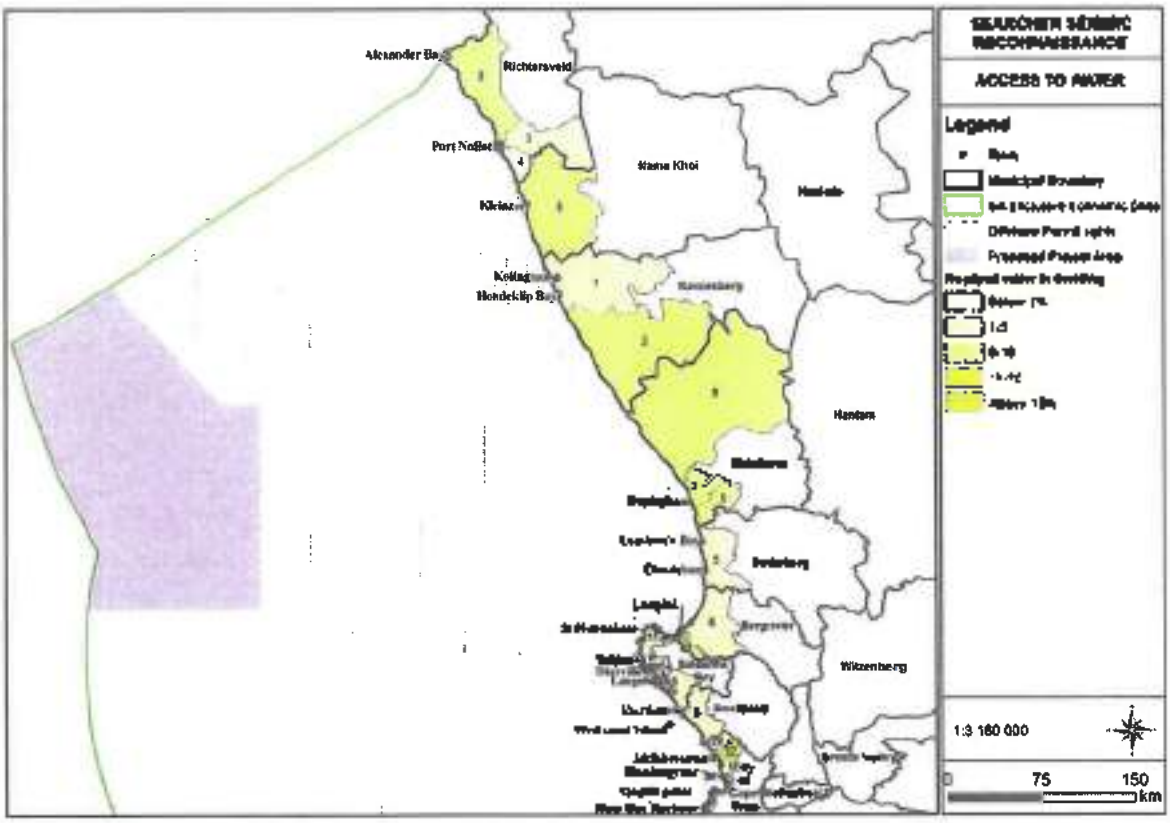
Figure 17: Proportion of households that does not have piped water in the dwelling (shown in percentage, source: Census 2011).



Access to a flush toilet is in general lower in the Northern Cape Municipalities (

Figure 18).

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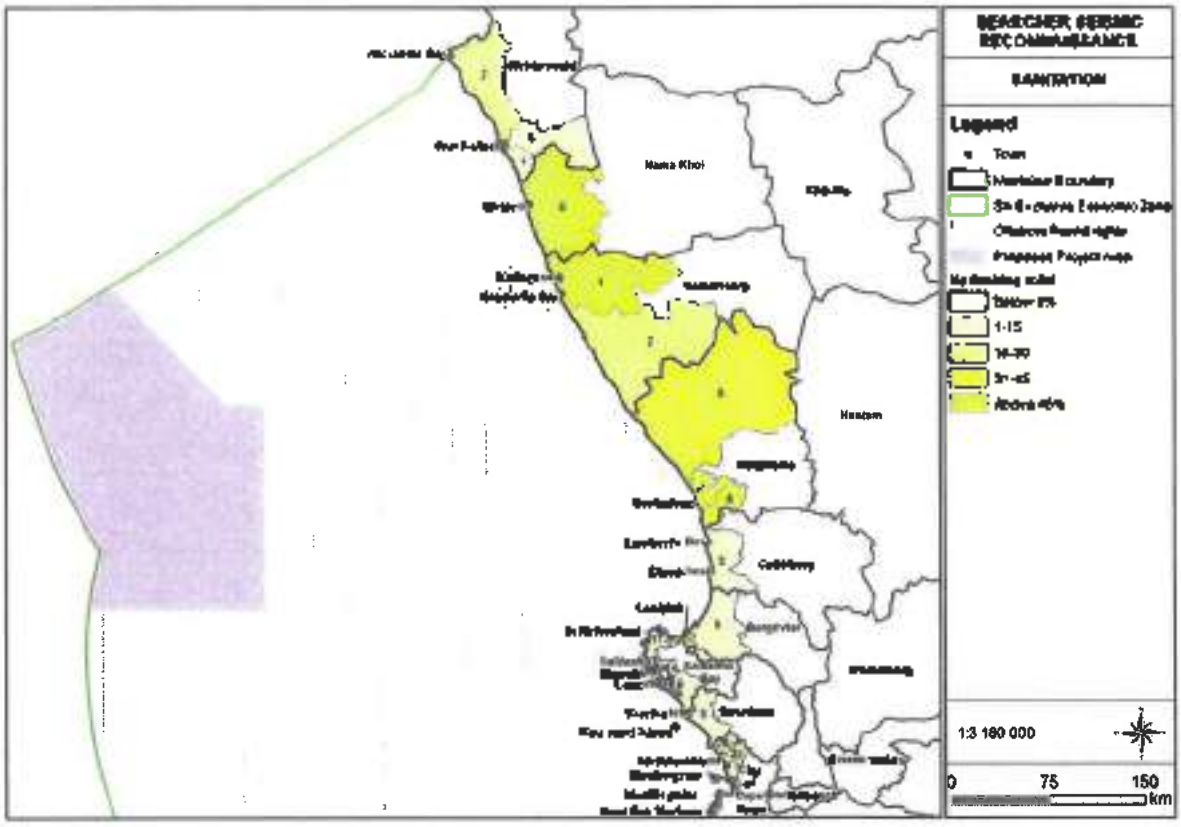
Figure 18: Proportion of households that does not have a flush toilet (shown in percentage, source: Census 2011).



5.2.9 Energy

Electricity is seen as the preferred lighting source (Noble et al, 2006) and the lack thereof should thus be considered a deprivation. Even though electricity as an energy source may be available, the choice of energy for cooking may be dependent on other factors such as cost. The majority of households have access to electricity for lighting purposes (

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Figure 19) but a lower proportion use electricity for heating (Figure 20) and cooking (Figure 21) purposes.

Figure 19: Proportion of households that use paraffin, candles, wood or nothing for lighting purposes (shown in percentage, source: Census 2011).

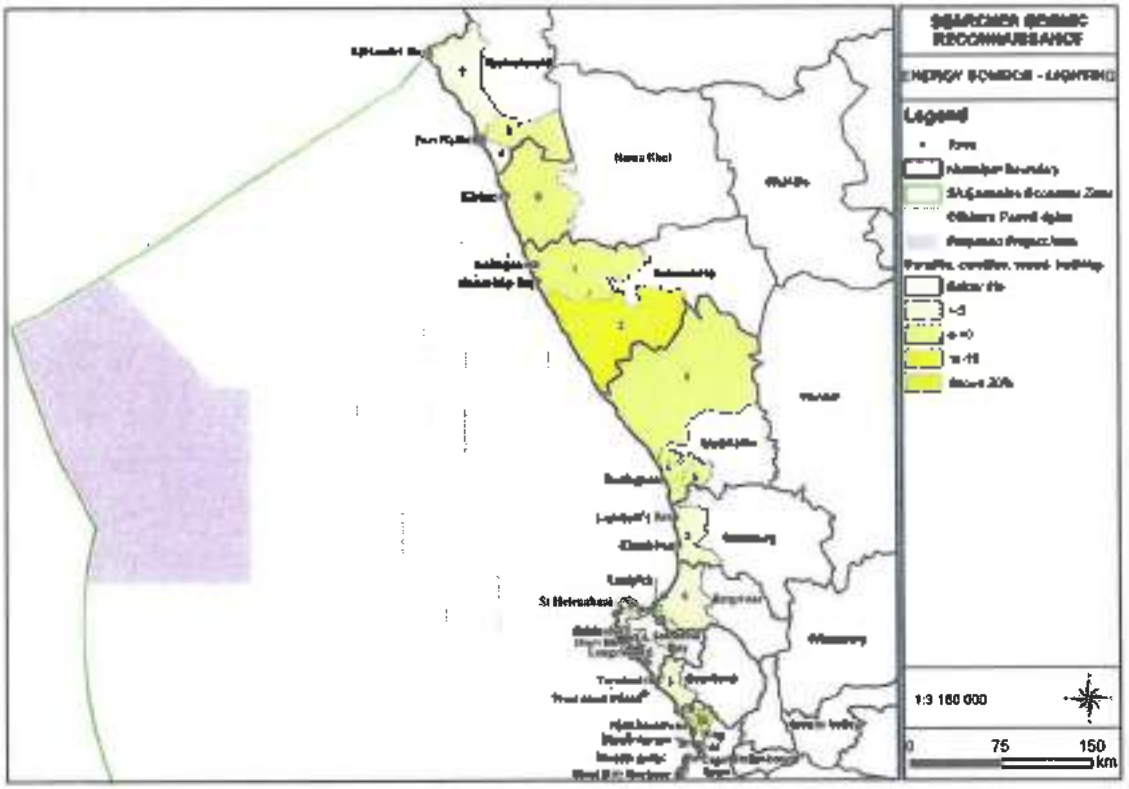


Figure 20: Proportion of households that use paraffin, wood, coal, dung or something else for heating purposes (shown in percentage, source: Census 2011).

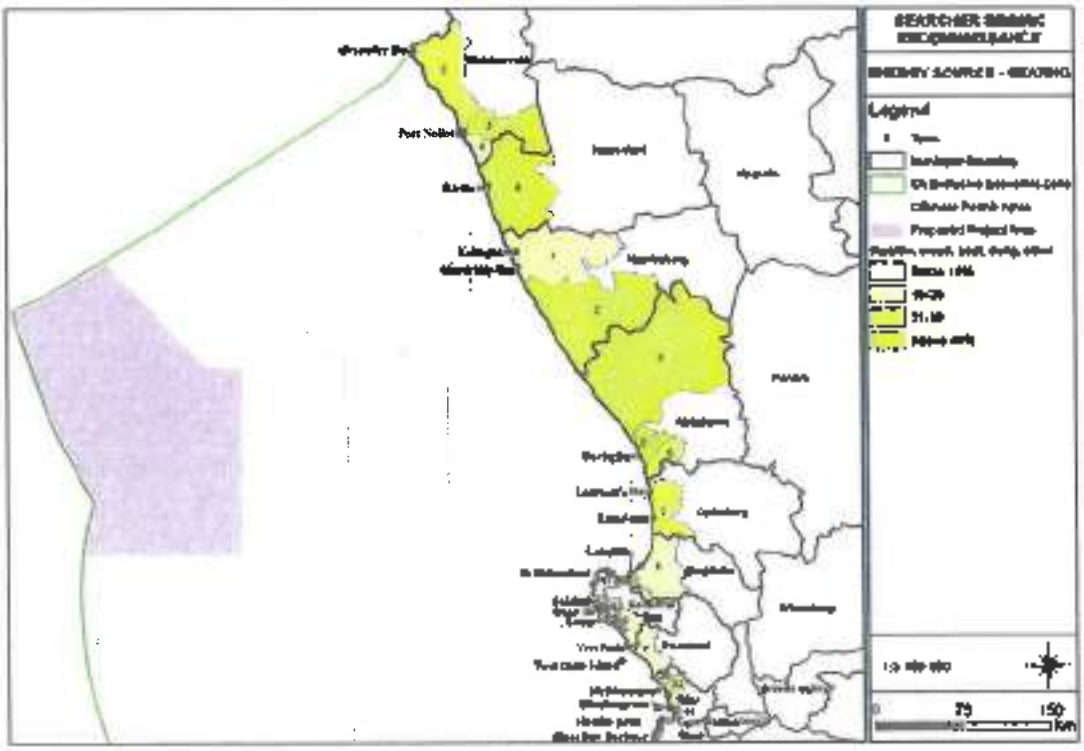
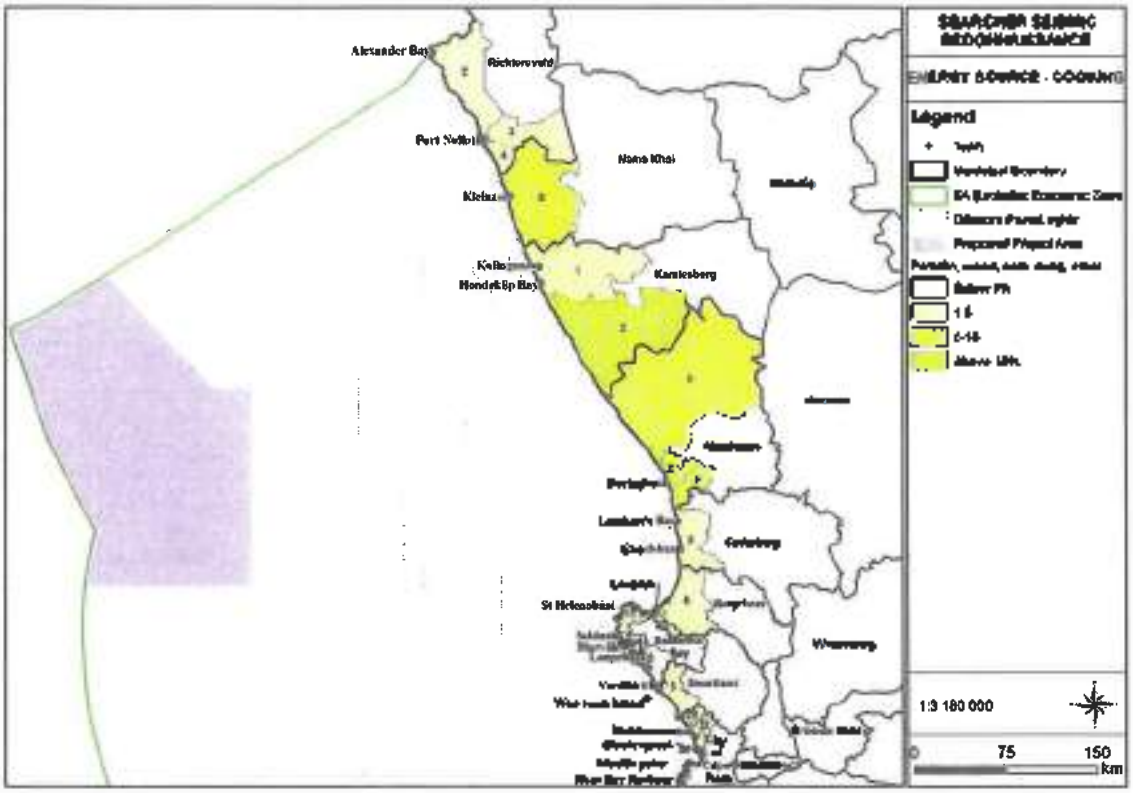


Figure 21: Proportion of households that use paraffin, wood, coal, dung or something else for cooking purposes (shown in percentage, source: Census 2011).



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6 Stakeholder Identification and Analysis

6.1 Approach

Stakeholders include all individuals and groups who are affected by, or can affect, a given operation. Stakeholders consist of individuals, interest groups and organizations (Vanclay, Esteves, Aucamp & Franks, 2015). Stakeholder analysis is a deliberate process of identifying all stakeholders of a project - the individuals and groups that are likely to impact or be impacted by it - and understanding their concerns about the project and/or relationship with it (Vanclay et al, 2015). Stakeholder analysis assists the proponent with understanding the local cultural and political context. It is acknowledged that different stakeholder groups have different interests, and that there are individual differences within stakeholder groups. The purpose of this section of the report is to introduce the stakeholder groups that will be affected by the proposed projects. The following stakeholder groups were identified and their interest in the projects will be discussed briefly in the section below.

6.2 List of stakeholders

The following stakeholders that may have an interest in or affected by the proposed Searcher seismic survey project have been identified:

Figure 22: Detail of Stakeholder Groups.

Stakeholder Grouping	Organisation
Internal Stakeholders	
Searcher Geodata UK Ltd	**Searcher Staff** involved with the **project**
Seiche	Seiche Staff involved with the project
Government	
Governmental departments and directorates	• Western Cape Provincial Government • Northern Cape Provincial Government • Petroleum Agency of South Africa • Department of Environment, Forestry and Fisheries • Department of Mineral Resources and Energy • South African Navy Hydrographic Office (SANHO) • Namaiwa District Municipality • West Coast District Municipality • City of Cape Town Metropolitan Municipality • Richtersveld Local Municipality • Nama Khoi Local Municipality • Kamiesberg Local Municipality • Matzikama Local Municipality

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Stakeholder Grouping	Organisation
	• Cederberg Local Municipality • Bergrivier Local Municipality • Saldanha Bay Local Municipality • Swartland Local Municipality • South African Heritage Resources Agency (SAHRA)
State-owned entities and regulators	• Transnet National Ports Authority • South African Maritime Safety Authority
Business	
Fishing Industry	Fishing industry associations Commercial fishing sectors: demersal trawl, midwater trawl, demersal hake longline, demersal shark longline, small pelagic purse-seine, large pelagic longline, tuna pole-line, traditional line fish, West Coast rock lobster, small-scale fisheries, beach-seine and gillnet fisheries (netfish), fisheries research
Petroleum and Gas Industry	Various companies that have expressed interest in oil or gas exploration in the West Coast area Companies conducting seismic surveys
Other industries	Industries providing support services such as equipment, fuel, accommodation, meals and other supplies
Environmental	
Environmental interest groups	Green Connection Coastal Links We Are South Africans Other relevant environmental interest groups
Societal	
Social Organizations	Masifundise Development Trust Small-scale fisheries cooperatives such as Aukatowa small scale fisheries cooperative Small-scale fishing communities such as Steenbergs Cove ABALOBI Coastal Justice Network Community forums (e.g., employment, youth)
Residents/ Community	
Local coastal communities	Hout Bay, Saldanha Bay, St Helena Bay, Lambert's Bay, Hondeklip Bay, Port Nolloth, Velddrif, Paternoster, Jacobsbaai, Langebaan, Grotto Bay, Elands Bay, Strandfontein, Doringbaai
Local indigenous people	Nama, Khoi and San groups, including Cochoque Tribal House, the Guriqua Tribe and the Katz Korana Royal House

The identified level of interest of each stakeholder helps assist with designing the stakeholder engagement strategy for the project, and to decide how much time to devote to engaging with each stakeholder or group. The engagement levels required for each group of stakeholders as revealed through this analysis may be more than consultation, for example they may include partnerships, involvement in community

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development plans or community monitoring, strategic planning, or any other activity. Knowing the needs, issues and expectations of affected stakeholders assist with building and retaining good relationships with them, and with managing their expectations.

Table 5 below plots the stakeholders according to their ability to influence the company's activities (horizontal axis) and the degree to which they are affected by the proposed Searcher activities, whether the impact is social, economic or environmental (vertical axis). In instances where the impact or influence is potentially significant individual stakeholder groups/organisations have been used. All other groupings are used in general.

Table 5: Stakeholder matrix.

Degree to which they are impacted on	Ability to influence company's activities: Low	Medium	High
High	Local coastal communities Local indigenous people	Fishing Industry	Searcher Geodata UK Ltd Seiche Petroleum and Gas Industry
Medium		Other industries Environmental interest groups Social Organizations	Governmental departments and directorates State-owned entities and regulators
Low			

When considering the project affected stakeholders it is important to consider the potential impacts after the seismic surveys are conducted. The stakeholders that will be impacted on most but have the least ability to influence the company's activities are local coastal communities and indigenous people, who is also seen as the most vulnerable group. Their fears about future impacts and uncertainty about the potential impacts on their livelihoods are already causing an impact on their emotional and physical wellbeing. There is a power imbalance between Searcher and the local communities. It is therefore of great importance that Searcher and the local

communities communicate frequently in an open and honest manner to avoid a standoff. Communities are supported by environmental and social interest organisation, and these organisations have the ability to mobilise community activists and fund potential court cases.

The community perception is that the government has already decided that it will allow this and similar projects to continue. The government is seen as a powerful stakeholder with significant ability to influence the decision-making process.

The placement of stakeholders in the stakeholder matrix may change with time, and it should be revisited frequently.

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7 Social risk

Social risk is a confusing term because it has different meanings in different discourses. In the SIA/corporate project discourse, 'social risk' is a largely similar concept to 'non-technical risk' and is the preferred term (Vanclay et al, 2015). The World Bank defines social risk as "the possibility that the intervention would create, reinforce or deepen inequity and/or social conflict, or that the attitudes and actions of key stakeholders may subvert the achievement of the development objective, or that the development objective, or means to achieve it, lack ownership among key stakeholders". For the Bank, social risk is considered to be both risk (threats) to the success of the project, but also risk (social issues) created by the project, which in turn become threats to the project. In a corporate setting, social risk can be regarded as the business risks (e.g. extra costs) to the company that arise from any social impacts or social issues created by the project, such as through unforeseen costs of mitigation, future litigation and/or compensation pay-outs, worker strikes, retaliatory acts of sabotage, and reputational harm (Vanclay et al, 2015).

Non-technical risks relate to the managerial, legal, social and political issues faced by a project, in contrast to the technical risks (i.e. the physical, structural, engineering and environmental risks). Non-technical risks are potentially serious financial risks to a project because of the protest actions local communities can take, and therefore should be considered and addressed (Vanclay et al, 2015).

Risk inevitably involves a concern with good and bad outcomes (Eiser, 2004). Such values will be implicit in any exchange. What any audience will be listening for is an indication of what they need to do – not simply for a prediction of what consequences may or may not happen, but also for an indication of how good or bad these consequences will be, and what they, or anyone else, is expected to do about it. The best way to communicate risk is to adopt a less didactic model of communication. It is already widely recognised that, to be effective, the communication of risks cannot be merely one-way. It must involve exchange and interaction between all parties. There are obstacles to putting such good intentions into practice. The 'experts' need to be prepared to give up not only time, but also some of their power (Eiser, 2004).

The 'public' need to be willing to be engaged in the decision process and take some responsibility for the outcomes if these have been shaped to take account of their views. All this can be costly, in terms of time, patience and the risk of disappointment if not everything one wants could be achieved. The real advantage over the traditional, less consultative, approach is that the debate or discussion can focus on what people want to know and issues of value, rather than merely probability can be considered (Eiser, 2004).

Another important social factor to consider is the "social licence to operate". In 2003 Pierre Lassonde drew attention to the observation that "*Without local community support, your project is going nowhere.*" He described social license as "*...the acceptance and belief by society, and specifically local communities, in the value creation of activities*". Social licence cannot be obtained by going to a government ministry and making an application or simply paying a fee. It requires far more than money to truly become part of the communities in which a company operates (Lassonde 2003). A primary objective of gaining a social license is to minimize project risk. "*Successful operations require the support of the communities in which they operate now, and in the future, to ensure continued access to land and resources*" (Render 2005). The social license to operate can be further described as the degree of match between stakeholders' individual expectations of corporate behaviour and companies' actual behaviour.

Seismic surveys are currently a controversial and political subject in South Africa. On 1 September 2022 there was a high court ruling against Shell conducting seismic surveys. The ruling found that coastal communities were not properly consulted (Judgement on Sustaining the Wild Coast vs Minister of Mineral Resources and Energy and others, 1 Sept 2022). The debate about the potential impacts of seismic surveys has been ongoing and in the public domain for the last couple of years but intensifying in the second half of 2022. For many people it is an emotional issue and goes much deeper than scientific research on potential impacts on the marine environment. For some people the core of the issue is the impact on their indigenous and culture rights, their customs and traditions and their livelihoods.

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Others feel that the seismic surveys are only the first step and that it will open the door to exploration for oil and gas. They are already aware of changes in the marine environment due to existing impacts such as shipping traffic, mining in the sea, climate change and over-fishing. Their concerns are related to the potentially negative impacts associated with the oil and gas industry, especially from an environmental perspective and the impact that using oil and gas will have on climate change. They feel that South Africa must move away from fossil fuels and act in line with the government's policies and international commitments in this regard. There are also people with the opinion that a developing country like South Africa cannot afford to not explore for oil and gas. Their feeling is that the energy transition will take some time, and that oil and gas are better than coal mines.

It is a contentious issue that can potentially cause damage to the social fabric of local communities, but also lead to civil unrest and reputational damage. From a social perspective these social risks must be highlighted. In the current socio-economic environment associated with the project area, there are significant non-technical risks associated with seismic surveys, irrespective of the company that will conduct the survey.

Table 6: Summary of potential social risks for the proposed project

Risk	Source	Motivation
Opposition to the project through appeals and court cases causing a significant delay in the procast	Local indigenous communities and fishers Environmental NGOs Social justice groups	During the SIA consultation process and as seen in the South African press it was clear that communities will not welcome seismic surveys. There is an example of a community winning a court case against a company wanting to do the survey. Communities may want to appeal the outcome of the EIA process and will resort to legal means if required because they know that resources are available to them from NGOs. These appeals and legal processes may cause a significant delay in the authorisation process which will have knock on effects.
Damage to corporate reputation	Local indigenous communities and fishers	Searcher's corporate reputation can be damaged if communities feel that the process has not been conducted in what the communities see as a meaningful manner.

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		There is a history tension between the Searcher and some of the communities, and this has attracted media attention in the past, so there is a chance that this may reach the media for whatever reasons again. This may impact Searcher on an international level, as rights groups may be concerned about grassroots impacts, human rights and social and environmental justice, and the shares are influenced negatively.
Loss of social license to operate	Local indigenous communities and fishers Environmental NGO's Social Justice groups	Searcher's social license to operate has been impaired by the court interdict in March 2022. Given the media attention surrounding the Shell ruling in September 2022 there is a general mistrust against any company that want to conduct seismic surveys. Communities demand meaningful consultation, which go beyond the requirements of an EIA process. They want to feel that they can make informed decisions and have sufficient time to digest the technical information. Community members expressed misgivings about the government and its ability to protect their interest. They feel that the decision to support the application has already been made.
Community protests and potential for civil unrest.	Local indigenous communities and fishers	Communities feel angry and disempowered. They do not differentiate between the different companies that apply for seismic surveys. They see a different face standing in front of them, sharing similar information, but never providing answers to their questions. They feel that they are not listened to and disregarded. Several coastal communities expressed their frustration. The communities communicate with each other via WhatsApp groups, and there is a strong possibility of social mobilisation that can lead to civil unrest and worse case scenario to violent protests.

Social risk's population-based nature sets it apart from traditional risk events such as cyberattacks, workplace safety incidents, and natural disasters. Traditional risk events impact a distinct set of people, while social risk can impact broad segments of society.

Social risk has five characteristics (Ludke, 2021):

- **Human.** Traditional forms of risk most often manifest themselves because of a discrete event or incident. Social risk is built on who we are as human beings and shaped by socio-economic status, social mobility, community environment and mental health.

- **Dynamic.** Social risk is always evolving and formed by how people react to events and ideas. For example, social risk is not necessarily the pervasive nature of socio-economic inequalities in the global economy, it is how the population react to these inequalities

- **Dispersed.** Social risk is a consequence of today's connected society where nearly everyone has the ability to increase their voice through technology and networks of family, friends, colleagues, and social media followers.

- **Distinctive.** Social risk is unique to each organization because it forms as humans organically react to events and ideas, no two social risk events are alike.

- **Scalable.** Social media platforms amplify public conversations. This accelerates social risk as it can scale very quickly from an isolated idea or conversation into a broader movement.

If Searcher choose to identify and mitigate social risk, the following general recommendations should be considered:

- **Create an ecosystem of diverse partners.** A diverse ecosystem will create an "early warning system" to help identify social risk before it manifests as a threat or crisis—provided you stay engaged with this ecosystem in a genuine dialogue.

- **Ask, don't tell.** When developing a social risk management strategy, getting honest feedback can help you avoid pitfalls and build credibility. Similar to engaging partners, this must be approached by listening rather than telling.

- **Communicate constantly.** In an age of social risk, communicating is not about pushing information to audiences. Rather, it is a methodical approach to all facets of a communications strategy that fosters dialogue.

- **Act with humanity.** Social risk is driven by human emotions that must be respected and appreciated.

Addressing social risk requires looking at its causes from a systemic standpoint, not on an event-by-event basis. The solutions must be focused on the same societal level as its causes, including poverty, injustice, inequality, or misinformation. Social risk touches all of society, and it comes from the perceptions and beliefs all humans have.

8 Description of potential impacts

8.1 Social Impact Assessment

> *"Almost all projects almost always cause almost all impacts. Therefore, more important than predicting impacts is having on-going monitoring and adaptive management."* Frank Vanclay

Considering the statement above, it must be considered that some social impacts will not be discussed in detail and that the focus will be on the most severe impacts. Nevertheless, it must be considered that the social environment is dynamic and adapts to change. The focus should be on the active management of social impacts than on the prediction and once-off mitigation thereof. Successful mitigation and management of social impacts requires long-term commitment and involvement and should form part of the strategic planning and management of the project until decommissioning. Suggestions for the management of social impacts are included in the report in the form of a social impact management plan (SIMP). The implementation of the relevant management suggestions should start as soon as possible since the social impacts of the project started when the project was announced. Another important consideration in this project is the social context in which it will be executed. Impacts are assessed from a community perspective, and where it will influence a specific group of stakeholders it will be indicated as such. An attempt was made to simplify the impact assessment and to focus on aspects that can aid the decision-making process.

Social impacts are the result of social change, and to fully understand the potential impacts it is important to know the impact pathways. A social change process is a discreet, observable, and describable process that changes the characteristics of a society, taking place regardless of the societal context (that is, independent of specific groups, religions etc.). Social change processes can be measured objectively. The way in which social change processes are perceived, given meaning, or valued, depend on the social context in which various societal groups act. Some groups in society are able to adapt quickly and exploit the opportunities of a new situation. Others (e.g. vulnerable groups) are less able to adapt, and will bear most of the negative

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consequences of change. These social change processes may, in certain circumstances and depending on the context, lead to the experience of social impacts. Social impacts are therefore completely context dependent (Vanclay, 2003).

8.2 Impact assessment criteria

It must be stated that the impact tables and ratings were adapted from the environmental sciences and that it is not always possible to compartmentalise the social impacts. For the sake of consistency this has been attempted, but it is not innate to social sciences. Allowance for the changing and adaptive nature of social impacts should be made when interpreting the impact tables.

The rating criteria used in determining the significance ratings are summarised in the tables below:

Figure 23: Criteria for determination of impact consequence.

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or

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	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible impact

Figure 24: Probability scoring.

Aspect	Score	Definition
	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%).
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

Figure 25: Criteria for the determination of prioritisation.

Aspect	Score	Definition
Cumulative impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (IR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).
Degree of Confidence	Low	<30% certain of impact prediction
	Medium	>30% and <60% certain of impact prediction
	High	>60% certain of impact prediction

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8.3 Social impacts and mitigation

In this section each impact will be described. The project will not have a construction phase and the mitigation measures for each impact that are relevant will be discussed at the end of the section.

8.3.1 Uncertainty

The fishing communities are uncertain about the impact that the seismic survey will have on their livelihoods. They feel that there is not enough information available to them to determine whether the surveys will have an impact on their activities. In the past year a number of companies approached them to participate in EIA processes about seismic surveys. They want to have some definitive answers about the potential impacts from specialists. They would like to engage with them for more than two hours to make sure that they understand exactly what the project entails and what the potential impacts are. Only then will they be able to make informed decisions. The fishing communities have made a living from the sea for hundreds of years and they have learned how to read the ocean and the weather to know where and when fish are moving. They are concerned that the surveys could disrupt the behaviour of snoek (that is endemic to the area and a major source of income) and other fish that they rely on. They have noticed changes in the patterns of the fish they catch due to industrial activities in the past. Some examples are the potato factory in Lambert's Bay that discharges warm water in the sea and the coffer dams constructed by the diamond mines. After a previous seismic survey at the Wild Coast, people observed dead Black Steenbras that were reported to have protruding nostrils. Furthermore, they also noticed changes in the patterns of the fish that they ascribed to climate change. For the fishing communities, the sea is an integral part of their identity, and they possess local knowledge that are not yet written up in scientific reports.

The marine fauna and fisheries reports indicate that low to negligible impacts on marine life and that all the impacts are reversible. However, the communities are not convinced. According to them, the fish can either go deeper in the sea to get away of the source of noise, which would be a tragedy for them, or they can go closer to the

shore, which would be beneficial for them. They feel that no-one can predict with certainty how the fish would respond to the noise, just that they would try to move away from the source.

The impact of seismic surveys on the catchability of marine fish remains a contentious issue for communities, with some claims that seismic surveys may negatively affect catch rates. However, little empirical evidence exists to quantify the impact or identify the mechanisms of such impact. The communities feel that there is simply not sufficient data available to negate or substantiate these claims and much more research on the topic is needed, especially from a local perspective. The consensus seems to be that there is a great knowledge gap in this regard. Community members feel that companies doing seismic surveys or those who have an interest in the data obtained through seismic surveys can make a great contribution to scientific knowledge of this field by funding independent research on the topic in South African waters.

People's livelihoods are already impacted by external factors such as fishing quotas, climate change, commercial over-fishing, mining in the sea and the recent Covid pandemic. They fear that the seismic surveys will contribute to an already dire situation and be a tipping point that will render them helpless and without their last source of income. They see seismic surveys as a gateway to oil and gas exploration and are concerned about the potential impacts that the results of the seismic surveys can unlock. There is a high level of uncertainty about the future of the ocean, which causes great concern and distress amongst the fishing communities, especially because the uncertainty is related to their livelihoods, and they are already struggling to make ends meet. Uncertainty also takes its toll on people psychologically and may result in mental health issues for some people in the long run.

8.3.2 Further marginalisation of vulnerable groups

In South Africa, claims for and access to natural resources are deeply embedded in people's histories, identities, and livelihood experiences. As in the case of land, access to and rights over fisheries resources is a highly contested issue where individuals and communities have equated such rights with human rights (Williams,2021).

Globally, fishing activities for many communities sees strong cultural and traditional links spanning many generations, and its value is seen beyond the means of earning a living (i.e. economic values). Whilst fishing takes place at sea, other activities related to fishing such as boat and net maintenance, the selling and trading of fish, etc. take place on land. Men and women are involved in fishing and indigenous knowledge and skills such as gutting and cleaning fish, reading the sea, and finding fish are transferred from generation to generation. The activities associated with fishing create a particular identity or characterise an area as a result of these activities (Williams,2021). Fishing is part of the cultural identity of the people living in fishing villages on the West Coast.

Many of the people on the West Coast belong to the Nama, Khoi or San people. Most of the Khoi people were traditionally cattle or sheep herders, while the San people were traditionally hunters and gatherers (www.san.org). They were the first inhabitants of southern Africa and one of the earliest distinct groups of homo sapiens. They have endured centuries of gradual dispossession at the hands of waves of new settlers, including the Bantu, whose descendants make up most of the black population of South Africa (https://foreignpolicy.com/2018/10/19/south-africas-first-nations-have-been-forgotten-apartheid-khoisan-indigenous-rights-land-reform/).
The process of land distribution instituted by the Government since 1994 has largely excluded the Khoi and the San people, as the government has not acknowledged them as the country's first peoples and their land was mostly taken before the apartheid era. There is a growing movement of indigenous activists that believe it is time to rightfully claim their traditional land.

One of the Khoi and San's biggest challenges is the racial classification system used in South Africa. They are being classified as 'Coloured' - a label that was used during Apartheid for citizens that did not fit the binary race model and included mixed-race children and Afrikaans-speaking non-whites. This categorisation condemned much of the Khoi and San's history to oblivion and facilitated the appropriation of their land. It excluded them from land restitution as it was conceived to be a benefit to black South Africans, and they were not considered to be black. As such the Khoi and San are

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considered to be very vulnerable and marginalised groups. Being marginalised means that they may easily be overlooked by corporate groups or businesses unfamiliar with the local history. Their needs, their views and even themselves as a stakeholder group can easily be omitted – both intentionally and unintentionally. In Searcher's previous application for a seismic survey in the area the Khoi and San felt that they were not consulted with. Therefore, they are sceptic about Searcher's intentions. They felt that they were discriminated against by not being consulted during the previous application, deepening their status as marginalised groups, and causing distraught to them as groups. Many of the fishers are of Khoi and San descendance, and they feel that they simply cannot win in any situation – whether it is fishing rights, land rights or culture identity.

With increasing interest in the West Coast area by seismic surveyors, which is viewed as the precursor for oil and gas companies to start developing the area, these communities risk increased marginalisation and an increase in vulnerability with every application where their voices are not being heard. They feel that currently they need to fight to make their voices heard. They have been using legal avenues, as they feel that just speaking up is not effective and has failed to give them the desired outcomes. Communities feel that their cultural heritage is threatened.

The San has published the San Code of Research Ethics that provides a guideline for researchers and companies that want to work in their sphere of influence on how to conduct themselves and how to interact with the San. From their perspective, an EIA application is also viewed as a form of research. This guideline can be applied to the Khoi and other people in the fishing communities as well. The San Code of Research Ethics is based on:

- Respect for individuals, community and culture;
- Honesty;
- Justice and fairness;
- Care; and
- Process (following San research protocol).

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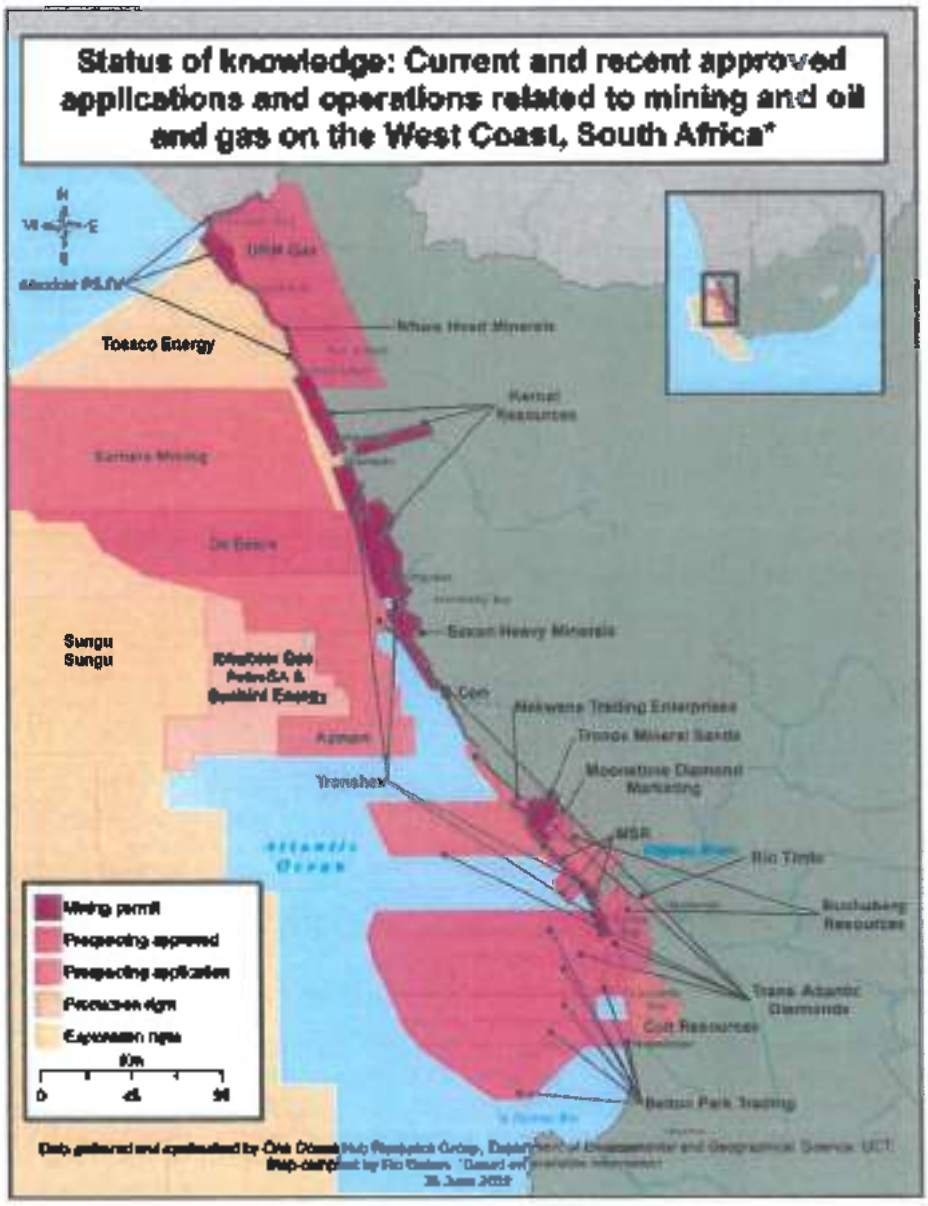
The San Code of Research Ethics states that lack of care can be demonstrated by talking down to communities, confusing them with complicated scientific language, or treating communities as ignorant. It further states that a lack of care is also represented by failing to ensure that something is left behind that improves the live of the San.

8.3.3 Concerns about cumulative impacts

A great source of concern for the fishing communities is the effect of cumulative impacts on their livelihoods and sense and spirit of place. There are a number of applications in process as well as approved applications relating to seismic surveys, mining, and oil and gas exploration in the West Coast area. There are also existing mining activities, significant shipping traffic and commercial fishing taking place in the ocean. The concern is that at some stage a tipping point will be reach where the marine life no longer recovers from the activities in the ocean or take a long time to recover to the extent that it would no longer be viable to make a living from the sea in those areas. In Norway small-scale fishing successfully co-exists with oil extraction in the ocean, but for the small-scale fishers on the West Coast, it remains uncertain to what extent it will be the case for them as well. Although cumulative impacts are assessed as part of the EIA process, there are limitations associated with budgets, timeframes, and access to resources. The competent authorities have a legal and moral duty to consider the cumulative impacts of the activities taking place and are planned to take place on the livelihoods and heritage of the vulnerable communities in the area from a strategic perspective. There must be a balance between the contribution these activities can make to South Africa's economy and sustaining the livelihoods of the vulnerable communities on the West Coast. The communities are clear that they do not necessarily want to stop development, they want to make sure that their livelihoods and heritage are protected, and that the rights of future generations will not be compromised. Once these have been affected negatively, it may not be possible to easily undo the damage.

Figure 26: Current and recently approved applications and operations relating to mining, oil and gas.



8.3.4 Impact on livelihoods

A livelihood refers to the way of life of a person or household and how they make a living, in particular, how they secure the basic necessities of life, e.g., their food, water, shelter and clothing, and live in the community (Vanclay et al., 2015). The coastal communities in the area of interest are mostly fishing communities that make their livelihoods from the sea and have been doing so for generations. They rely on the ocean for food and economic security, as well as their identity and heritage. They

know how to make a living from the sea. If it is no longer possible for them to make a living from the sea, or if their ability to make a living from the sea is reduced it will result in a great increase in poverty in the area as there are very limited alternative options for them to make a livelihood. Their skill sets are strongly linked to the sea and cannot be transferred to other economic activities without skills development, training activities and the economic diversification of the area. Men and women rely on the sea for their livelihoods, and it is closely linked to the culture and identity of the people. This makes these communities extremely vulnerable. Furthermore, an increase in poverty in the area will place an additional burden on tax payers.

The small-scale fishers can travel approximately 15 nautical miles offshore with their boats. Some of them have indicated that they already sometimes need to go further to be able to catch enough fish, which is not only more expensive for them in terms of the diesel required for their boats, but it is also more dangerous. In the mining areas around Port Nolloth they are struggling to get access to the sea and the areas where they are allowed to fish are getting smaller.

Livelihoods are already compromised due to the fishing quota system, over-fishing, lack of employment opportunities, pollution, effects of climate change and the recent Covid 19 pandemic.

8.3.5 Impacts on sense and spirit of place

Sense of place refers to an individual's personal relationship with his/her local environment, both social and natural, which the individual experiences in his/her everyday daily life (Vanclay et al, 2015). It is highly personal, and once it is affected, it cannot be restored. It is also difficult to quantify. The environmental philosopher Glenn Albrecht noted a consistent theme of distress caused by coal mining in Australia by the assault on the people's sense of identity, place, belonging, control, and good health. He identified a melancholia from the loss of solace and comfort connected with their home which he termed 'solastalgia' – a form of homesickness that one gets when one is still at 'home' associated with the major project impacts they experienced (Albrecht et al, 2007). Social impacts can therefore range from significant health impacts to the loss of a cherished landscape and associated loss of a sense of place.

Spirit of place refers to the unique, distinctive, and cherished aspects of a place. Whereas 'sense of place' is the personal feelings an individual has about a place, spirit of place refers the inherent characteristics of the place (Vanclay et al, 2015). In this case the spirit of place includes the ocean and the properties assigned to it.

Many things can impact on a person's perception of sense of place. For the fishing communities the ocean is an integral part of their being, therefore anything that is perceived to potentially harm the ocean would also cause harm to them. The ocean provides them with food and thus keeping them from starvation. For many the sea is a sacred place. Its water has healing powers that take care of the sick. Many loved ones have given their lives to the ocean while they were out trying to make a living, and their remains have never been found. The sea kept their bones, making the ocean the graveyard where their loved one's rest. For some people the thought of disturbance in the sea causes great distress. The heritage aspects relating to this are discussed in the heritage impact assessment report. Although this cultural and spiritual connection with the sea might be difficult to understand for outsiders, it must be respected as a cultural right.

8.3.6 Impacts on the social licence to operate

Social licence to operate (SLO) is a popular expression to imply that the acceptance of the community is also necessary for a project to be successful. It appears as if Searcher does not currently have social licence to operate in the fishing communities. Based on the events surrounding Searcher's previous application and recent reports about seismic surveys in the media, the communities expressed that they do not trust Searcher or any other company conducting seismic surveys. Applications for seismic surveys and community opposition to these surveys have been widely reported and debated in the media during the last year (Compare News 24, 13 Jan 2022; Mail and Guardian, 20 Jan 2022; Eye Witness News, 1 September 2022 amongst others). Numerous NGOs specialising in social and environmental justice have aligned with communities and assist them with opposing seismic surveys. Some community members think that seismic surveys are opening the door for oil and gas exploration,

which is a great concern for them, mostly due to the anticipated impacts on their livelihoods.

Given that there are a number of applications for seismic surveys in the Orange Basin, and that each application is subjected to a Basic Assessment process, communities are confused and reaching saturation regarding consultation. From their perspective, with each new application, it is a new face standing in front of them, from a new company, but "basically everyone wants the same thing". Communities do not distinguish between different seismic survey companies. They feel as if their questions are not answered, and concerns are not addressed – each consulting firm just repeat the same technical information about what a seismic survey entails to them. Although this is not Searcher's fault and they are following a prescribed legal process, it impacts on their social licence to operate and on the seismic survey industry as a whole.

The term "social fabric" embraces numerous complex and interrelated phenomena, including demographic and economic factors, behavioural issues (e.g. investment choices, political dynamics), social institutions (e.g. families), social organisations (e.g. municipalities and churches), and social networks, or relationships amongst people. The social fabric is underpinned by people's beliefs and sentiments, including a sense of belonging and identification with a particular social unit (Atkinson et al, 2017).

The social fabric in the communities have been damaged through previous negative experiences with businesses in the area. A number of factories in the greater area have closed or moved away and in the process of doing so created great hardship for the communities remaining behind. Very little severance was paid, and this aggravated the communities. Mines closed without proper rehabilitation plans. In some places, access to the areas where they earn their livelihoods are becoming increasingly restricted, especially through the activities of mining companies. This has reached a point where the communities have realised that they need to fight for the protection of their livelihoods as historically companies have in most cases not treated them fairly or with respect. It is unlikely that any company that would like to undertake an activity in the ocean will be given social licence to operate by the community. The community have been traumatised by historical events and behaviour of companies

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too many times. On the other hand, there are members in the community that welcome any new development and feel that living from the sea has its limitations and would soon be impossible. The dynamics between the different groups in the community, caused by the myriad of seismic survey applications, has already done significant harm to the social fabric of the fishing communities. People with individual agendas cause conflict in the community, and given the vulnerability of the community, the dire socio-economic conditions and high levels of poverty, illiteracy and unemployment, community members are susceptible to these forms of manipulation.

> ***Example of deterioration of social fabric:***
>
> *An individual rallied the youth in the community by telling them that they will be given work by Searcher (specifically) and ask them to complete forms and sign it. Searcher is unaware of this activity. Other members of the community find out about this and informed the consultants. Older community members fear that the signatures will be used to show community support to the project. Community members that lived together in peace and harmony for years are suddenly not talking to each other, and the community is divided.*

Another aspect that affects Searcher's current social license to operate negatively, is that they failed to conduct sufficient meaningful consultation with the small-scale fishers in the past. The MPRDA Regulations as amended in 2020 define meaningful consultation as: *consulting in good faith, in a way that gives the landowner, lawful occupier and/or interested and affected persons all the relevant information, and reasonable time and opportunity to make an informed decision regarding the impact of the proposed activities.*

The communities feel disrespected and marginalised by the processes followed up to date by Searcher and other companies. Engaging with the communities in a meaningful way, following the appropriate structures and protocols, will go a long way in improving Searcher's social license to operate. It does not guarantee that the communities will accept Searcher or any other company wanting to conduct seismic surveys. It must be kept in mind that improving social license to operate takes time and effort.

8.3.7 Community expectations

Not everyone in the fishing communities is opposed to the project or to oil and gas exploration. Their perceptions are that the ability to make a living from the sea is already declining. It is a hard live and they want a better life for their children. There are very limited alternative opportunities for making a livelihood and very limited job opportunities. They will support industrial development in the area if it brings opportunities for their children for employment and skills development. They want to know that they will benefit from the process that will be set in motion by the seismic surveys. They know they will not be direct beneficiaries from the extraction of oil and gas, but that they will be the ones that pay the price. Their expectations are that the oil and gas companies will invest in these communities and assist them with creating alternative livelihoods and obtaining the necessary skills and experience in that regard. Although Searcher will be doing a survey to gather data that will be utilised by oil and gas companies, and Searcher's activities will be of a temporary nature, with little benefit to the locals, the communities do not distinguish between data collection and exploration or extraction. For them these companies are one and the same, and they have similar expectations of Searcher.

The proposed project collects data that would be of great value for the companies interested in extracting oil and gas in the area in future. Should this happen, it would have a positive impact on the economy of South Africa, seen together with the Government's plans for the development of a new industrial port at Boegoebaai. In a country with very high unemployment levels and suffering from a recession and an energy crisis, this is seen as a positive future development by many role players. As such, the communities feel that the government supports the application, and that community consultation is simply a matter of ticking the boxes. The question of who pays the price and who gets the benefit is relevant in this context. The price that the fishing communities will pay eventually, will be high as it may have an extremely negative impact on their livelihoods with little or no benefit to them, unless measures are put in place to protect their livelihoods. It must be considered that community livelihoods are broader than just catch rates and fishing, but includes the capabilities,

assets (including both material and social resources) and activities required for a means of living.

8.3.8 Social unrest

Generally, social unrest occurs when a group gathers publicly to express dissatisfaction or anger centred around a common cause and is usually accompanied by a demand for societal change. Poor socio-economic conditions caused by unemployment rates, corruption, inflation, and bad governance can contribute to social unrest. South Africa has a history of using protests to air grievances. Social unrest is often triggered by an event or action that provokes strong feelings amongst community members.

Some of the communities are adamant that they would not allow gas or oil extraction in the area, and that includes collecting the required data from the ocean. There have already been court cases in this regard, and there are also court cases that are ongoing. Some community members have threatened with violence against Searcher's vessel. Others have threatened that they will take action to fight seismic surveys, in any way that they seem appropriate. This is a very emotional issue for many people and that could erupt into social unrest. Related to this is potential for conflict between community members who support the project and those that are against the project.

8.3.9 Mitigation and management

Searcher's activities for this application would be of short duration if approved, and if viewed in isolation considering only technical risks as discussed in various specialist reports conducted as part of the EIA process, the impacts will be negligible. However, communities feel that there are significant gaps in the available data and from a social perspective the non-technical or social risks can potentially cause significant impacts. Although the marine fauna and fisheries specialists have indicated that the impacts on the marine fauna would be negligible, the communities, with generations of experience in the ocean, fear that the behaviour of the fish will change and that this would affect their catch rates and consequently their livelihoods. What is seen as a minor impact in a large eco-system may be experienced as a major impact by an individual. The marine fauna might not be affected greatly, but the fishing community

fear that marine fauna might change its behaviour in response and that is a main concern from a social perspective.

It must be considered that from a social perspective perceived impacts (something that is believed to be a potential impact rather than something that has been established as being an actual impact) should be treated as real impacts. Perceived impacts affect how people feel about the project and how they feel and behave generally, thus perception is reality for them (Vanclay et al, 2015). While the public's assessment of risk is perceptual in nature, their fears should not be dismissed as irrational and therefore unimportant. Living with the fear and uncertainty is an impact in itself (Burdge, 1998).

There are current impacts on the livelihoods of the communities from aspects such as pollution, shipping traffic, mining in the sea, over fishing and climate change. The cumulative impact of additional activities in the ocean where these communities earn their livelihoods is of concern to them, especially if a number of companies engage in exploration activities in the area in an unplanned manner. They urge the government to approach the matter from a strategic perspective. The strategic approach is not the responsibility of Searcher but must be managed by government.

The short-term nature of the seismic reconnaissance and proximity from communities must be considered when suggesting mitigation measures. The mitigation measures suggested must be seen as building blocks for any potential further developments or activities that may be conducted by Searcher in future.

Figure 27: **Potential mitigation for impacts on existing livelihoods.**

No	Mitigation Measures	Phase	Timeframe	Responsible party for implementation	Monitoring party (frequency)	Target	Performance indicators (monitoring tool)
1	Searcher should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities and include a communication strategy and grievance mechanism.	All phases	Commence in the planning phase and continue throughout the life of the project	Searcher	Keep records of all communication with communities throughout the life of the project	Establish good relationships with fishing communities	Written community engagement protocol Communication register, social risk and incident register
2	Searcher should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as shoek respond to seismic surveying. Collaboration across seismic operators with holders of hydrocarbon exploration and the industry as a whole to collectively fund pro-active research would provide opportunity for the development and implementation of a structured and experimentally sound acoustic study. This would quantitatively inform the authorities and stakeholders of acoustic impacts to the various faunal groups in South African Waters.Communities should be consulted on the issues that should be researched.	All phases	Commence in the planning phase and continue throughout the life of the project	Searcher	Meetings with communities. Meetings with independent research organisations	Protect the livelihoods of the fishing communities	Minutes of meetings Written agreements with independent research organisations such as universities

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3	Consult with communities on ways in which to positively contribute to the communities.	All phases	Commence in the planning phase and continue throughout the life of the project	Searcher	Meetings with communities	To give something back to the communities	Minutes of meetings Written agreements with candidates
4	A representative from Searcher should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with readjusting the relationship between Searcher and the traditional communities. If needed, the meetings can be facilitated by an external party. This is an explicit request from community members and failing to do so will increase the reputational risk for Searcher and weakens their social licence to operate further. It will also cause significant delays in the application process. Given the current socio-political conditions in the coastal communities following prescribed legal processes is not sufficient to be seen as meaningful consultation from a community perspective.	All phases	Commence in the planning phase and continue throughout the life of the project	Searcher	Meetings with leadership	To ensure that there will be no misunderstanding about what meaningful consultation entails in future. It will also assist with clearing up past misapprehensions	Minutes of meetings

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5	Assessing all cumulative impacts of the seismic survey industry on the livelihoods of communities, addressing perceptions and alleviating fear from a strategic perspective is not Searchers' responsibility and falls outside the scope of one environmental impact assessment. It is the responsibility of the relevant authorities and the industry. However, the seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.	Before the study commence	Before the study commence	Searcher to initiate discussions with the industry governing bodies.	Meetings with industry role players and relevant authorities	Ensure that communities can make informed decisions and engage in meaningful conversations about seismic surveys.	Workshops, awareness raising campaigns and community education

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8.4 Impact ratings

Impact	Phase	Pre-Mitigation							Post-Mitigation							Confidence	Impact Prioritisation		Priority Factor	Final Score
		Nature	Extent	Duration	Magnitude	Reversibility	Probability	Post-mitigation ER	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Post-mitigation ER		Cumulative Impact	Irreplaceable Loss		
Uncertainty	Planning	-1	4	4	4	3	5		-1	4	2	3	2	4	-11	High	3	3	1.50	-16.5
Concerns about cumulative impacts	Planning	-1	4	4	4	3	5		-1	4	2	3	2	4	-11	High	3	3	1.50	-16.5
Further marginalisation of vulnerable groups	Planning	-1	4	4	4	3	5		-1	4	2	3	2	4	-11	High	3	3	1.50	-16.5
Impact on livelihoods	Operation	-1	4	4	4	3	3	-11.25	-1	4	3	3	3	3	-9.75	Medium	2	3	1.38	-13.41
Impacts on sense and spirit of place	Operation	-1	4	5	3	3	3	-11.25	-1	4	5	3	3	3	-11.25	Medium	2	3	1.38	-15.47
Impacts on social licence to operate	Operation	-1	4	4	5	4	5		-1	4	2	4	3	4	-13	High	2	2	1.25	-16.25
Community expectations	Operation	-1	4	4	4	3	4	-15	-1	4	2	3	2	4	-11	High	2	3	1.38	-15.13
Social unrest	Operation	-1	4	2	3	3	3	-9	-1	4	2	3	2	3	-8.25	High	2	1	1.13	-9.28

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9 Conclusion and recommendations

Searcher's activities for this application would be of short duration if approved, and if viewed in isolation considering only technical risks as discussed in various specialist reports conducted as part of the EIA process, the impacts will be negligible. However, communities feel that there are significant gaps in the available data and from a social perspective the non-technical or social risks can potentially cause significant impacts. Although the marine fauna and fisheries specialists have indicated that the impacts on the marine fauna would be negligible, the communities, with generations of experience in the ocean, fear that the behaviour of the fish will change and that this would affect their catch rates and consequently their livelihoods. What is seen as a minor impact in a large eco-system may be experienced as a major impact by an individual. The marine fauna might not be affected greatly, but the fishing community fear that marine fauna might change its behaviour in response and that is a main concern from a social perspective.

Another concern is the cumulative impact of activities in the ocean where these communities earn their livelihoods. Their fears about the tipping point where their source of livelihood does not recover from all the activities in the ocean, and they are no longer able to make their livelihood as fishing communities must be considered. Currently these communities are able to sustain themselves, although it is difficult. The communities are not against development, but they want to see it happen in a sustainable way that does not jeopardise their source of livelihood. They have already seen how their livelihoods are being affected by mining that is taking place in the sea, pollution, climate change, over fishing and businesses such as factories that come and go and often and do not leave in a socially responsible way.

Searcher, as well as other companies that want to do surveys or exploration in the area, currently do not have social license to operate. A large part of this is due to a lack of meaningful consultation from a community perspective. If Searcher or any other seismic survey company wants to proceed with the project, they will need to

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engage in meaningful conversation with the communities and try to restore relationships. From a community and social risk perspective this is not negotiable.

Seismic reconnaissance projects are controversial in South Africa and has been in the news frequently in the last year. For many stakeholders it is an emotional matter, for others the potential of impacting their livelihoods is the biggest fear. There are also stakeholders that feel that the exploration for fossil fuels is not in line with sustainable development and the fight against climate change. Other stakeholders feel that it is imperative for the growth and development of the South African economy to engage in these investigations. It is a complex and wicked[2] problem.

Based on the findings, the following recommendations are made:

- Searcher should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism.

- Searcher should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. Collaboration across seismic operators with holders of hydrocarbon exploration and the industry as a whole to collectively fund pro-active research would provide opportunity for the development and implementation of a structured and experimentally sound acoustic study. This would quantitatively inform the authorities and stakeholders of acoustic impacts to the various faunal groups in South African Waters.

- Consult with communities on potential ways in which to make a positive contribution to the communities.

- A representative from Searcher should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist

[2] a wicked problem is a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize.

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with readjusting the relationship between Searcher and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective.

- Searcher should initiate discussions in their industry. The seismic survey industry should reassess their position and social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.

From a social perspective it is clear that the communities and majority of local people are opposed to the project. If the project is considered in isolation, the impacts are negligible. However, the project does not happen in a vacuum, and the social environment is much wider than the footprint of the project. If the social risks and potential damage to cultural and indigenous rights are considered the impact on the social fabric of already vulnerable communities may be significant. From as social perspective the project can only be recommended after meaningful consultation, local research, education, and awareness raising has been done in the project affected communities. At this stage communities feel that they cannot make informed decisions. Although all legal processes have been followed, the seismic survey industry is not moving at the pace of the community, and in the long run this will be detrimental to the industry. Potential future benefits and the economic development of the country should the surveys find any significant resources are not disputed. The recommendation is therefore that the project can only proceed once the social mitigation measures have been implemented and the community are sufficiently informed and educated to able to engage in a meaningful manner.

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Saldanha TGS interaksie

18 May 2023

"A11.5"

Ons as die vissers van Saldanha het n vergadering met EIMS by hoedtjies baai Hotel vir TGS bygewoon en ons het die volgende met hulle gedeel. Ons as visser is gekant teen alle forms van Olie en Gas in oseane vir die volgende redes. Die vis species wat tans folop is sal uitgeroei word en ons ervaring is dat hierdie vis spesies al reeds skaars as gevolg van klimaats verandering. Olie/Gas Drilling is n bedreiging vir alle marine spesies in die oseane. Dit gaan ons vissers voortbestaan verder in armoed dompel. Ons will dit pertunent stel van Noord tot Wes, Suid en Oos,ons is bank vas gekant teen Olie en Gas en ons weier om ons oseane beskikbaar te stell vir enige Olie en Gas. Hierdie vergadering was nie goed bygewoon die deur die bree gemeenskap nie en ons wonder was daar nog soort gelyke opvolg vergaderings gehou

Opvolg verslae:

Ons as die vissers, en Ek spesifiek wat by die vergadering was van TGS het geen terugvoering ontvang vanaf TGS tot kennisgewing 26 April 2023. Ons as Visser drae nie kennis van verslae wat in biblioteek of ander plekke was nie.Ons het nie geleenheid gehad om seker te maak dat ons komentaar well akuraat opgeteken was nie en dra nie kennis hoe hulle ons kometaar beantwoord het nie.

Baie Dankie

Carmerlita Mosterd

Coastal links Saldanha

TGS

forestry, fisheries & the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002

Email: appeals@dffe.gov.za

APPEAL RESPONSE REPORT

PROJECT NAME/TITLE: PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT PROJECT LOCATED OFFSHORE THE WEST COAST, SOUTH AFRICA

PROJECT LOCATION: ORANGE BASIN LOCATED OFFSHORE THE WEST COAST, SOUTH AFRICA

PROJECT REFERENCE NUMBER: PASA REF: 12/1/040

DMRE REF: 1520

DATE PROJECT/ACTIVITY AUTHORISED: 17th of April 2023

DATE NOTIFIED OF DECISION: 26th April 2023

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Initials

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DETAILS OF THE APPELLANT	DETAILS OF THE APPLICANT
Name of appellant: The Green Connection and Natural Justice	Name of applicant: TGS Geophysical Company (UK) LTD
Appellant's representative (if applicable): Green Connection: Liziwa McDaid Natural Justice: Melissa Groenink-Groves	Applicant's representative (if applicable): Mr Jevon Hilder
Postal address: 53 Hout Street, Cape Town	Postal Address: 8 Dalmeny Road, Pine Park, Randburg PO Box 2083, Pinegowrie 2123, South Africa
Email Address: liziwe@mweb.co.za / melissa@naturaljustice.org	Email Address: EIMS Public Participation Team tgs@eims.co.za; jevon.hilder@tgs.com
Telephone number: 082 731 5643	Telephone number: 011 789 7170
Fax Number: N/A	Fax number: N/A

Initials

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
INTRODUCTION 1. This is an appeal to the Honourable Minister of Forestry, Fisheries and the Environment ("Appeal" to the "Minister"), directed to the Director: Appeals and Legal Review of the Department of Forestry, Fisheries and the Environment ("DFFE"), to set aside the decision of the Director-General of the Department of Mineral Resources and Energy (as "DG" or "DMRE") dated 17 April 2023 granting environmental authorisation to TGS Geophysical Company (UK) (as "Third Respondent") allowing for a 3D seismic survey off the West Coast of South Africa. 2. The Minister should set aside the decision to grant authorization because the Environmental Basic Assessment Report (FBAR) did not comply with NEMA in several ways. The decision to grant authorization violates various provisions of NEMA, including the requirements for granting environmental authorizations and the National Environmental Management Principles. The FBAR and the decision-maker failed to establish the need and desirability of the Project, failed to adequately consider marine impacts, and neglected to assess the cumulative impacts of the Project. The Second and Third Respondent also failed to engage in meaningful consultation, violating principles of fair administrative decision-making and the right of affected communities to be consulted. This failure to consult is inconsistent with NEMA's requirement to promote participation and take into account the interests of all parties. Moreover, the decision-maker disregarded NEMA Principles, including the precautionary principle and the principle of sustainable development, as well as the constitutional right to a non-harmful environment. The decision therefore to issue the authorization and the reasons provided are deemed irrational and unreasonable. 3. The Appellant submit this appeal on the following grounds:	For the reasons provided in the responses below it is the opinion of TGS Geophysical Company (UK) (TGS) that the Environmental Authorisation (EA) should remain valid, since the Basic Assessment Process was conducted in line with the requirements of the Environmental Impact Assessment (EIA) Regulations, 2014, as amended. This included amongst others that: • The Need and Desirability of the Project was adequately addressed and assessed – Refer to Section 5 of the Basic Assessment Report (BAR)); • Marine and cumulative impacts were considered in detail in the BAR – refer to Section 9 of the BAR; • The EAP appointed for the project conducted an extensive Public Consultation Process, which resulted in meaningful consultation – Refer to Section 7 and Appendix 2 of the BAR; • As stated in Section 11.3 of the BAR, The findings of the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the reconnaissance activities, the findings of the specialist studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team and the EAP that the significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures and the project should be authorized.	

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3.1. Ground 1: A flawed and misguided need and desirability assessment 3.1.1. Climate Change Impacts. 3.1.2. The climate crisis. 3.1.3. South Africa's international climate change commitments. 3.1.4. Need for seismic data. 3.2. Ground 2: Failure to adequately consider marine impacts 3.2.1. Underwater sound from acoustic seismic surveys. 3.2.2. Harms to marine life. 3.2.3. Acoustic Modelling 3.2.4. Heightened Legislative Requirements are Not Considered for Critical Biodiversity Areas (CBAs), Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs). 3.2.5. CBAs 3.2.6. EBSAs and MPAs. 3.2.7. Cape Fur Seals 3.2.8. Whale and Dolphins. 3.2.9. Fish. 3.2.10. Zooplankton. 3.2.11. The proposed mitigation measures are inadequate to prevent unacceptable harm to marine life. 3.2.12. Simultaneous Surveys. 3.2.13. Lack of baseline noise assessment. 3.2.14. Chronic Noise Impacts.	It is not clear from the evidence presented by Appellant, that they have sufficient mandate from the communities that they claim to represent.	

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3.3. Ground 3: Failure to adequately assess cumulative impacts 3.4. Ground 4: Failure to conduct meaningful consultation with communities and local people (and in particular small-scale fishers), within the public participation process, including the Social Impact Assessment process. 3.5. Ground 5: The FBAR does not contain a proper and objective assessment of the negative impacts of the project on people's human rights 3.6. Ground 6: Failure to consider relevant coastal management considerations or to comply with the National Environmental Management: Integrated Coastal Management Act 24 of 2008 3.7. Ground 7: Failure to provide adequate reasons for the decision 4. The Authorisation, with reference number 12/1/040, was granted in terms of regulation 24 of the National Environmental Management Act, 1998 ("NEMA") Environmental Impact Assessment Regulations, 2014 ("EIA Regulations"). 5. The Appeal is lodged in terms of section 43(1A) of NEMA, which provides that: "*Any person may appeal to the Minister against a decision made in terms of this Act or any specific environmental management Act by the Minister responsible for mineral resources or any person acting under his or her delegated authority*", read with the NEMA National Appeal Regulations, 2014[1] ("the Appeal Regulations"), which provide for the submission of an appeal within 20 days from the date that the notification of the decision for an application for environmental authorisation was sent to the registered interested and affected parties (I&APs) by the Applicant (26 April 2023).[2]		

[1] GN R 993 GG 38303 of 8 December 2014.
[2] Regulation 4(1)(a) NEMA National Appeal Regulations, 2014.

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6. In accordance with the requirements of Regulation 4(2)(a) of the Appeal Regulations: 6.1. this Appeal is submitted in writing in the form obtained from the Appeal Administrator, and accompanied by this more detailed appeal document, being a statement setting out the grounds of appeal ("the Grounds of Appeal"). The Appellants are entitled to also submit these more detailed Grounds of Appeal as the Appeal submission. This submission must be taken into account by the Minister in making a decision on the Appeal; 6.2. to the extent possible, the Appeal is accompanied by relevant supporting documentation which is referred to in this Appeal submission - attached as Annexure B; and 6.3. we confirm, in compliance with Regulation 4(1) of the Appeal Regulations, that this Appeal is submitted within 20 days[5] from the date of notification to I&APs to the Appeal Administrator. A copy of the Appeal will be provided to the Applicant and to those registered I&APs, and organs of state with an interest in the matter, insofar as possible and within time and cost constraints. The statement regarding compliance with Regulation 4(1) is contained in the cover letter to which these Grounds of Appeal are attached. In any event, we confirm compliance with Regulation 4(1). 7. The Appellants further submit that there are grounds for judicial review under the Promotion of Administrative Justice Act, 2000 ("PAJA") because the Authorisation comprises administrative action that *inter alia*.		

[5] The Appellants submit that the process provided for in the Appeal Regulations, in particular the requirement to submit an appeal in 20 days of the notification, severely prejudices the Appellants and infringes on their rights to a fair process. The Appellants continue to assert that the unreasonably short timeframes and onerous notification requirements of regulation 4(1), among others, render the Appeal Regulations a violation of the rights to just administrative action, and are thus unconstitutional.

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7.1. is unconstitutional or unlawful;[4] 7.2. was taken because of the failure to consider relevant considerations;[5] 7.3. is not rationally connected to the information before the decision-maker in making the Decision or to the reasons provided by the decision-maker for the Decision;[6] and 7.4. is so unreasonable that no reasonable person could have granted it.[7] **PARTIES** 8. The First Appellant is **Natural Justice**. 8.1. Natural Justice: Lawyers for Communities and the Environment is a non-profit organization specializing in environmental and human rights law in Africa – with a focus on the pursuit of social and environmental justice for local and indigenous communities. Natural Justice offers direct support to local and indigenous communities impacted by the ever-increasing demand for land and natural resources.. 9. The Second Appellant is **the Green Connection.** 9.1. Green Connection is a registered non-governmental organisation, that believes that economic growth and development, improvement of socio-economic status and conservation of natural resources can only take place within a commonly understood framework of sustainable development. The Green Connection aims to provide practical support to both		

[4] PAJA section 6(2)(d),(f)(i) and (ii).
[5] PAJA section 6(e)(iii).
[6] PAJA section 6(f)(ii)(cc) and (dd).
[7] PAJA section 6(h).

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the government and non-governmental/civil society sectors, which are an integral part of sustainable development. 10. The Appellants have legal standing to bring the Appeal not only in terms of section 43 of NEMA, but also to enforce environmental laws in terms of NEMA section 32, in that they *inter alia* act: *"(c) in the interest of or on behalf of a group or class of persons whose interests are affected; (d) in the public interest; and (e) in the interest of protecting the environment."*[8] The Appellants act in the interest of, or on behalf of, persons who, for practical reasons, are unable to institute such proceedings, including members of coastal communities who do not have the capacity or resources to do so, in the interests of coastal communities who are affected by the proposed seismic activities, in the public interest, and in the interest of protecting the environment, to further the objectives of section 24 of the Constitution of the Republic of South Africa, 1996 ("the Constitution") and NEMA. 11. The Appellants are also Registered Interested and Affected parties (I&AP) in respect of the application process for this authorisation. **BACKGROUND AND DESCRIPTION OF THE PROJECT** 12. The proposed project area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay over a number of petroleum licence blocks. The application area for the proposed 3D seismic survey is approximately 57 400 km^2 in extent. TGS proposes that a single survey vessel equipped with seismic sources and streamers be used. The proposed 3D survey would be supported by two escort vessels. It is estimated that the 3D survey will take 70 days (including downtime).[9] The area proposed for the		

[8] NEMA section 33(1)(c)-(d).

[9] BAR Executive Summary, pxvi.

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seismic survey is a large under-explored area with potential for both oil and gas. 13. On the 25th of November 2022, the Applicants submitted comments on the draft Basic Assessment Report prepared as part of the Environmental Impact Assessment (EIA) process. As mentioned above, the DG granted the Project an Environmental Authorisation on 17 April 2023, and the Appellants received notification of the decision on 26 April 2022. 14. The Reasons for the Decision are set out in Annexure 1 to the Authorisation. GROUNDS OF APPEAL 15. The decision to grant the Authorisation should be set aside by the Minister because the final Environmental Basic Assessment Report ("FBAR") failed to comply with NEMA in various respects; and the Director General's decision to grant the Authorisation contravenes various provisions of NEMA, including the requirements for granting environmental authorisations, the requirements of the National Environmental Management Act and the National Environmental Management Principles (section 2 of NEMA) ("NEMA Principles"), in that: 15.1. the need and desirability of the Project has not been established, as required by regulation 18 of the EIA Regulations read with regulation 23(3) and Appendix 3 to the EIA Regulations. 15.2. the FBAR and the DG failed to adequately consider the marine impacts and therefore have failed to meet the requirements of, inter alia, section 240(1) NEMA to account for all relevant factors,[10] in particular those regarding the pollution,		

[10] NEMA, section 2401(b).

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environmental impacts or environmental degradation *"likely to be caused if the application is approved"*,[11] as well as any guidelines, departmental policies, and environmental management instruments and any other information in the possession of the competent authority relevant to the Application.[12] This is also in contravention of the NEMA requirement to ensure that the activity's potential environmental impacts are properly assessed;[13] 15.3. The FBAR and DG have failed to adequately assess and consider the cumulative impacts of the Project, as required by the NEMA EIA Regulations, Appendix 3 section 3(j)(i). 15.4. TGS, and its appointed Environmental Assessment Practitioner ("EAP", has failed to engage in meaningful consultation in violation of the principles of fair administrative decision-making and the right of interested and affected communities to be meaningfully consulted prior to a decision on authorisation being made, and in violation of section 2(4)(f) of NEMA, which stipulates that the participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured. It is also inconsistent with section 2(4)(g) of NEMA, which requires that decisions must take into account the interests, needs and values of all interested and affected parties, and this includes		

[11] NEMA, section 24O1(b)(i).
[12] NEMA, section 24O1(b)(viii).
[13] NEMA, section 24(4)(a)(iv).

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recognising all forms of knowledge, including traditional and ordinary knowledge. 15.5. the DG failed to consider and/or give effect to: the NEMA Principles, including the precautionary principle and the principle that requires development to be environmentally, socially and economically sustainable; and the Constitutional rights to an environment that is not harmful to health or wellbeing – as enshrined in section 24 of the Constitution of the Republic of South Africa, 1996 ("the Constitution"). The decision to issue the Authorisation and the reasons provided therefore are, furthermore irrational and unreasonable, and thus in contravention of PAJA. 15.6. The DG failed to consider relevant coastal management considerations or to comply with the National Environmental Management: Integrated Coastal Management Act 24 of 2008. 15.7. Ground 7: The DG failed to provide adequate reasons for the decision.		
Ground 1: A flawed and misguided need and desirability assessment 16. The NEMA EIA Regulations stipulate that a basic assessment report must include a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location.[11] 17. Section 5 of the FBAR includes a motivation of need and desirability for the proposed 3D seismic survey. Unsurprisingly, the FBAR	The EAP has conducted the impact assessment on the basis of the activities proposed by the applicant. Any subsequent authorisation would be restricted to these specifically assessed activities. Should the applicant or other applicants wish to undertake any additional exploration activities which are not addressed in the current Environmental Authorisation (EA) application, there would be a consequent need to apply for the relevant permissions. These would include a formal application for an Exploration or Production Right as	

[11] NEMA EIA Regulations, Appendix 1, section 2(c). With regard to need and desirability, a distinction is drawn between the 'general purpose and requirements' of the proposed activity and 'need and desirability'. The 2017 Guideline on Need and Desirability states as follows (at p10):

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focusses on justifying the 'need and desirability' of the proposed project and fails to reflect views critical to 3D seismic surveys and offshore oil and gas exploration (and ultimately production). As a consequence, the 'need and desirability' assessment provided in the FBAR follows the pattern of previous seismic survey EIAs by (among other things) limiting the assessment of potential impacts to the proposed 3D seismic survey, with no assessment of the need and desirability of exploring for (and ultimately producing and using) new oil and gas reserves (including in the context of the climate change crisis and the right to food). The assessment also includes a section motivating the 'need' for seismic data. 18. It is noted that the FBAR Needs and Desirability analysis indicates that the proposed project *'aims to identify oil and gas resources to be used in... energy production and/or processing or manufacturing of materials'*.[13] The FBAR also claims in passing that "seismic surveying is not only used for petroleum and natural gas exploration and development, it can in certain instances also be used for	well as a new EA. The impacts of such proposed activities would consequently require specific assessment and public consultation prior to approval. It is premature to assess the likely impacts of further invasive exploration activities or production activities as the extent, duration, location, and magnitude applicable to these activities are unknown at this stage. The NEMA EIA Regulations make a clear distinction between the reconnaissance, exploration, and production activities in that these are listed as distinct and separate listed activities. There is provision in law for these activities to be assessed on their merits as and when they are proposed. Please refer to Section 5 of the EA Report in regard to the need and desirability for the proposed activities. According to the Integrated Resource Plan 2019 (IRP 2019), which is the country's electricity planning strategy, there is a need for gas in South Africa's energy mix in the future. This need is driven in part by the expectation that natural gas may act as a transition fuel, whilst other greener technologies mature. According to the National Department of Forestry, Fisheries	

In order to properly interpret the EIA Regulations' requirement to consider "need and desirability", it is necessary to turn to the principles contained in NEMA, which serve as a guide for the interpretation, administration and implementation of NEMA and the EIA Regulations. With regard to the issue of "need", it is important to note that this "need" is not the same as the "general purpose and requirements" of the activity. While the "general purpose and requirements" of the activity might to some extent relate to the specific requirements, intentions and reasons that the applicant has for proposing the specific activity, the "need" relates to the interests and needs of the broader public.

...

The consideration of "need and desirability" in EIA decision-making therefore requires the consideration of the strategic context of the development proposal along with the broader societal needs and the public interest. The government decision-makers, together with the environmental assessment practitioners and planners, are therefore accountable to the public and must serve their social, economic and ecological needs equitably. Ultimately development must not exceed ecological limits in order to secure ecological integrity, while the proposed actions of individuals must be measured against the short-term and long-term public interest in order to promote justifiable social and economic development – i.e. ensuring the simultaneous achievement of the triple bottom-line. Considering the merits of a specific application in terms of the need and desirability considerations, it must be decided which alternatives represent the "most practicable environmental option", which in terms of the definition in NEMA and the purpose of the EIA Regulations are that option that provides the most benefit and causes the least damage to the environment as a whole, at a cost acceptable to society, in the long-term as well as in the short-term. (emphasis added)

The Guideline requires need and desirability assessments to address the impact of planned activities on global and international responsibilities relating to the environment, including climate change (at p11).

[13] FBAR, item 1.7.1, p24.

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development of offshore wind, geothermal energy, and low-carbon solutions such as carbon capture and storage and also more generally for providing more insight and understanding into the regional geology of the area for scientific purposes." This statement about other uses is misguided and irrelevant. These other purposes of the projects surveying results are speculative at best, and have far less impacts on the ocean than oil and gas surveying.[16] It is also abundantly clear from the FBAR that the main purpose of this project is to survey for oil and gas deposits. 19. The FBAR concludes that *'[a]s a result of the fact that this project entails only survey activities, it is anticipated that this project will not lead to a significant impact on the receiving environment'.*[17] In line with this, the FBAR does not consider or assess the potential climate and other negative impacts of subsequent oil and gas exploration, production and use. In other words, it fails to consider the lifecycle impacts associated with exploring for and exploiting oil and gas resources. Yet, at the same time, it does consider the positive impacts should oil and gas be eventually produced, such as the claim that it will provide energy security to South Africa. This self-serving analysis is not only deceiving, it is unlawful. **Climate change impacts**	and the Environment (DFFE), targets have been determined to achieve our national GHG Emissions commitments. These targets consider the likely GHG emissions outcome of the implementation of current South African policies including the IRP. The proposed seismic activities may be used to determine whether a viable gas or oil resource is present. The outcomes of this could provide insight into potential alternative supply options to inform the future energy planning and policy for South Africa. Considering this, and other new information on supply options, as well as the rapid technological advancements in the energy sector (and specifically in the low carbon alternatives), it is crucial that the energy planning for South Africa is continually reassessed and revised to ensure that the most suitable and sustainable strategy is defined. The 2021 NDC's are aligned with the IRP 2019. The GHG emissions and associated climate change impacts associated with the seismic survey itself would be negligible. There are no significant GHG emissions directly related to the proposed activity nor significant climate change vulnerability risks. As such, the life-cycle of the project would be limited to the Reconnaissance activities only (i.e. identification only – and does not necessarily imply actual exploration or further production of oil and gas resources) and	

[16] For example, the offshore wind industry does not use airguns, and instead relies on High Resolution Geophysical (HRG) surveys to map the ocean bottom and its shallow geological features. That technology, such as echosounders, sidescan sonar, and sparkers, uses considerably less power as compared to seismic airguns and also tends to operate at higher frequencies. Not only do higher frequency sounds dissipate more quickly in the ocean but they also tend to fall outside of the general hearing range of baleen whales, such as humpbacks and right whales. The use of seismic surveying to develop offshore wind is the equivalent of using a hammer when a feather could do the job. The area that is being surveyed is also 120 – 230 km offshore and includes deep to ultradeep depths between 1,500 – 4,000m. It would not be feasible to install a fixed nor floating turbines at those depths, as they are more suitable for depths of less than 50m and 50 to 1,000m, respectively. Lastly, a World Bank analysis does not find the area TGS is surveying to be ideal for offshore wind generation. ESMAP. 2019. Going Global: Expanding Offshore Wind to Emerging Markets at p. 20-21. Washington, DC: World Bank ("fixed foundation is considered technically viable in areas with water depth less than 50 m and average wind speeds over 7 m/s. Floating wind is considered technically viable with water depths from 50 m up to 1,000 m.").

[17] Ibid, Item 1.8.3, p24.

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20. The FBAR states that from a climate change perspective, it is '*not currently possible to accurately assess the risks associated with oil and gas activities, given that the specific details of these potential future activities are not known and therefore climate change impacts would need to be assessed in detail during any subsequent Scoping and EIA processes for any potential subsequent oil and gas production projects*'.[18] As a result, the FBAR does not conduct any climate change impact assessment, even in broad terms. 21. It is relevant to note that the issue of whether the decision-maker properly considered climate change impacts was referred to in the judgment of the full bench of the Makhanda High Court in the Shell Wild Coast seismic survey case.[19] The court stated in its judgement that the intervening parties' contention that the decision-maker gave no proper consideration to climate change impacts of the decision to grant the exploration right is an important factor to be considered in the process of granting an exploration right. The court referred to expert testimony relied upon to support this contention, which showed that '*most of the discovered reserves of oil and gas cannot be burnt if we are to stay on the pathway to keep global average temperature increases below 1.5 degrees Celsius. Authorising new oil and gas exploration, with its goal of finding exploitable oil and/or gas reserves and consequently leading to production, is not consistent with South Africa complying with its international climate change commitments*'.[20] 22. The court noted that according to the respondents in that case, climate change considerations are irrelevant when considering an	this has been specified and defined in the Need and Desirability, and the associated impacts identified and assessed. The statement made by the Appellent that the Need and Desirability is misleading and unlawful in that it considers "*positive impacts should oil and gas be eventually produced, such as the claim that it will provide energy security to South Africa*" is in itself misleading and inaccurate. In fact, the Need and Desirability clearly states that "*The proposed project aims to identify oil and gas resources and will not, at this stage, involve the use of the natural resources identified as part of the proposed survey project*" and furthermore makes no claims of any significant positive impacts and states on numerous occasions that "*The proposed activities are anticipated to have low negative ecological impacts. Refer to the impact assessment in Section 9 in this report.*" Also noted is that TGS is a seismic data acquisition company and is in the business of data acquisition, and are not an Oil & Gas Exploration or Production company. Data from TGS' seismic libraries are not only used for petroleum and natural gas exploration and development, data may also be used for development of offshore wind, geothermal energy, low-carbon solutions such as carbon capture and storage and also more generally for providing more insight and understanding into the regional geology of the area for scientific purposes.	

[18] FBAR, p33.

[19] *Sustaining the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021, at paras 120 to 125.

[20] Ibid, at para 121.

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application for an exploration right, and these considerations are premature because they fall to be considered at a much later stage. 23. The court pointed out that on the authority of the *Save the Vaal* case,[21] the '*processes are discrete stages in a single process that culminates in the production and combustion of oil and gas, and the emission of greenhouse gases that will exacerbate the climate crisis and impact communities' livelihoods and access to food*'.[22] The court went on to state that the respondent's thesis does not find support in *Earthlife Africa Johannesburg v Minister of Environmental Affairs and Others* either, and referred approvingly to the following passage in Murphy J's judgement: The absence of express provision in the statute requiring a climate change impact assessment does not entail that there is no legal duty to consider climate change as a relevant consideration and does not answer the interpretative question of whether such a duty exists in administrative law. Allowing for the respondents' argument that no empowering vision in NEMA or the regulations explicitly prescribes a mandatory procedure or condition to conduct a formal climate change assessment, the climate change impacts are undoubtedly a relevant consideration as contemplated by section 240 of NEMA for the reasons already discussed. A formal expert report on climate change impacts will be the best evidentiary means of establishing that this relevant factor in its multifaceted dimensions was indeed considered, while the absence of one will be symptomatic of the fact that it was not.[23] 24. The court in the Shell Wild Coast seismic survey case went on to state the following:	The Earthlife Africa case referred to relates to the EA issued to construct and operate a new coal fired power station which bears no resemblance to seismic survey data acquisition. It is agreed that pending the outcome of an appraisal on the viability of extracting any oil or gas resource, which this seismic survey is likely to inform, due caution will need to be taken to avoid overcommitments and stranded assets. In terms of the "Need for Seismic Data", the main aim of the Needs and Desirability Section of the BA Report is to determine the need for the activity, and it is argued for that the survey is desirable given the current energy planning of the country, amongst other factors It is agreed, considering the rapid technological advancements in the energy sector, that there is a need to continually reassess and revise where relevant the energy planning and policy for South Africa. Pending the outcome of an appraisal on the viability of extracting any oil or gas resource, which this seismic survey is likely to inform, due caution will need to be taken to avoid overcommitments and stranded assets associated with the timing of South Africa's prevailing climate change commitments. The potential for methane leaks during resource extraction, processing, and utilisation will need to be assessed as and when such is proposed. It should further be noted that the acquisition of seismic survey data is considered important with respect to understanding the potential for future oil and gas production as part of the energy mix of the country	

[21] *Director: Mineral Development, Gauteng Region and Another v Save the Vaal Environment and Others* (133/98)[1999] ZASCA 9 (12 March 1999).

[22] Ibid, para 123.

[23] Ibid, para 124.

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It seems clear from the aforegoing, even taking into account the contentions raised by the respondents, that, had the decision-maker had the benefit of considering a comprehensive assessment of the need and desirability of exploring for new oil and gas reserves for climate change and the right to food perspective, the decision-maker may well have concluded that the exploration is neither needed nor desirable.[24] (emphasis added) 25. The Green Connection and Natural Justice submit that the FBAR is deficient, and the Needs and Desirability analysis incomplete, without at the very least a broad assessment of the climate change impacts should commercially exploitable oil and gas resources be identified through the proposed seismic survey (and should these resources be produced and utilised). It would be pointless to authorise this (and other) 3D seismic surveys should such an assessment conclude that the development of new oil and gas fields is incompatible with South Africa's climate change commitments. *The 'climate crisis'* 26. The need and desirability (from a climate change perspective) of conducting a 3D seismic survey (which – as mentioned above – the FBAR aims to identify oil and gas resources to be used in energy production and/or processing or manufacturing of materials) is particularly important given that climate change has been acknowledged as a 'crisis' with human-induced climate change impacts being experienced in every region. It is also recognised that the climate change 'crisis' requires immediate, rapid and large-scale reductions in greenhouse gas (GHG) emissions to limit global warming to 1.5°C (including accelerated action in this decade to reduce global carbon dioxide emissions by 45 per cent by 2030 relative to the 2010 level and to net-zero around mid-century). In	going forward. The seismic data will provide information with which future decisions can be made. The South African legislation requires the payment of royalties and taxes to the South African government associated with the extraction of resources. There are further obligations on holders of mineral and petroleum rights to contribute to local economic development. The Draft Upstream Petroleum Resources Development Bill also provides for the state to receive a 20% carried interest in exploration and production rights. According to the specialist investigations undertaken, there is unlikely to be a significant impact on the marine environment and therefore there is not anticipated to be a consequent impact on the right to food. It should further be noted that, in the recent Presidential Climate Commission (PCC) recommendations on the electricity system which also specifically considered many local and international studies (including some of those cited by the appellant), the PCC expects a policy adjusted IRP to promote approximately 50 to 60 GW of variable renewable energy by 2030, supported by co-located storage, and between 3 and 5 GW of peaking support (for example gas, running at low utilisations). Therefore, although the PCC doesn't advocate for large scale new coal or gas the PCC does recommend the inclusion of up to 5GW of peaking support (typically to be provided in part by gas). In summary, the re-evaluation of South Africa's energy planning and policy falls beyond the scope of this assessment. The current policy provides for a portion of the electricity mix to be provided by gas, and that such has been accounted for and included in the countries climate change commitments (NDC's). The source of the gas to meet this need would either be imported of produced locally. The feasibility of the later can only be defined once the extent if the resources have been defined.	

[24] Ibid, para 125.

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support of these submissions, some of the recent developments relating to the climate crisis are discussed briefly below. 27. In August 2021, the Intergovernmental Panel on Climate Change (IPCC) [an international body for assessing the science related to climate change] released its 6th Assessment Report (AR6).[25] In its summary for policymakers, the IPCC indicates (among other things) that: 27.1. It is unequivocal that human influence has warmed the atmosphere, ocean and land, and that widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred;[26] 27.2. The scale of recent changes across the climate system as a whole – and the present state of many aspects of the climate system – are unprecedented over many centuries to many thousands of years;[27] 27.3. Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since AR5;[28] 27.4. Global surface temperature will continue to increase until at least mid-century under all emissions scenarios considered, and that global warming of 1.5°C and 2°C will be exceeded during	Thereafter a decision can be taken as to whether the resource should be extracted or produced. The EA was issued for seismic survey only and does not result in any stranded assets, but aims to provide information on potential resources. Assessment and analysis of the data acquired by this survey will help inform the Government's decisions on the viability and impact of producing any located assets compared to importing equivalent energy resources.	

[25] Climate Change 2021: The Physical Science Basis, available online at: https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/

[26] Para A.1

[27] Para A.2

[28] Para A.3

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the 21st century unless deep reductions in CO_2 and other GHG emissions occur in the coming decades;[29] 27.5. Many changes in the climate system become larger in direct relation to increasing global warming. They include increases in the frequency and intensity of hot extremes, marine heatwaves, heavy precipitation, and, in some regions, agricultural and ecological droughts; an increase in the proportion of intense tropical cyclones; and reductions in Arctic sea ice, snow cover and permafrost;[30] 27.6. Continued global warming is projected to further intensify the global water cycle, including its variability, global monsoon precipitation and the severity of wet and dry events;[31] 27.7. Many changes due to past and future GHG emissions are irreversible for centuries to millennia, especially changes in the ocean, ice sheets and global sea level;[32] 27.8. From a physical science perspective, limiting human-induced global warming to a specific level requires limiting cumulative CO_2 emissions, reaching at least net zero CO_2 emissions, along with strong reductions in other GHG emissions. Strong, rapid and sustained reductions in CH_4 emissions would also limit the warming effect resulting from declining aerosol pollution and would improve air quality.[33] 28. On 9 August 2021, the IPCC issued a press release relating to its AR6 report. It states that the report provides new estimates of the		

[29] Para B.1
[30] Para B.2
[31] Para B.3
[32] Para B.5
[33] Para D.1

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chances of crossing the global warming level of 1.5°C in the next decades, and finds that unless there are immediate, rapid and large-scale reductions in GHG emissions, limiting warming to close to 1.5°C or even 2°C will be beyond reach.[34] 29. Also on 9 August 2021, UN Secretary-General António Guterres described the AR6 report as nothing less than "*a code red for humanity. The alarm bells are deafening, and the evidence is irrefutable*". (emphasis added) 30. Guterres is reported as noting that the internationally agreed threshold of 1.5 degrees above pre-industrial levels of global heating was perilously close, and that we are at imminent risk of hitting this threshold in the near term. Guterres is indicated as advising that the only way to prevent exceeding this threshold, is by urgently stepping up our efforts, and pursuing the most ambitious path. Guterres is reported as stating that solutions are clear: "*Inclusive and green economies, prosperity, cleaner air and better health are possible for all, if we respond to this crisis with solidarity and courage*". Ahead of the COP26 climate conference in Glasgow in November 2021, Guterres stated that all nations needed to join the net zero emissions coalition, and reinforce their promises on slowing down and reversing global heating "*with credible, concrete, and enhanced Nationally Determined Contributions (NDCs)*" that lay out detailed steps. 31. In April 2022, Guterres tweeted that '*[c]limate activists are sometimes depicted as dangerous radicals. But the truly dangerous radicals are the countries that are increasing the production of fossil fuels. Investing in new fossil fuels infrastructure is moral and economic madness*'.[35] Addressing graduate students in May 2022, Guterres expressed the view that investing in fossil fuels is now "a		

[34] https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/

[35] https://twitter.com/antonioguterres/status/1511294073474367488?lang=en

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dead end - economically and environmentally. No amount of greenwashing or spin can change that. So, we must put them on notice: Accountability is coming for those who liquidate our future."[36] 32. The 26th Conference of the Parties of the UNFCCC (COP26) was held in Glasgow in the last quarter of 2021. Recognition of the climate 'crisis', as well as the urgent need to increase effort and to accelerate action to address climate change (including by developing nations), are reflected in the outcome of COP26 and recorded in the Glasgow Climate Pact. The Glasgow Climate Pact (among other things): 32.1. Expresses alarm and utmost concern that human activities have caused around 1.1°C of global warming to date and that impacts are already being felt in every region; 32.2. Reaffirms the long-term global goal to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; 32.3. Recognizes that the impacts of climate change will be much lower at the temperature increase of 1.5°C compared with 2°C and resolves to pursue efforts to limit the temperature increase to 1.5°C, 32.4. Recognizes that limiting global warming to 1.5°C requires rapid, deep and sustained reductions in global GHG emissions, including reducing global carbon dioxide emissions by 45 per cent by 2030 relative to the 2010 level and to net zero around mid-century as well as deep reductions in other GHGs;		

[36] https://news.un.org/en/story/2022/05/1118932

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32.5. Also recognizes that this requires accelerated action in this critical decade, on the basis of the best available scientific knowledge and equity, reflecting common but differentiated responsibilities and respective capabilities and in the context of sustainable development and efforts to eradicate poverty; 32.6. Invites Parties to consider further actions to reduce by 2030 non-carbon dioxide GHG emissions, including methane which has been identified as a driver of climate change and the main polluting emission from natural gas; 32.7. Calls upon Parties to accelerate the development, deployment and dissemination of technologies, and the adoption of policies, to transition towards low-emission energy systems, including by rapidly scaling up the deployment of clean power generation and energy efficiency measures, including accelerating efforts towards the phasedown of unabated coal power and phase-out of inefficient fossil fuel subsidies, while providing targeted support to the poorest and most vulnerable in line with national circumstances and recognizing the need for support towards a just transition; 32.8. Emphasizes the importance of protecting, conserving and restoring nature and ecosystems, including forests and other terrestrial and marine ecosystems, to achieve the long-term global goal of the Convention by acting as sinks and reservoirs of GHGs and protecting biodiversity, while ensuring social and environmental safeguards. 33. The climate 'crisis' is also recognised by the International Energy Agency (IEA), of which South Africa is an IEA associated country. During or about July 2021, the IEA published its *Net Zero by 2050 – A Roadmap for the Global Energy Sector* report. In the foreword to this report, the Executive Director of the IEA states (among other things) as follows:		

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We are approaching a decisive moment for international efforts to tackle the climate crisis – a great challenge of our times. The number of countries that have pledged to reach net-zero emissions by mid-century or soon after continues to grow, but so do global greenhouse gas emissions. This gap between rhetoric and action needs to close if we are to have a fighting chance of reaching net zero by 2050 and limiting the rise in global temperatures to 1.5 °C. Doing so requires nothing short of a total transformation of the energy systems that underpin our economies... Despite the current gap between rhetoric and reality on emissions, our Roadmap shows that there are still pathways to reach net zero by 2050. The one on which we focus is – in our analysis – the most technically feasible, cost-effective and socially acceptable. Even so, that pathway remains narrow and extremely challenging, requiring all stakeholders – governments, businesses, investors and citizens – to take action this year and every year after so that the goal does not slip out of reach. This report sets out clear milestones – more than 400 in total, spanning all sectors and technologies – for what needs to happen, and when, to transform the global economy from one dominated by fossil fuels into one powered predominantly by renewable energy like solar and wind. Our pathway requires vast amounts of investment, innovation, skilful policy design and implementation, technology deployment, infrastructure building, international co-operation and efforts across many other areas. Since the IEA's founding in 1974, one of its core missions has been to promote secure and affordable energy supplies to foster economic growth. This has remained a key concern of our Roadmap, drawing on special analysis carried out with the International Monetary Fund and the International Institute for Applied Systems Analysis. It shows that the enormous challenge of transforming our energy systems is also a huge opportunity for our economies, with the potential to create millions of new jobs and boost economic growth.		

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Another guiding principle of the Roadmap is that clean energy transitions must be fair and inclusive, leaving nobody behind. We have to ensure that developing economies receive the financing and technological know-how they need to continue building their energy systems to meet the needs of their expanding populations and economies in a sustainable way. It is a moral imperative to bring electricity to the hundreds of millions of people who currently re deprived of access to it, the majority in of them in Africa... 34. On fossil fuels used in energy production, the report states that: ***There is no need for investment in new fossil fuel supply in our net zero pathway.*** Beyond projects already committed as of 2021, there are no new oil and gas fields approved for development in our pathway, and no new coal mines or mine extensions are required. 35. When natural gas is burned for energy, it releases carbon dioxide into the atmosphere. More importantly, the extraction, processing, transport and use of natural gas cause significant amounts of methane to be released into the atmosphere too. *According to the United Nations, **methane is a 84-86 times more potent greenhouse gas than carbon dioxide over a 20-year period, and 28-34 times more potent over 100-year period.***[37] More research is also showing that methane often leaks during the production, transport and use of natural gas. Therefore, its contribution to climate change is significantly unaccounted for.[38] Drones, laser absorption spectroscopy, and satellites, among other new methane monitoring technologies, have improved the identification and quantification of emissions across the gas lifecycle, leading researchers to conclude		

[37] International Energy Agency, Global Methane Tracker 2022- Overview, https://www.iea.org/reports/global-methane-tracker-2022/overview. See also International Energy Agency, Global Energy Review: CO2 Emissions in 2021 (2022). https://iea.blob.core.windows.net/assets/c3086240-732b-4f6a-89d7db01be018f5e/GlobalEnergyReviewCO2EmissionsIn2021.pdf.

[38] South Africa is likely among those that are underreporting because the Technical Guidelines for GHG reporting uses outdated emission factors from the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines

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that national governments have almost universally underestimated these emissions.[39] 36. If 3,000 megawatts of new gas-to-power plants were built to meet South Africa's 2019 Integrated Resource Plan for Electricity, and the plants were fuelled by imported LNG, the annual emissions from this fuel use would be more than 2.5 million tonnes of CO_2e (carbon dioxide equivalent) if the plants ran at 75% capacity. This is the equivalent of driving over half a million gasoline-powered vehicles for a year.[40] For gas or any other fossil fuel, a life-cycle analysis is therefore necessary to quantify the total amounts of GHG emissions (predominantly carbon dioxide and methane) that result from every step in the energy production process: from extracting the fossil fuel at the well or mine to burning it at a power plant or other facility. This is therefore important because all these processes are linked and should not be viewed in isolation. ***South Africa's international climate change commitments*** 37. South Africa is a Party to the United Nations Framework Convention on Climate Change (UNFCCC), which enjoins State Parties to take precautionary measures to anticipate, prevent or minimize the causes of climate change (Article 3.3). 38 South Africa, as a Party to the UNFCCC that ratified the Kyoto Protocol and adopted the Paris Agreement, has committed to *'working with others to ensure temperature increases are kept well below 2°C above pre-industrial levels, which could include a further revision of the temperature goal to below 1.5°C in light of emerging*		

[39] Jonathan Mingle, Methane Detectives: Can a Wave of New Technology Slash Natural Gas Leaks?, YALE E360, (2019), https://e360.yale.edu/features/methanedetectives-can-a-wave-of-new-technology-slash-natural-gas-leaks

[40] EPA, EPA equivalency calculator, https://www.epa.gov/energy/greenhouse-gasequivalencies-calculator#results

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science' by reducing GHG emissions. South Africa has also committed (among other things) to:

38.1. Preparing, communicating and maintaining Nationally Determined Contributions (NDCs) that it intends to achieve reach global peaking of GHG emissions as soon as possible, and to undertake rapid reductions thereafter;[41] and

38.2. Striving to formulate and communicate long-term GHG emission development strategies.[42]

39. There have been various Conferences of the Parties and meetings since, with decisions related to Nationally Determined Contributions (NDCs) contained in decisions 4/CMA.1 and 18/CMA.1 and their annexes.

40. South Africa submitted its first intended Nationally Determined Contribution under the Paris Agreement on 25 September 2015, which became the country's first NDC on 1 November 2016. Subsequently, South Africa revised its first NDC in 2021:[43]

[illegible]

Year	Target	Corresponding period of implementation
2025	[illegible]	2021-2025
2030	[illegible]	2026-2030

[41] Paris Agreement, Article 4.1 – 4.3.

[42] Paris Agreement, Article 4.19

[43] Available online at https://www.dffe.gov.za/sites/default/files/reports/draftnationallydeterminedcontributions_2021updated.pdf#:~:text=South%20Africa%E2%80%99s%20intended%20nationally%20determined%20contribution%20%28INDC%29%28RSA%2C%20n.d.%29,Agreement.%20The%20INDC%20and%20first%20NDC%20are%20identical. This revised NDC is indicated as an enhancement and update of South Africa's NDC under the Paris Agreement, 'meeting its obligation under Article 4.9 to communicate NDC's every 5 years, and responding to requests in paragraphs 23 to 25 of decision 1/CP.21'. South Africa's second (next) NDC is intended to be communicated in 2025.

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41. South Africa's energy sector is estimated at contributing about 84% percent to the country's overall GHG emissions (including Carbon Dioxide and Methane).[44] 42. In February 2020, South Africa submitted to the UNFCCC its first long-term low GHG emission development strategy titled *South Africa's Low Emission Development Strategy 2050*. It is indicated in the executive summary of this strategy that South Africa, as one of the top 20 global GHG emitters and with a high dependency on fossil fuels, will need to make substantial emission cuts to contribute its fair share to global GHG emission reductions.[45] 43. The FBAR does not provide any indication (or estimation) of how future GHG emissions (resulting from future exploitation of oil and gas that may be discovered through the exploration drilling project) would impact on South Africa's ability to achieve its GHG emissions targets (as set out in South Africa's NDC) or its updated GHG emissions targets (as set out in South Africa's revised NDC). This is particularly relevant given that the emissions targets for the 2026-2030 period are lower than the targets for the 2021-2025 period, while offshore oil and gas developments could take at least a decade to reach the production stage. This could result in offshore oil and gas investments (as well as associated gas infrastructure developments) in the future becoming unneeded 'stranded assets' and a burden on future generations. There is also a risk that in the future tariffs will be levied on various goods exported by fossil-fuel dependent countries – the European Union is reported to be		

[44] https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-south-africa

[45] South Africa's Low Emission Development Strategy 2050, pviii.

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gradually phasing in its Border Adjustment Mechanism as part of the EU's Green Deal.[46] ***Need for seismic data*** 44 Under the sub-heading 'Need for seismic data', the FBAR states that a discussion of the needs and desirability of the project '*would not be complete without understanding the need for acquisition of the seismic data and possible oil and gas exploration and production that could potentially take place in the future as a result of the survey*'.[47] 45. Ironically, the FBAR then quickly goes on to state that *'It cannot be said with absolute certainty that exploration drilling, let alone production activities, will be undertaken in the future. As such, it is not currently possible to accurately assess the risks associated with these activities, given that the specific details of these potential future activities are not known. While it is acknowledged that the risks mentioned would need assessment, such assessment falls outside of the scope of the current application and would need to be assessed in detail during subsequent Scoping and EIA processes, should exploration drilling or production be proposed. The environmental consequences applicable to the planned survey activities have been identified and assessed in this BA Report'*.[48] The views of the Makhanda High Court in this regard (in the context of future production, climate change and the right to food) have been traversed earlier in the Green Connection and Natural Justice's comments (see paragraphs 27 to 30 above) and are not repeated here. The Green Connection and Natural Justice stands by their view that at the very least a broad assessment of the impacts and risks		

[45] See for example *Just Energy Transitions and Natural Gas in Africa: Balancing Climate Action and Structural Transformation*, The African Climate Foundation, August 2022, at p14. Available online at: https://africanclimatefoundation.org/wp-content/uploads/2022/10/ACF-GAS-REPORT-V7.indd-final-1.pdf

[47] FBAR, p33-34.

[48] Ibid.

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associated with future invasive exploration activities, production activities and use of any discovered oil reserves should be included in the BAR. 46. The FBAR report then proceeds with a glowing (and one-sided) endorsement of the use of natural gas: The fastest growing sector for the use of natural gas is for the generation of electric power. Natural gas power plants usually generate electricity in gas turbines, directly using the hot exhaust gases from the combustion of the gas... Of the three fossil fuels used for electric power generation (coal, oil and natural gas), natural gas emits the least carbon dioxide per unit of energy produced. Natural gas emits 30% and 45% less carbon dioxide than burning oil and coal, respectively. Burning natural gas also releases lower amounts of nitrogen oxides, sulphur dioxide, particulates and mercury when compared to coal and oil. The increased use of natural gas can, in the short term, serve as a transition fuel on the path to the carbon-neutral goal of the Paris Agreement. In addition to gas as a key transitional fuel reducing reliance on coal, the benefits of oil and gas could include significant amount of job creation, especially if local beneficiation takes place. An increase in domestic natural gas reserves would enable South Africa to take steps to secure the countries' energy supply (through diversification), assist in reducing the emissions of greenhouse gases (by reducing the country's reliance on coal for electricity generation) and reduce the need for the importation of gas. As such, exploration for additional domestic hydrocarbon reserves is considered important and supported by national policy, and any discoveries would be well received by the local market and are consistent with the objectives stated in the 2019 IRP. Natural gas emits 30% and 45% less carbon dioxide than burning oil and coal, respectively, and 65% less carbon dioxide than coal when the increased efficiency of Combined Cycle Gas Turbines versus coal fired power stations is considered. Eskom produces over 200MtCO2/yr, over 40% of South Africa's total. South Africa also has SASOL's Secunda coal to liquids		

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plant, the biggest single source of CO2 in the world at 57MtCO2/yr (~12.5% of South Africa's total) to produce 160k barrels of products per day. Supplying these products from conventional oil production and refining would generate approximately 10% of those emissions, 5 to 6MtCO2/yr. According to the 2019 IRP the availability of gas in the short to medium term is a risk as South Africa does not currently have gas resources. There is also a supply and foreign exchange risk associated with likely increase in gas volumes depending on the energy mix adopted post 2030 when a large number of coal fired power stations are decommissioned. South Africa's economic growth is dependent on the availability of energy, ensuring a sustainable and reliable supply of electricity with sufficient capacity is a key aspect to growing the economy of South Africa in the future. The electricity shortages experienced in South Africa over the past decade are a contributing factor to the significant slowdown in economic growth rate. To enable economic growth within the target rate of between 6% and 8% to be achieved, it will be necessary for Government to continue increasing electricity generating capacity in the country. The use of natural gas for electricity generation is identified in national policy, together with renewable energy technologies, as an alternative in diversifying the domestic energy supply away from its current reliance on coal. Gas is identified in the draft Integrated Resources Plan as significant contributor to South Africa's energy mix in the period up to 2030. Availability of gas also provides an opportunity to convert to Combined Cycle Gas Turbine and run open-cycle gas turbine plants at Ankerlig (Saldanha Bay), Gourikwa (Mossel Bay), Avon (Outside Durban) and Dedisa (Coega IDZ) on gas (IRP 2019).[49] 47. Perhaps concerned that it is making the case that seismic surveys are indeed the 'thin edge of the wedge' that will lead to increased fossil fuel extraction, production and use (with associated climate change		

[49] Ibid

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impacts), the BAR steps back from its natural gas endorsement to repeat the point that *'[f]rom a climate change perspective, it is not currently possible to accurately assess the risks associated with oil and gas activities, given that the specific details of these potential future activities are not known and therefore climate change impacts would need to be assessed in detail during any subsequent Scoping and EIA processes for any potential subsequent oil and gas production projects'.*[50] 48. The FBAR then proceeds to argue that: The feasibility of using natural gas for domestic power generation is considered to be dependent on the extent of available domestic reserves of natural gas, as well as the financial cost of importing natural gas should those reserves be insufficient. The acquisition of seismic survey data is therefore considered important with respect to understanding the potential for future oil and gas production as part of the energy mix of the country going forward and the need and desirability of the project is therefore supported from an energy security perspective.[51] 49. We note here that despite reliance on the IRP to motivate for the project, the FBAR fails to assess whether the amount of gas called for in the IRP would in any event require the exploitation of the resources sought by TGS. 50. Two recent independent studies (among others) challenge the view that fossil gas is necessary for electricity generation and as a transition fuel. 51. The International Institute for Sustainable Development's (IISD) *Gas Pressure: Exploring the case for gas-fired power in South Africa* (March 2022) report points out that while there used to be a rational view that fossil gas would be necessary either during a transition to		

[50] Ibid.
[51] Ibid.

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low-carbon energy or as part of the long-term energy mix for electricity production: ....revolutions first in renewable energy costs and then in battery storage costs have upended this view. Analysis of the South African electricity system shows that gas supply is not technically necessary until at least 2035, if ever. In the last few years, either the risks associated with gas have increased, or the understanding of existing risks has increased. Consequently, South Africa may see significant negative outcomes from developing a large gas-to-power system now... the trend toward decarbonization, coupled with cost reductions for renewable energy and storage, creates risks for gas investment. Investment in gas can reasonably be expected to lead to higher costs for consumers, just transition challenges for workers, and losses for investors.[52] 52. The ISSD report highlights some of the risks associated with gas-to-power investment in South Africa. These risks include significant contributions to climate change (as a consequence of CO_2 and methane emissions when gas is burned), increasing international pressure to move away from gas due to climate impacts, financial risks linked with gas-to-power, the risk of reduced security of affordable gas supply, the risk of stranded assets, and the risk of creating an additional just transition burden (future gas workers and communities face a repeat of the transition hardships currently faced by the coal sector).[53] 53. Meridian Economics' *'Hot Air about Gas – An Economic Analysis of the Scope and Role for Gas-Fired Power Generation in South Africa'* (June 2022) report points out that while South Africa's large-scale use of gas appears to be central to current energy policy direction in South Africa, *'this rests on a 2012 vision which pre-dates dramatic*		

[52] ISD report, p iv. Available online at: https://www.iisd.org/publications/report/south-africa-no-need-for-gas
[53] ISD report, pages 8 – 12.

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reductions in renewable energy costs and carbon emissions space'.[54] The report goes on to state that independent analysis of the power sector across multiple recent studies shows that South Africa's power needs can be met both now and in the future with very little use of gas, and that there is *'no evidence to support the large-scale gas envisaged in the GMP; this is uneconomical even before carbon emissions are considered'.*[55] Meridian point out that *'the assumption that gas-fired power generation would replace coal ignores the fact that other technology combinations are now better at replacing coal-fired power than gas, and it is against these technologies that gas-fired generation should actually be compared'.*[56] Meridian demonstrate that existing modelling provides no economic rationale for "big gas" in the power sector, and that *'the impact of using large volumes of gas to generate power will be borne by electricity consumers and will essentially be a subsidy provided by power consumers to otherwise unviable gas use in other sectors'.*[57] 54. The Vital Ambition Report[58] by Meridian Economics in collaboration with the Council for Scientific and Industrial Research ("CSIR") Energy Centre ("Vital Ambition Report") states that gas to power is only justified in the South African energy mix in so far as it is required for low-utilisation flexible capacity (peaker plants) for balancing the system during peak power demand. The report confirms that no investments in gas infrastructure for energy production and generation is needed now or in the near future.[59] Furthermore the		

[54] Meridian report, page ii. Available online at: https://meridianeconomics.co.za/wp-content/uploads/2022/06/Hot-Air-About-Gas.pdf
[55] Ibid.
[56] Ibid, p1.
[57] Ibid, p37.
[58] Meridian Economics, 2020. A Vital Ambition: Determining the Cost of Additional CO2 Emission Mitigation in the South African Electricity System. See at https://meridianeconomics.co.za/wp-content/uploads/2020/07/Ambition.pdf
[59] Gas and peaking resources contribute just 1.1% of total electricity generation in 2025, and 2.4% by 2035 according to the same Meridian report.

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2019 IRP will likely need to be updated in the foreseeable future to align with South Africa's 2021 Nationally Determined Contribution under the Paris Agreement and to keep pace with quickly evolving science and significant reductions in price for solar and wind energy. However, even the 2019 IRP, which is rooted in an outdated and scientifically and economically unsound understanding of the necessity for any gas in the energy mix[60], only projects the collective contribution of gas and diesel to the 2030 energy mix to be 1.3% combined.[61]		
55. According to a recent report prepared by Robert W. Howarth titled "Methane emissions and climate warming risk from hydraulic fracturing and shale gas development: implications for policy"[62] the climate impacts of gas are greater than those of coal per unit of energy produced when evaluated over a 20-year timeframe, the period most relevant for climate change if humans are to avoid catastrophic run-away warming. Though gas emits less carbon dioxide per unit energy than coal, its upstream GHG emissions are more problematic for the climate, as it leaks and vents potent methane throughout its lifecycle; researchers have been able to better detect emissions across the lifecycle of gas ever more accurately thanks to new methodologies and technologies (particularly "top-down" measurements using satellite and aerial assessments).		
56. The use of fossil fuels must be phased out quickly due to the urgent need to address global warming. A recent study published in *Nature*,		

[60] Meridian Economics, Hot Air About Gas: An Economic Analysis of the Scope and Role for Gas-Fired Power Generation in South Africa (2022), pages 2-3, https://meridianeconomics.co.za/wp-content/uploads/2022/06/Hot-Air-About-Gas.pdf

[61] 2019 Integrated Resource Plan, page 42.

[62] Robert W Howarth. 2015. Methane emissions and climate warming risk from hydraulic fracturing and shale gas development: implications for policy" Energy and Emissions Control Technologies at pages 47-50. See https://www.research.howarthlab.org/publications/f_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100815_27470.pdf

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the world's leading multidisciplinary science journal, discovered that "by 2050, we find that nearly 60% of oil and fossil methane gas, and 90% of coal, must remain unextracted to stay within a 1.5 °C carbon budget." According to the study, "most regions must reach peak production now or within the next decade, making many operational and planned fossil fuel projects unviable."[63] It is common practice that proposed exploration activities such as reconnaissance, only commence months and sometimes years after the need and desirability assessment is undertaken, with extraction and production only commencing years later.[64] According to one study, the world's largest oil and gas fields took an average of 5.5 years from discovery to first production and 17 years to reach peak output.[65] Chevron Corporation's (CVX) Gorgon natural gas development project off the coast of Australia took 30 years to complete, and another six years to begin producing liquefied natural gas.[66] Therefore exploration projects whose objectives are to locate gas deposits for energy companies to exploit through the construction and production of fossil fuels, run the risk of creating risks for such infrastructure to become stranded assets which invariably impacts on the development potential of South Africa in achieving its climate goals. With no economic justification for large-scale gas use in power, such a strategy would result in assets that are stranded before their first kWh of power is generated. Given this, the proposed reconnaissance		

[63] Welsby, D., Price, J., Pye, S. et al. Unextractable fossil fuels in a 1.5 °C world. Nature 597, 230–234 (2021). https://doi.org/10.1038/s41586-021-03821-8.

[64] While new wells in developed reservoirs can be drilled and brought online in a matter of months, production from new fields can take years due to complex permitting requirements and the construction of infrastructure such as pipelines and storage facilities

[65] Henrik Wachtmeister, Mikael Höök, "Investment and production dynamics of conventional oil and unconventional tight oil: Implications for oil markets and climate strategies" Energy and Climate Change,
Volume 1, 2020, 100010, ISSN 2666-2787, https://doi.org/10.1016/j.egycc.2020.100010.
(https://www.sciencedirect.com/science/article/pii/S2666278720300106

[66] https://australia.chevron.com/-/media/australia/our-businesses/documents/Gorgon-Project-Milestones-Fact-Sheet.pdf

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project in no way provides a remedy nor will address in the immediate future South Africa's current energy insecurity issues. 57. Importantly, seismic surveys to explore for oil and gas will not have any immediate impact on South Africa's energy security, as any oil and gas extracted would not belong to South Africa, but would invariably belong to the companies that extract for profit.[47] Energy companies compete for access to mineral rights granted by governments by either entering a concession agreement, meaning any discovered oil and gas are the property of the producers, or form part of a production-sharing agreement which favours the interest of the producers and ultimately diminishing the general interests of the broader South African Republic. 58. The oil and gas that will be eventually extracted by oil and gas companies is ultimately exploited for profit. It is not used to generate a benefit that results in broad based security for energy production nor does it lead to the production of energy for South Africa and its citizens. If oil and gas found following a successful reconnaissance, and that are ultimately exploited, are not used to produce energy for South Africa, this invariably undermines the sole stated goal underpinning the need and desirability of this proposed reconnaissance project—its supposed contribution to energy security for South Africa—and provides no tangible benefit for South Africans. 59. While the increased use of gas as a 'transitional fuel' is promoted by government and vested interest groups, the Green Connection and Natural Justice submit that the increased use of fossil gas (especially in electricity generation) will lead to increased emissions of climate warming GHGs, and methane (CH_4) in particular. While natural gas combustion is less carbon-intensive than that of coal, fugitive emissions arising from the production, transport, storage and use of natural gas have a much greater climate impact than CO_2. In		

[47] Stewart Glickman and Shang Yang Chuah, Oil, Gas & Consumable Fuels Industry Surveys (New York: CFRA, 2019)

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particular, over a 20-year period (which is particularly relevant since the next 20 years are a critical window for addressing the climate crisis) methane emissions, which make up approximately 70-90% of natural gas emissions, are projected to be 82.5 times as impactful as those of CO_2.[69] The desirability of using gas as a 'transitional' fuel is also questionable having regard to volatile international gas prices, as well as the potential risk of Carbon Border Taxes being introduced in the future.[70] This risk will impose restrictions on the export of products with a high carbon footprint, putting South Africa's economy at greater risk of developing gas to power rather than clean renewable alternatives. This invariably diminishes the need and desirability for promoting new gas development projects, as the negative climate impacts and financial risks undermine the potential for gas to represent a viable solution for South Africa's ambitions to address development whilst respecting universal and regional climate change obligations.		
60. The fundamental outcome of the need and desirability assessment should not be centred on the determination of whether gas technology will ensure security of supply for electricity. Instead, due to the climate crisis, this assessment should be centred on whether South Africa needs, or should rely on, gas to provide security of supply of electricity and whether alternative technologies could meet the same supply objectives with less harm and risk. Renewable energy and/or storage can replace gas to provide reliable and cost-effective generating capacity while greatly reducing the environmental and health risks associated with gas.[72]		

[69] See the IPCC's 6th Assessment Report (AR6), Working Group 1, Chapter 6 *The Earth's Energy Budget, Climate Feedbacks and Climate Sensitivity*, Table 7.15 at p1017. Available online at: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter07.pdf

[70] https://cer.org.za/wp-content/uploads/2022/10/Natural-Gas-factsheet.pdf

[72] See, e.g., Union of Concerned Scientists, Turning Down the Gas in California (13 July 2018), https://www.ucsusa.org/resources/turning-down-gas-california?_ga=2.79265367.2135392956.1587590973-34786515.1587590973#ucs-report-downloads

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61. The call for gas as part of the energy mix set forth in the 2019 IRP does not excuse the decision-maker from taking climate change impacts into account, including as part of the need and desirability assessment. The case for need and desirability must address climate impacts and cannot simply rest on the 2019 IRP as evidence of need or desirability as relied upon by the EAP in the BAR. In the judgment of the High Court in *Earthlife Africa*[71], the court expressed that with respect to a decision maker's reliance on the IRP when rendering a decision on an application for environmental authorisation, the following is important to acknowledge: (a) "Policy instruments developed by the Department of Energy cannot alter the requirements of environmental legislation for relevant climate change factors to be considered".[72] (b) Establishing the need and desirability of a proposed project, is a key objective of each stage of scoping and impact assessment and must account for South Africa's 2021 NDC under the Paris Agreement. The EAP must therefore provide a broad and robust analysis of multiple alternative literature on renewable energy resources and make a justifiable and reasonable case for a project's need and desirability having considered the available literature, without relying solely on the 2019 IRP and other policy documents. This invariably assists the decision maker to prioritise the granting of the best decision which will prioritize the integrity of the environment, and the social welfare, health and safety aspects of the socio-economic environment for present and future generations.		
Ground 2: Failure to adequately consider marine impacts. *Underwater sound from seismic surveys*	The importance of sound is clearly acknowledged in the BAR and consequently a dedicated acoustic modelling assessment was prepared as part of the BAR. EIMS appointed experienced and qualified scientists	

[71] Earthlife Johannesburg and Another v. Minister of Energy and Others 2017 2 All SA 519 (GP)

[72] See above at para 97.

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62. The ocean is an acoustic world. This is because water is a dense medium, and sound travels faster and farther underwater. Marine species, from larvae to whales, utilise this efficiency and have evolved to depend on sound for essential biological functions, including feeding, breeding, communicating, navigating, and socializing.[73] 63. Sound is also a fundamental component of marine habitats. Different ocean environments have distinct acoustic signatures that comprise their acoustic habitat. These acoustic habitats are created from a combination of biological sounds (e.g., fish choruses, snapping shrimp, urchin movement, whale calls) and environmental sounds (e.g. waves crashing, rain, earthquakes). The addition of anthropogenic noise to these soundscapes disrupts the abilities of marine species to use naturally occurring acoustic cues and has detrimental effects on individual organisms, populations, and communities.[74] 64. Seismic airgun blast are the loudest human-created noises introduced into the ocean environment and they travel long distances through seawater. Studies have shown that seismic blasts are at least detectable at distances greater than 500-700 km, even up	to assess the likely impacts from seismic noise. The associated noise impacts were a key focus of the BAR and this clearly indicated in Section 9 of the BAR. It should be noted that a qualified and experienced marine ecology specialist was appointed to conduct an assessment of the likely impacts as identified and described in Section 9.3.1of the BAR. The significance rating for each impact is determined through consideration of the nature, extent, duration, magnitude and probability of each impact. Please refer to section 9.1 of the BAR for an explanation of the assessment methodology utilised. The significance of all identified impacts in the marine ecology report, which included the impacts associated with the underwater sound from the proposed seismic survey, were considered to be of low significance once mitigation has been applied. The significance of environmental impacts varies depending amongst others on the specific location, prevailing sensitivities, receptors, timing, and extent of the proposed activities. The EAP and the specialists identified and assessed potential environmental impacts (supported by inputs from the public consultation process) and has	

[73] Supporting Affidavit of Dr. Aaron N. Rice at paras. 8, *Sustaining the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021, attached marked Annex B1; Supporting Affidavit of Dr. Douglas P. Nowacek at paras. 9 & 13, *Sustaining the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021, attached marked Annex B2.

This appeal incorporates the expert opinions of Dr. Rice and Dr Nowacek who submitted affidavits in the matter of *Sustaining the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021. Both of the affidavits provide expert insight on underwater acoustics, how marine species utilize acoustic cues for biological processes, and how seismic surveys may impact different taxa. The declarations will be used to assist the court to understand general principles and processes and will not be used to support specific impacts that were associated with that case on the east coast of South Africa.

[74] Rice Supporting Affidavit at para. 12.

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to 4,000 km.[75] Other studies have detected seismic surveys at levels sufficient to mask, or obscure, baleen whale calls at distances of thousands of kilometres away from the source.[76] Airgun noise influences and degrades the acoustic habitat of marine species over a far greater area than the metres and kilometres that the EBAR considers and in fact, according to the science, can easily reach coastal areas 120 – 230 km from the survey area. 65. In addition, the noise produced by airgun arrays becomes virtually continuous at greater distances from the source creating chronic noise impacts. This is because the sounds emanating from a seismic airgun array do not behave as individual and finite sound source *in situ* but reflect off the ocean surface and seafloor as they travel, leading to a continuous increase in the sound level through reverberation. The effect has repeatedly been documented.[77] Studies have found seismic surveys causing elevated ambient noise levels by more than 25 dB (approximately a 4-fold increase in noise levels) across distances of 40 km and these sound levels remain elevated during the periods between airgun blasts.[78] Open ocean condition observations have found that the noise produced and were sustained for months at a time.[79] 66. Because of several flaws in its approach, the EAR does not fully identify and assess the risk posed to marine species and ecosystems and does not effectively mitigate the risks from the proposed the proposed surveying.	proposed management and mitigation measures. The impacts are, by virtue of the fact that the impact assessment is a predictive assessment, regarded as 'potential'. All impacts identified in the process can be reduced to a low or medium significance with the implementation of the management and mitigation measures. All impacts associated with a proposed project are considered potential impacts until the impact actually occurs. The studies undertaken internationally over the past ~70 years on the impacts of noise on marine fauna (of which some 400 peer-reviewed publications have been summarised and cited in the marine faunal specialist study) have concluded that the effects of underwater sounds vary substantially and depend on a wide variety of physical and biological factors. When writing articles on the effects of seismic acquisition on marine fauna it is therefore not difficult to bias the literature cited to either demonstrate detrimental and irreversible impacts or only very limited impacts, depending on the personal view of the author(s) and/or the targeted readership. The marine faunal assessment has made efforts to present published results objectively, and nowhere claims that acoustic surveys do not result in impacts. Injury is likely at very short range, with behavioural disturbance occurring over greater distances. The final significance ratings are determined using information from the peer-reviewed literature together with the noise modelling results (which put the threshold distances from the source array to mortality and	

[75] Rice Supporting Affidavit at para. 18; Nowacek Supporting Affidavit at paras. 9-10.
[76] Rice Supporting Affidavit at para. 18; Nowacek Supporting Affidavit at paras. 13.
[77] Rice Supporting Affidavit at para. 19-20; Nowacek Supporting Affidavit at para. 10.
[78] Rice Supporting Affidavit at para. 19-20; Nowacek Supporting Affidavit at para. 10.
[79] Rice Supporting Affidavit at para. 19-20; Nowacek Supporting Affidavit at para. 10.

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Harms to marine life 67. It is well established that marine seismic surveys cause serious and irreparable harms to marine life. The Biodiversity and Ecosystem Services Assessment Report[40] ("Pisces Report") prepared for the Project acknowledges the a wide range of impacts on numerous species: • Physiological injury and/or mortality; • Behavioural avoidance; • Reduced reproductive success/spawning; • Masking of environmental sounds and communication; • Collision of turtles/marine mammals with the survey and support vessels or entanglement in towed acoustic apparatus; and • Indirect impacts on piscivorous predators due to seismic effects on prey species. 68. According to the Pisces Report, the following species are present in the Project area and face the highest risk of harm from the proposed survey: • humpback whales, which migrate through the area between June and November (inclusive); • sperm whales, beaked whales and other odontocetes that frequent offshore waters; • large migratory pelagic fish and shark species that show seasonal association with Child's Bank and Tripp Seamount;	potential mortal injury into perspective), adopting the precautionary principle as is required when undertaking such impact assessments, and taking into account the sensitivity of receptors present in southern African waters. Given all of the evidence, the conclusion reached for the various assessments is that impacts are either of low or very low significance. The Noise impact on plankton is assessed in Section 9.3.1.1.7 of the BA report. The reconnaissance permit area is located far offshore (120 km at its closest point) and therefore beyond the influence of coastal upwelling, which will influence both plankton abundance and the abundance of fish species that depend on plankton as a food source. From Figures 17, 18 and 19 in the marine ecology specialist assessment it is evident that the project area lies well beyond major fish spawning and recruitment area (and therefore zooplankton and ichthyoplankton abundance). An EIA is a risk-assessment based study and is a process of evaluating the likely environmental impacts of a proposed project or development. It is not possible to provide conclusive evidence of the fact that impacts will be negligible. However, it can be stated with regards to the uncertainties and gaps in knowledge that these have specifically been taken into consideration during the assessment of the particular impacts. The confidence level of the rating has been stated and the level and type of mitigation proposed has followed the clear mitigation hierarchy presented in the Specialist reports and also the EIA Report. Accordingly, the mitigation measures proposed are deemed to be sufficient to account for the eventuality that unforeseen events or organism responses are encountered during the actual survey operations, and will ensure that there is independent oversight and feedback to ensure compliance with the EMPr.	

[40] PISCES Environmental Svcs (Pty) Ltd (for TGS Geophysical Company), *Biodiversity and Ecosystem Services Assessment Report* ("Pisces Report") (Sept. 2022).

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• leatherback turtles which frequent offshore waters in low numbers and aggregate around seamounts to feed on jellyfish; and • various pelagic Albatross, Petrel, Storm Petrel and Shearwater species (the Pisces report indicates that pelagic seabirds are likely to be relatively frequently encountered in the offshore waters of the Reconnaissance Permit area).[41] 69. A 2022 review of peer-reviewed literature on the physiological, behavioural and ecological impacts of the 3D seismic survey activities on marine wildlife[42] ("Harris Report", attached marked Annex B3) found that the type of sound emitted during seismic surveys has been directly linked to physical damage to marine animals, including soft tissue trauma damage, emboli/ams, damage to organs used in balance and orientation, concussions, haemorrhaging, decompression sickness and both temporary and permanent threshold shifts to hearing ability. The Harris Report also found that some species display physiological stress responses and behavioural changes to seismic activities, such as moving away rapidly, diving or remaining still. These responses are likely to increase their energy consumption and energy costs, reduce their time to forage, and/or affect their vulnerability to predation, thus having negative impacts on the survival of individuals (especially young or compromised animals) as well as the overall population growth and survival of a species (especially for threatened species that are already at risk of extinction). **Acoustic Modelling**	The extent of the TGS survey area is substantively different from that applied for by Searcher in 2021 and which was the focus of the Harris (2002) review. The TGS Application Area is located further from shore and avoids many of the identified sensitive areas and sensitive times of the year. A team of similarly qualified specialists considered the proposed activity, identified and assessed potential impacts, and where applicable made recommendations to manage and mitigate the impacts. All impacts assessed can be reduced to a medium or low significance with the implementation of management and mitigation measures described in the BA report and accompanying EMPr. Please refer to Section 9.3.1 of the BA Report for the assessment of the potential impact on marine fauna (including impact on humpback whales, southern right whales, leatherback turtles, African penguin, and cape fur seal) in the context of the proposed activity. The Appellant's submission that the Acoustic Modelling, is largely a desktop assessment is correct. However, it cannot be stated that the model failed to provide meaningful information as is claimed by the Appellant. The technical noise report relies on predictive modelling to predict the noise impacts associated with the seismic survey. In order to refine and confirm this information, the underwater noise modelling study recommends that "Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented	

[41] Pisces Report at 45.

[42] Harris, Otbers & Wright, *Report on Scientific Basis for concerns of significant harm inflicted to marine wildlife by 2D and 3D seismic surveys on the South and West Coasts of South Africa* (14 January 2022).

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70. The Appellants submit that the underwater noise modelling was largely a desktop study rather than a meaningful examination of the acoustic harms that seismic surveying will have. 71. The acoustic modelling failed to provide meaningful information in several ways: 71.1. The model should have included in situ testing to 'ground truth' the modelling and accurately determine the potential noise impacts associated with various aspects of the proposed 3D seismic survey (sound in the ocean is affected by pressure, salinity, temperature and temperature gradients, and can travel many kilometres from the source). 71.2. The model should have assessed the impacts of noise on all species (different species have different sensitivities to noise) during the environmental impact assessment process (not ex post factor). 71.3. The assessment should include (but not be limited to) potential impacts on the migration of snoek (a species that is important to the livelihoods of small-scale fishers) and juvenile turtles (which are significant from a biodiversity perspective given their endangered status) that are in turn dependent on other species. **Heightened Legislative Requirements are Not Considered for Critical Biodiversity Areas (CBAs), Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs)** 72. The National Environmental Management: Biodiversity Act, 2004 ("NEMBA") provides for ecosystems that warrant special conservation attention. These include ecosystems identified as Critical Biodiversity Areas ("CBAs") or Ecological Support Areas ("ESAs") in a bioregional plan, biodiversity sector plan or provincial spatial biodiversity plan.	that would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior to the commencement of the survey and then operational levels of noise during the survey." The migration of snoek has been described in Section 8.5.3.10 of the BA Report. Additionally, the impact of the proposed activity on juvenile turtles is described detail in Section 4.3.3 (Impacts of Seismic Noise on Turtles) of the Marine Ecological Assessment. It is also already recommended in Section 9.3.4.2 of the BA Report as well as the EMPr that TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. The NEM:BA, NEM:PAA and NEM:ICMA are all identified as key pieces of legislation applicable to the proposed project in Section 4 of the BAR. Furthermore, the BAR goes on to discuss CBAs and ESAs in Section 6.2 – CBA 1 indicates irreplaceable or near-irreplaceable sites that are required to meet biodiversity targets with limited, if any, option to meet targets elsewhere, whereas CBA 2 are "best design sites" and there are often alternative areas where feature targets can be met; however, these will be of higher cost to other sectors and / or will be larger areas. Activities within these management zones are classified into those that are "compatible", those that are "not compatible", and those that have "restricted compatibility". Non-invasive (e.g. seismic surveys) and invasive (e.g. exploration wells) exploration activities are classified as having "restricted compatibility". Activities with restricted compatibility require a detailed assessment to determine whether the recommendation is that they should be permitted (general), permitted subject to additional regulations (consent), or prohibited, depending on a variety of factors. Petroleum production is, however, classified as "not	

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73. The Appellants contend that the Minister ignored the critical importance of NEM:BA, NEM:PAA and relevant provisions of NEM:ICMA in terms of protecting and conserving the identified CBAs within the survey area, as well as the EBSAs and MPAs. At the very least, the value of these areas and the extent of potential negative impacts of exploratory activities on these areas should have been considered. The BAR failed to provide any assessments for the CBAs contained within the Application Area or the EBSAs and MPAs that are adjacent to the area. <u>CBAs</u> 74 The FBAR failed to meet even minimal standards of providing a "detailed assessment" and relevant mitigation in order to protect irreplaceable and near-irreplaceable CBAs from the intense and chronic blasts of the seismic survey. In fact, the Sound Transmission Loss Modelling report makes no reference to critical biodiversity areas 75. FBAR acknowledges that there are several CBAs within the Application Area itself: *The Application Area overlaps with areas mapped as Critical Biodiversity Area 1 (CBA 1): Natural and Critical Biodiversity Area 2: (CBA 2) Natural. Approximately 32.25 % of the proposed 3D acquisition area is covered by CBA 1 and CBA 2 Natural, 0.22% by CBA 1 and CBA 2 Restore, and 1.75% by ESA (see Figure 91).*[83] 76. CBA 1 are irreplaceable or near-irreplaceable sites that are "required to meet biodiversity targets with limited, if any options to meet targets elsewhere."[84] CBA 2 are best design sites where there may be alternative areas where biodiversity targets can be met at a higher	compatible" in CBAs, but may be compatible, subject to certain conditions, in ESAs. Seismic surveying is not only used for petroleum and natural gas exploration and development. It is also used for development of offshore wind, geothermal energy, and low-carbon solutions such as carbon capture and storage and also more generally for providing more insight and understanding into the regional geology of the area for scientific purposes. Therefore the CBA areas are not considered no-go areas for the purposes of seismic survey activities. In addition, the National Coastal and Marine Spatial Biodiversity Plan for the coast and ocean around the South African mainland states that petroleum production may be possible in CBAs using lateral drilling or other techniques that do not result in biodiversity impacts. According to the plan if significant petroleum resources are identified in these areas the selection of the site as a CBA could be re-evaluated, although this would require alternative CBAs to be identified to meet biodiversity targets. The potential impact on MPAs, CBA's and EBSA's is specifically noted in the BAR. A buffer of at least 5 km is recommended around MPAs, as stated in the EMPr. No buffer requirements are proposed by the marine fauna specialist for CBAs or ESBAs as the impact on these areas is expected to be low – negligible. Section 8.6 of the BAR presents the proximity of the planned activities in relation to ecologically or biologically significant areas. There is one Ecologically or Biologically Significant Marine Area (EBSA) overlapping the application area, and this was considered through the selection of the L1 point in order to gauge the effects on the Tripp Seamount to the	

[83] BAR at 162.
[84] BAR at 162.

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cost or requiring the allocation of additional area to achieve the targets.[85] 77. The FBAR recognizes that the exploration activities, including seismic surveys, are classified as having restricted compatibility with CBAs, which require a "detailed assessment to determine whether the recommendation is that they should be permitted (general – as is the case for this assessment), permitted subject to additional regulations (consent), or prohibited, depending on a variety of factors."[86] The BAR fails to even identify the unique and irreplaceable features of the CBAs in order to be able to assess whether this activity should be permitted. 78. CBA areas have been identified and set aside, and resources have been invested, in order to protect these biologically critical habitats and the marine species that depend on them. Seismic surveys will run directly over these critical biodiversity areas designated as irreplaceable and near-irreplaceable, causing severe and potentially irreversible impacts. 79. The FBAR has failed to look in detail at the CBAs, understanding why they were identified as critical biodiversity areas, and then propose specific mitigation measures in order to make an informed assessment as to the "restricted capability." <u>EBSAs and MPAs</u> 80 The underwater Sound Transmission Loss Modelling report conducted for the BAR indicates in its introduction that the proposed survey areas are adjacent to a few Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs) including Childs Bank and Shelf Edge, and Cape Canyon and	north. A number of Marine Protected Areas (MPAs) are located adjacent to the proposed survey areas. Section 9.3.1.1.2 of the BAR identifies and assesses the potential impact on Cape Fur Seals. Figure 37 in the marine ecology specialist assessment illustrates the foraging ranges of seals on the West Coast from tracking data. From this it is evident that the survey area lies offshore of these foraging ranges. Additionally, suitable mitigation measures have been proposed to monitor for and protect the seals should they be encountered during the survey in Section 9.3.1.1.2 of the BAR. Section 9.3.1.1.1 and Appendix 3-5 of the BAR identifies and assesses the potential impact on beaked and other whales. This includes a description of the potential impact on: • Physiological injury and mortality; • Behavioural avoidance; • Masking of Sounds and Communication; and • Indirect impacts due to effects on predators or prey. Section 9.3.1.1.1 of the BAR then goes on to state that *"The potential impacts cannot be eliminated due to the nature of the seismic sound source required during surveying. The proposed mitigation measures, which are essentially designed to keep animals out of the immediate area of impact and thereby reduce the risk of deliberate injury to marine mammals would reduce the intensity of most impacts to medium, and the residual impacts will reduce to low consequence and LOW significance, except for the effects on prey which remains of VERY LOW significance."*	

[85] BAR at 162.
[86] BAR at 162

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Associated Islands, Bays and Lagoon.[87] The BAR expands that list adding important areas such as the Benguela Muds MPA, Robben Island MPA, Southeast Atlantic Seamounts MPA and additional MPAs "that fall within the broader project area."[88] The Bar also identifies and describes eight EBSAs, including transboundary relevant to the seismic survey area.[89] 81. Although these protected areas do not fall within the seismic survey area itself, the nature of seismic survey will cause impacts on the habitats and the marine species that these areas are meant to protect. These include endangered and protected species, breeding areas, sensitive and vulnerable habitat, resident whales, and many other features which make the species fragile and sometimes slow to recover, which has warranted their protection. 82. The FBAR makes no effort to identify impacts to these sensitive areas and to mitigate the potentially irreversible harms that the seismic survey will cause. As noted above, the sound from seismic surveys can travel hundreds of kilometres and will penetrate into the MPAs and EBSAs. Further, the seismic surveys will increase the ambient noise beyond the survery area. The chronic blasting every 6-20 seconds for months (70 days) will cause behavioural disturbances and possibly more damage to these sensitive areas, which the BAR did not take into account. **Cape fur seals** 83. In South Africa, since October 2021, thousands of dead and/or dying Cape fur seals, have washed ashore along the south and west coasts. The cause of these die-offs remains unknown but avian flu has been ruled out and malnourishment appears to be the most widely	Section 9.3.1.1.5 of the BAR identifies and assesses the potential impact on pelagic fish. It was concluded that the location of the Application Area well to the west of the 'ring-fenced' area and proposed mitigation measures, which are essentially designed to keep animals out of the immediate area of impact and thereby reduce the risk of deliberate injury to fish, reduces the intensity of the impacts relating to physiological injury / mortality to medium, the residual impact will reduce to low consequence and be of LOW significance. All other impacts on fish remain of LOW significance. Avoidance effects or behavioural alterations from seismic surveys involving many fish species do not automatically imply risk factors and thus do not necessarily cause a disturbance to the fishery (McCauley et al., 2000). A recent large-scale experiment conducted by Meekan et al (2021) in Australia showed no short-term or long-term effects on the abundance or behaviour of demersal fish assemblages in response to a commercial seismic source. This suggests that seismic surveys have little impact on demersal fishes. Other studies that found no evidence of significant changes in catch rates or fish abundance include Hassel et al. 2004, Picket et al. 1994, Miller and Cripps 2013 and Thomson et al. 2014. Noise modelling was undertaken for the proposed survey and the transmission of sound at various threshold levels was taken into account. In terms of the Russell Report, inputs from the fisheries specialist points to the fact that tuna catches globally were under stress mainly from fishing effort and also due to climate variability. In fact, the data, if interrogated further, shows that the variability in catches in Namibia	

[87] TGS: South Africa Orange Basin 3D Seismic Survey, Sound Transmission Loss Modelling at at 1-2

[88] BAR at 157-59.

[89] BAR at 159-61.

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accepted reason. Activities associated with the Project could further pressure this species by physically harming individual seals, and by disrupting the seals' food supply. 84. The Pisces Report states that Cape fur seals are unlikely to be found in the project area, citing map that shows generalized foraging areas that extend nearly exactly to the edge of the reconnaissance area.[90] However, the report also states, "[s]eals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles (~220 km) offshore,"[91] meaning a large part of the reconnaissance area is well within the foraging range of Cape fur seals. Moreover, the Based on the questionable assumption that Cape fur seals are unlikely to occur within the reconnaissance area, the Pisces Report authors deemed their sensitivity to the proposed seismic operations to be "LOW," in spite of the finding that "The potential impact of physiological injury to seals as a result of seismic noise is deemed to be of HIGH intensity."[92] **Whales and dolphins** 85. There is genuine conservation concern for beaked whales that are particularly sensitive to anthropogenic noise, including seismic surveys. It has been demonstrated that even minor, non-lethal disturbances, resulting in changes in behaviour such as displacement from preferred habitats, could impact a population.[93] 86 The phenomenon of energy-cost (from stress and avoidance behaviour) is of particular concern for some of the species expected to be encountered in the survey area in question, particularly the humpback whales and southern right whales who are at risk of the	were more associated with operational dynamics of the Namibian fleets and their licensing conditions that had reduced their effort (as South African vessels were not permitted to fish in Namibian waters). Cumulative impacts are assessed in Section 9 of the BA report. For both technical and commercial reasons, it is unlikely that concurrent seismic surveys will be undertaken in the same area during the same survey window. However, the cumulative impacts associated with multiple surveys was assessed and detailed in Section 9.3.5 of the BAR. Section 9.3.5 of the BA Report states that "three seismic surveys of regional extent, undertaken simultaneously, could be expected to result in an impact of medium negative significance on the large pelagic longline sector, both with and without the application of mitigation measures. This relates to the large pelagic long-line sector only, and only in the event that all three surveys are undertaken simultaneously. It should be noted that the seismic industry typically avoids simultaneous surveys occurring in close proximity to each other as this has the potential to degrade the quality of the recorded survey data. Other cumulative impacts are all expected to be low after mitigation is applied – therefore overall cumulative impacts are considered low post-mitigation. It should also be noted that of the three potential surveys cited by the Appellants, the GX Technologies survey should be disregarded as the company went into liquidation in 2022. The appellants' contention that up to 30% of the revenue generated by the impacted fisheries would be lost during the 70 day period is unsubstantiated and vague for the following reasons:	

[90] Pisces Report at 69 (Fig. 37).
[91] *Id.* at 111.
[92] *Id.*
[93] Harris Report

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airgun noise affecting their behaviour or interfering with the communication between mother and calf. Any impact on their energy reserves could impact on their condition (weight-loss and physiological condition) and affect survival of the animals during a vulnerable time (especially for lactating mothers and their calves) on their long migration to feeding grounds in Antarctica.[94] **Fish** 87. The BAR downplays the impacts of seismic surveys on fish and the fisheries they support, particularly in the case of the large pelagic longline fishery and the tuna pole-line fishery. While the BAR assesses the exclusion of fishing vessels due to temporary safety zones during seismic surveys, it fails to adequately assess the actual impacts of seismic activities on the target fish species themselves, both in the short and long-term. During the seismic survey, fishing vessels would be required to maintain a safe operational distance from the survey vessel and streamer array, which may extend up to 6 nautical miles. The FBAR assessed the impact of potential exclusion for each commercial sector based on the affected area of fishing ground and the amount of catch reported within the Reconnaissance Permit area. Given the location of the Reconnaissance Permit application area, two high-value fisheries are directly impacted: the large pelagic longline fishery (targeting tuna, swordfish and shark) and the tuna pole-line fishery. 88. The FBAR concluded that the Project's activities will result in exclusion to fishing grounds for at least the large pelagic longline fishery. The FBAR states that "[t]here is a high probability that the large pelagic longline sector (targeting tuna, swordfish and shark) will experience loss of access to fishing ground over the duration of the	• The four-month window is proposed to coincide with the period of lowest activities for the fisheries that operate in the potentially affected sectors; • It should further be noted that the survey will not be undertaken over the entire tuna fisheries area or the whole application area at the same time and will thus not lead to a complete shutdown of the fishing activities in the pelagic longline sector during the 70 day period of the survey; and • The mitigation measures included in Section 9.3.2 of the BAR provide for avoidance of the peak fishing periods and, furthermore, for the establishment of clear communication channels to be established with the other users of the survey area and to ensure that the disturbance within this sector is reduced to the absolute minimum. The impact on the affected fishing sectors was assessed to be of low significance and short duration and it could thus not be stated that "The FBAR fails to consider the long-term behavioural or migration impacts that seismic activity could have on the pelagic longline fishery, which include several species of tuna." Impacts of cumulative sound exposure on marine mammals are evaluated using disturbance and injury threshold, defined as temporary threshold shifts (TTS) and permanent threshold shifts (PTS) (Southall et al. 2019). The audibility of a noise pertains only to the perception or detection of a sound above background levels of ambient noise. The thresholds established by Southall et al. (2019) are internationally regarded as standard references for environmental impact assessment of underwater noise. Although the modelling report doesn't specifically reference the CBA areas, the purpose of the modelling was to model the likely sound transmission and contours. The outputs of the model were then	

[94] Harris Report

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proposed 70-day survey," and that (t)he impact of exclusion is assessed to be of high magnitude."[95] 89. In terms of noise impacts to the target fish of the large pelagic longline fishery and the tuna pole-line fishery, the Pisces Report acknowledges that "(s)eismic activities have been predicted to possibly affect the migration patterns of tuna leading to substantially reduced catches of albacore and southern bluefin tuna in southern Namibia and the Great Australian Bight, respectively,"[96] yet ultimately the Report concludes that "(a)s there is currently a dearth of information on the impacts of seismic noise on truly pelagic species such as swordfish and tuna (Evans et al. 2018; Webster et al. 2016), links between changes in migration patterns and subsequent catches thus remains speculative."[97] The FBAR thus maintains that potential impact on individual fish behaviour is of MEDIUM consequence and that "the residual impact due to seismic noise is considered to be of LOW NEGATIVE significance for the large pelagic longline and tuna pole-line sectors."[98] 90. Overall, the FBAR concludes that with mitigation (timing of the surveys to avoid peak fishing periods), the following overall impact significance: Based on the combination of extent, duration and magnitude of the impact, and considering the high probability that the impact would occur, the overall significance of the impact is considered to be MEDIUM	considered and assessed by the marine ecology specialist who specifically considered the CBA areas. The Appellants' submission that mitigation measures proposed only focus on marine mammals, is not substantiated by the large number of mitigation measures as detailed in Section 9 and 11.4 of the BAR. The use of infra-red cameras was discussed during the various public meetings held during the BAR review phase and included in the Public Participation Report in Appendix 2. It should further be noted that the Appellants' commented on the lack of inclusion of infra-red cameras during the BAR review phase, and subsequently the EAP included this as a specific mitigation measure in the final BAR. It is therefore strange that the Appellant now disputes the use of this technology and lists this as a supporting factor in this grounds of appeal. The Noise impact on plankton is assessed in Section 9.3.1.1.7 of the BA report. The study by McCauley et al. (2017) generated significant public attention, but the paper has not been widely accepted by the scientific expert community as the findings are considered severely flawed. Details on the independent reviews of the paper are provided in the EnerGeo response to a publication by the Scientific Advisory Group on Emergencies (SAGE). Follow-up studies by Richardson et al (2017) failed to conclusively demonstrate discernible effects on zooplankton biomass on a regional scale and Fields et al. (2019) detected no significant behavioural differences in the copepod species *Calanus*	

[95] BAR, pg. 212.
[96] Pisces Report, pg. 132.
[97] Pisces Report, pg. 132.
[98] BAR, pg. 244.

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NEGATIVE. Due to the low probability of the operations of the tuna pole-line sector within the Reconnaissance Permit area, the overall significance of the impact on the sector is considered to be LOW NEGATIVE. 91. The EIAR fails to adequately assess the vulnerability of the targeted fish species (including tuna and sharks) to noise impacts, and any decision based on it would be unreasonable. This is a major flaw because many of the large pelagic fish and shark species likely to occur in the offshore regions of the Orange Basin are considered globally 'Vulnerable' (e.g., bigeye tuna, blue marlin, Oceanic Whitetip shark, dusky shark, great white shark, longfin mako), 'Endangered' (e.g., shortfin mako, whale shark) and 'Critically Endangered' (Southern bluefin tuna). 92. The impact on fish assemblages is difficult to interpret, due to multiple factors at play including but not limited to the ability of a species to move from an area as well as the receiving habitat. A global review of the effect of seismic activities on fish and invertebrates acknowledged the limits of the current research due to experimental designs used or due to the focus on single species during investigations. A key concern is a lack of research focused on confounding effects and multiple stressors, therefore potential impacts of seismic surveys that have been previously identified may be reflective of underestimation or overestimation and would depend on the type of interaction (synergistic, additive, or antagonistic).[39] 93. Sounds pollution from seismic surveys may have a wide range of effects on fish species. Exposure to intense sounds can result in mortal injury, but over longer distances issues are associated with sounds that are detectable by fish and which may affect their behaviour, causing them to move away from their migration routes, flee important habitats in which they feed or breed, interfere with	*finmarchicus* based on distance to the source or control vs. exposed groups. The reconnaissance permit area is located far offshore (120 km at its closest point) and therefore beyond the influence of coastal upwelling, which will influence both plankton abundance and the abundance of fish species that depend on plankton as a food source. From Figures 17, 18 and 19 in the marine ecology specialist assessment it is evident that the project area lies well beyond major fish spawning and recruitment area (and therefore zooplankton and ichthyoplankton abundance): Figure 27 shows the area in relation to Cape Gannet and African Penguin distribution; Figure 37 shows the area in relation to seal foraging areas and Figure 47 shows the area in relation to virtual turtle hatchling trajectories. The survey area in relation to various marine mammal distributions is also provided and in all cases it is evident that interaction with marine fauna in those offshore waters should be minimal. The impact assessment shows that these impacts are of a medium-low significance even before any mitigation measures are applied. Regarding the supplementation with respect to the operating hours of the PAM monitoring: This would require the survey to likely run over two (or more) seasons. This is not only not cost effective for the seismic operator, but would extend the duration of the acoustic impacts (and others) associated with surveying. Considering that the survey area is located within the major shipping lanes and that ambient sound levels (dominated by the noise of vessels) will be persistent throughout the day and night, it seems more appropriate to undertake the survey in as	

[39] Harris Report

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their communications, affect reproductive behaviour (where sound is used to attract mates and facilitate spawning), or prevent or mask the detection of other biologically important sounds. Because of these many-pronged effects, seismic surveys can have compounding negative impacts on marine fish. 94. In his expert affidavit filed in a recent seismic survey case,[300] Dr Alexander Claus Winkler provided testimony regarding evidence of direct, lasting behavioural effects of seismic surveys on the rhythmic behavioural foraging patterns of cod in the North Sea. Winkler points out that both hake and snoek perform rhythmic diel foraging migrations off the seafloor at night and onto the seabed during the day. Given that seismic surveys are conducted both during the day and night, it is likely that these benthic fish species will migrate higher up the water column at night, bringing them within distances that may expose them to direct injury and mortality impacts from seismic surveys. It is noted that the Pisces report indicates that species most likely to be found in the area of interest include large migratory fish (such as tuna, billfish and sharks), many of which are considered threatened by the IUCN due to overfishing.[301] 95. In addition, contrary to the **FBAR**'s conclusions that there is only **LOW NEGATIVE** significance for the large pelagic longline and tuna pole-line sectors,[302] a 2018 desktop survey of South Africa fisheries impacts from seismic surveying by Namibian fisheries expert David Russell ("Russell Report") concluded the following: (W)here there are cumulative impacts from repetitive surveys in the same area, as has occurred off Southern Namibia tuna fishing grounds, where	short a time as possible, in which case night-time operations are necessary. The studies undertaken internationally over the past ~70 years on the impacts of noise on marine fauna (of which some 400 peer-reviewed publications have been summarised and cited in the marine faunal specialist study) have concluded that the effects of underwater sounds vary substantially and depend on a wide variety of physical and biological factors. When writing articles on the effects of seismic acquisition on marine fauna it is therefore not difficult to bias the literature cited to either demonstrate detrimental and irreversible impacts or only very limited impacts, depending on the personal view of the author(s) and/or the targeted readership. The marine faunal assessment has made efforts to present published results objectively, and nowhere claims that acoustic surveys do not result in impacts. Injury is likely at very short range, with behavioural disturbance occurring over greater distances. The final significance ratings are determined using information from the peer-reviewed literature together with the noise modelling results (which put the threshold distances from the source array to mortality and potential mortal injury into perspective), adopting the precautionary principle as is required when undertaking such impact assessments, and taking into account the sensitivity of receptors present in southern African waters. Given all of the evidence, the conclusion reached for the various assessments is that impacts are either of low or very low significance. It is not disputed that MMO sightings are not 100% efficient. Various approaches have been adopted over the years to improve observer	

[300] Available online at: https://drive.google.com/drive/folders/1m-h8MoRdfUfKHuB_uD1KX-dBktua (21. Alexander Winkler).

[301] Pisces Report at 40.

[302] Capricorn Report, pg. xxiv.

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catches have severely declined since 2011, and in 2017 dropped off to non-commercial catch rates, there is the ominous possibility that the tunas change their migration path. Environmental factors such as El Nino appear to also have contributed significantly, but combined with regular seismic surveys, the environmental signals are potentially devastating.[303] 96. There is a possibility that up to three seismic surveys (Searcher, TGS, and GX Technologies) would take place simultaneously in the area, which would further increase geographic exclusion of the fishery. If multiple 3D seismic surveys were not undertaken simultaneously, then sequential surveys in the same area would prolong the loss of access to the pelagic longline sector and duration of seismic impacts to fisheries. Yet the FBAR does not directly assess the impacts of simultaneous surveys on the fisheries. 97. The FBAR concludes, without citing any evidence, that after months of up to three simultaneous seismic surveys in the pelagic longline sector, "[o]nce completed there is not expected to be any residual impact."[304] As noted above, the Russell report identified potential long-term impacts of repeat seismic activity on Southern Namibian tuna fisheries, with implications that tuna may change their migration patterns to avoid noise pollution.[305] The BAR fails to adequately consider or mitigate impacts to the pelagic longline sector that are both short-term (potentially closing the fishery for 70 days or longer given multiple surveys in a single year) and long-term (inflicting behavioural and migration shifts).	efficiency, particularly at night, with infra-red binoculars and mast-mounted infra-red (IR) cameras being tested. These have, however, not proven as effective as initially anticipated, due to lack of detectable temperature differences, resulting in the implementation of the 24/7 PAM surveillance. From a seismic operator's perspective, it is not feasible or cost-effective to cease airgun operations at night as this would prolong the duration of the survey possibly requiring multiple seasons to complete the acquisition. This would also add substantially to the overall survey duration and cumulative impacts.	

[303] Assessing the Impact of Seismic Surveys on South African Fisheries, 2018. David Russell Fisheries Consultancy for the Responsible Fisheries Alliance ("Russell Report"), pg. 6.

[304] BAR, pg. 236.

[305] Russell Report.

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98. The sector had an estimated wholesale value of R124 Million in 2018, or 1.2% of the total value of all fisheries combined. For tuna pole-line, the fishery runs predominantly from November through June, while the large pelagic longline fishery runs highest from May to November.[106] The FBAR lists a proposed window of January – May for its 70-day 3D seismic survey, meaning a large fraction (up to 30% with an approximate wholesale value of R40 Million) of the fishery year stands to be excluded. Because its assessment did not adequately consider the longer-term residual impacts on the fisheries from seismic activity, this monetary loss stands to be much greater than that estimated from fishery exclusion alone. 99. The FBAR fails to consider the long-term behavioural or migration impacts that seismic activity could have on the pelagic longline fishery, which include several species of tuna. Such changes in the fishery could have severe and lasting implications for communities dependent on this important fishery for many years to come and should have been included in the impact assessment. 100. The FBAR states that "[t]he zones of TTS [temporary threshold shift] effect for fish species with and without swim bladders are predicted to be within 3.5 km from the survey lines for the 3D survey 24-hour operation scenarios considered."[107] This predicted zone of TTS for fish both with and without swim bladders is a gross underestimation and based on minimal and non-regional specific data, including data from riverine 2D seismic activity on freshwater species (e.g. Popper et al., 2005). As the Capricorn Report admits, "(t)o date there have		

[106] BAR App. 3 2 PROPOSED 3D MULTI-CLIENT SEISMIC SURVEY IN THE ORANGE BASIN. OFFSHORE SOUTH AFRICA Fisheries Specialist Study, September 2022 ("Capricorn Report"), pg. 86.
[107] BAR, pg. 235.

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been no studies focused directly on the (fish) species found locally."[108] 101. Most of the mitigation measures proposed in the BAR are designed to minimise impacts to marine mammals. As admitted in the Pisces Report, vastly less is known about how such mitigation measures alleviate sound impacts experienced by marine fish species.[109] Large pelagic fish (e.g. tuna, sunfish, or sharks) would not be detected by PAM (which would be tuned for marine mammal vocalisations) and would not likely be detected visually at night by observers or using an infrared thermal imaging camera (since cold-blooded fish, as opposed to warm-blooded mammals, do not have high enough temperature differences from the water). 102. The FBAR further fails to provide evidence that infrared thermal imaging is effective as a mitigation measure. 103. TGS takes no preventative mitigation measures to minimise impacts to marine fish species during 3D surveying and has a single and insignificant mitigation measure (7.1) to shut down seismic shooting in the case the following is observed: "mass mortalities of squid and fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO [marine mammal observer] to be as a direct result of the survey."[110] 104. Although it has been suggested that the sound energy from air guns may harm fish species with swim bladders and those without, there are very few studies directly examining the potential effects on fish physiology or behaviour, and even fewer focusing on pelagic fish species. Unknown impacts are not the same as no impacts, and the		

[108] Capricorn Report, pg. 10.
[109] PISCES Report, pg. 192.
[110] PISCES Report, pg. 197.

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precautionary principle should be invoked. There are significant knowledge gaps regarding the impact of 3D seismic surveys on marine fish species, particularly those that would be impacted by the Project. Specifically, there is currently not enough information about the fish species in the area or their response to sound to be able to make any meaningful assessment of the impacts. Therefore, the precautionary approach set out in NEMA suggests that this lack of knowledge should weigh against the proposed 3D seismic surveying in a vital and valuable offshore fishery. **Zooplankton** 105. The FBAR disregards the precautionary approach at every step in the analysis of impacts on plankton, which it concludes does not warrant mitigation measures and will have a medium pre-mitigation impact, yet a very low residual impact.[111] Yet, as demonstrated below, there is a significant concern that the BAR underestimates the impacts of seismic surveys on plankton, which form the base of the ocean food chain. 106. The FBAR does not provide actual data to demonstrate that there is not significant or even medium plankton abundance in the survey area. The BAR "expects" that plankton abundance to be low with seasonal peaks may occur associate with MPAs.[112] Yet, the surveying is meant to have temporal overlap with speak spawning products of commercially important species.[113] 107. Studies by McCauley et al. (2017) referenced in the Pisces Report indicates that seismic blasts may kill various species of zooplankton in Australia at distances of up to 1200 m from an airgun[114], and more		

[111] Marine Ecology Impact Assessment at 144.

[112] Marine Ecology Impact Assessment at 141.

[113] Marine Ecology Impact Assessment at 144.

[114] Robert D. McCauley *et al.*, *Widely used marine seismic survey air gun operations negatively impact zooplankton*, 1, Nat. Ecol. Evol., 1–8 (2017).

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recent research shows lethal and behavioral impacts to zooplankton from airgun discharges.[115] Still, other studies (Fields et al., 2019), report no measured mortality or sublethal effect on copepods at distances >10 m from a seismic blast in Norwegian waters.[116] And other studies (Richardson 2017) found "substantial impact of seismic activity on zooplankton populations on a local scale within or close to the survey area."[117] While noting that zooplankton mortality can be difficult to assess in the field (in situ) and that realistic conditions are very difficult to reproduce in a laboratory setting, nevertheless these highly contradictory results suggest that effects may be variable and highly dependent on zooplankton species and/or marine geographical area. Research should be undertaken to survey the current literature on zooplankton types in the Benguela Upwelling Zone and better link this knowledge to the airgun impacts literature available. The BAR fails to take these steps, making it impossible to assess the impacts of seismic surveys to the zooplankton communities underpinning the food webs that support fish, marine mammals, and fisheries.		
108. As noted, zooplankton forms the base of many important food webs in the marine environment. Depletion of zooplankton could thus have an impact on food for their predators (such as fish) as well as impact fish eggs and larvae (ichthyoplankton) with potential local impacts on species important in fisheries. This damage to zooplankton as found by studies over 1km away (McCauley 2017) and within 15km (Richardson 2017) from the survey array raises concern		

[115] Emilie Hermes Vereide *et al., Effects of airgun discharges used in seismic surveys on development and mortality in nauplii of the copepod Acartia tonsa*, 327, Environ. Pollut., 121469 (2023).

[116] *Id.*

[117] Rice Supporting Expert Affidavit at para. 29 (restating the conclusion from the study's authors: "We found there was substantial impact of seismic activity on zooplankton populations on a local scale within or close to the survey area, with a maximum decline of 22% in zooplankton populations in the survey area, 14% within 15 km of the survey area.").

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that a 500m buffer for other animals that are unable to move away from the sound, is far too small to ensure that damage is not inflicted (even if they were able to evade it).[118] **The proposed mitigation measures are inadequate to prevent unacceptable harm to marine life** Simultaneous Surveys 109. The FBAR proposes the use of a 40 km buffer between vessels during concurrent simultaneous surveys (p. 211) as a mitigation measure, relying on "advice from the US Department of Interior (2014)." The purpose of the buffer is to mitigate "the cumulative impacts of three potential surveys occurring concurrently."[119] The 40 km buffer mitigation measure, first proposed in the United States, originally purported to avoid harassment of marine mammals during simultaneous surveys. This was expected to be achieved through a distance between vessels that would provide a corridor where "airgun noise is below [harassment] thresholds and approaching ambient levels such that animals may pass through rather than go larger distances to go around the survey vessels."[120] However, the mitigation measure neither provides a corridor below harassing levels of acoustic noise for marine mammals between vessels seismic surveying, nor does it mitigate cumulative impacts as portrayed in the FBAR. In fact, the mitigation measure is not even used in the US, making the FBAR reliance upon this measure deeply flawed. 110. First, the 40 km buffer is based upon a threshold of 160 dB for harassment, a standard that the U.S. government has since abandoned as appropriate to provide adequate protections. For		

[118] Harris Report

[119] BAR at 211.

[120] US Department of Interior, Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas, Final Programmatic Environmental Impact Statement at 2-37 (2014).

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example, the US government found in 2018 in reviewing harms to marine mammals during oil and gas geophysical surveys that, "[s]tudies of marine mammals in the wild and in experimental settings do not support" use of a single 160-decibel threshold and that "that an approach reflecting a more complex probabilistic function is better reflective of available scientific information," because it "takes the fundamental step of acknowledging the potential for . . . harassment at exposures to received levels below 160 [decibels]."[121] 111. Second, as noted above, scientists recognize that this 160 decibel threshold is not supported by science. In addition, in his expert declaration Dr. Nowacek noted that "seismic surveys can disrupt important behaviors in baleen whales at exposure levels far below the 160 dB threshold".[122] 112. Third, the application of a 40 km buffer as a wholesale solution for simultaneous surveys is incompatible with even the 2014 Department of Interior document that the BAR is relying upon. In fact, the US Government prohibits the use of a 40 km buffer as a general mitigation measure. It instead found that new science demonstrated that "airgun noise can be detected at great distances from the sound source, such as across ocean basins," and that therefore, the mitigation measure must be considered in the site-specific context and include any new information at the time as well as "any potential aggregate effects from existing permitted		

[121] See Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Geophysical Surveys Related to Oil and Gas Activities in the Gulf of Mexico, 83 Fed. Reg. 29,212. 29.247-48 (June 22, 2018).

[122] See Nowacek Supporting Affidavit at para. 18.

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surveys."[123] The BAR does none of this analysis and in fact proposes potentially reducing the buffer zone.[124] 113. This mitigation measure has been proven to be scientifically unsound and ineffective and uses an approach inapposite with the base documents upon which the BAR relies, inconsistent with the current practice of the US Government, and inconsistent with the science. Therefore, there is no basis for the BAR to conclude that a 40 km buffer will mitigate cumulative impacts of concurrent seismic surveys. Inefficacy of Proposed Mitigation Measures 114. Several of the proposed mitigation measures are ineffective to mitigate the harms related to the impacts of the seismic surveys. Consequently, the significance of the post mitigation impacts are understated, exposing marine species, in particular marine mammals and to more injury and harm than indicated in the conclusions of the BAR. 115. Soft Starts and Ramp Ups: Harris *et al.* found that the soft starts are "are likely to reduce the impact for highly mobile large animals, this is unlikely to be adequate for the many species that are prevalent in the area over the austral summer months and are unable to avoid the array or leave the area due to their lower mobility, such as smaller turtles, penguins, invertebrates, some fish species and zooplankton."[125] Moreso, Dr. Nowacek found that soft starts or ramp ups do not protect highly mobile cetaceans, finding them "inadequate to protect cetaceans present year-round or deep-diving		

[123] US Department of Interior, Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas, Final Programmatic Environmental Impact Statement at 2-38 (2014).
[124] BAR at 211.
[125] Harris Report at Summary of Findings.

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beaked whales."[126] Dr. Nowacek further expounded "there has been no experimental confirmation that this procedure is broadly effective at reducing overall exposure."[127] In considering a situation where soft starts or ramp ups worked perfectly, Dr. Nowacek found that "this mitigation measure would reduce only the number of injuries incurred in the vicinity of the seismic vessel and does not address at all the larger body of effects."[128] 116. Observers: Harris *et al.* explain that visual observers, although important to mitigation, have deficiencies, which brings into question the EAR's conclusions regarding the level of impacts post-mitigation: *"The finding of observer efficiency (from a scientific monitoring study conducted during the 2018/19 and 2019/2020 seasons on the humpback whales on the east coast) suggests that even with trained observers up to 44% of humpback whales in an area went undetected. This casts doubt on the effectiveness and success of Marine Mammal Observer (MMO) sightings of the largest species (humpbacks) as a mitigation measure, indicating that it is most likely that whales go undetected. Furthermore, the detection rate for smaller species, such as dolphins, seals, turtles and flightless birds (penguins), would be expected to be much lower, obviating the effectiveness of visual observations to prevent harm to these species."*[129] 117. Dr. Nowacek reiterates that the mitigation measure of visual observers is "inadequate to protect cetaceans present year-round or deep-diving beaked whales."[130] Dr. Nowacek further explains that the use of visual observers to detect whales "is imperfect at best"		

[126] Nowacek Supporting Affidavit at para. 13.4.
[127] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 47 of expert declaration by reference).
[128] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 47 of expert declaration by reference).
[129] Harris Report at Summary of Findings.
[130] Nowacek Supporting Affidavit at para. 13.4.

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because low light and other poor visibility conditions (such as fog or high-sea states) impair the ability to spot whales and, as Dr. Nowacek goes into further detail, even in ideal conditions it is very difficult to spot whales.[131] This is echoed by Harris et al. stating the "efficacy of a MMO is likely to be low due to the nature of the offshore marine environment in the survey area (frequent high swells and winds affecting surface visibility), putting species who are missed by MMOs and PAM operators at extreme risk, particularly at night or during adverse weather conditions."[132] 113. Passive Acoustic Monitoring (PAM): Harris et al. discuss how "the reliance on observers to do visual sightings to supplement the PAM monitoring during the day, as a mandated mitigation measure, necessitates questioning the acceptability of continuing with survey activities at night. If the visual observations are useful (perhaps sighting large animals around 65% of the time) in addition to PAM, then relying on PAM alone at night cannot be an effective mitigation measure. The authors express the opinion that surveys should not occur between sunset and sunrise each day if a real attempt of maximum avoidance of cetaceans is the objective of this mitigation measure."[133] 114. Dr. Nowacek discusses as well the limited benefit of PAM. With PAM, "whales will not be detected even when present if they are quiet or not vocalizing or if background noise is too high." Dr. Nowacek also noted that "studies show that baleen whales cease vocalizing in the presence of even low levels of seismic survey noise."[134]		

[131] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 45 of expert declaration by reference).
[132] Harris Report at Summary of Findings.
[133] Harris Report at Summary of Findings.
[134] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 46 of expert declaration by reference).

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120. The FBAR's attempts to address this shortcoming in mitigation by equipping MMOs "with infra-red cameras in order to observe mammals at night."[135] However, this is an undeveloped technology for spotting cetaceans. It is not reliable, so much so that it is not typically used by scientists as part of their surveys. Further, there are questions with the scope of view, range/distance, as well as the impact of conditions on the ability to use the technology. In short, it is encouraging to bring new technologies to the table, however it requires more testing and improvement before it could be considered suitably reliable and certainly before it could be factored into the the mitigation of harms to cetaceans. **Lack of baseline noise assessment** 121. The FBAR fails to establish an acoustic baseline assessment of the area, and furthermore fails to present a plan to conduct an adequate baseline noise assessment. As part of its recommendations to minimise impacts to marine fauna, the BAR lists: Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented that would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior to the commencement of the survey and then operational levels of noise during the survey.[136] 122. The FBAR provides no guidance for the recommended baseline noise measurement, including the duration of monitoring period, or a		

[135] BAR at 251.

[136] Final BAR, pg. 241.

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range or frequency for detection. This lack of detail means it remains impossible to assess if this mitigation step would meet best practice standards such as those put forward by the Marine Mammal Observers Association. 123. The current lack of a baseline assessment means that the ambient background noise considered in the noise modelling falls short of best practices. Best practice acoustical modelling entails collecting site-specific data to calibrate acoustic models that can then be applied to characterize acoustic exposure of marine fauna in a given study area.[137] **Chronic Noise Impacts** 124. The seismic survey's airguns consist of 24 active airguns that will blast sound loud enough to penetrate the seabed floor every 6-20 seconds, 24 hours a day, for 70 days. Each acute blast will create direct harms to marine species. In addition, besides the direct harm that the pulse will create, the repetitive blasting will increase ambient noise, even at a distance of 100 kilometres.[138] These two factors expose marine species to chronic noise impacts over a large distance, as the sound travels hundreds and even thousands of kilometres.[139] The FBAR fails to take into account the increased stress and behavioural impacts that this chronic noise will cause on marine species in the area of seismic surveying and beyond		

[137] Alexander N. Rutenko *et al., Acoustic monitoring and analyses of air gun, pile driving, vessel, and ambient sounds during the 2015 seismic surveys on the Sakhalin shelf*, 194, Environ. Monit. Assess., 744 (2022).

[138] Nowacek Supporting Affidavit at para. 13.

[139] Rice Supporting Affidavit at paras. 16, 24 & 36; Nowacek Supporting Affidavit at paras. 9-10, 13.

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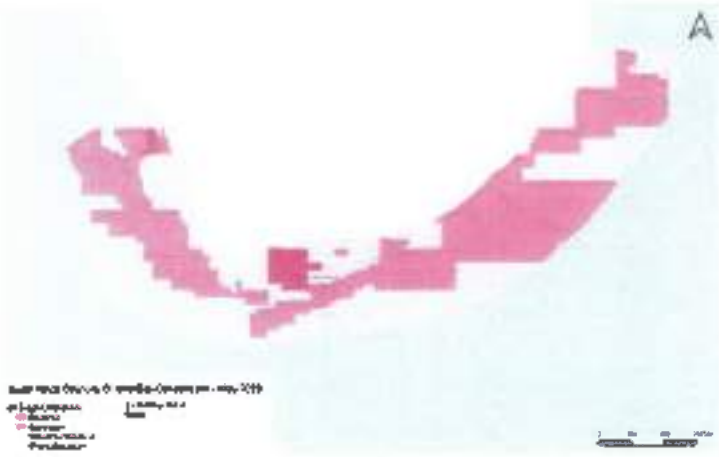
Ground 3: Failure to adequately assess cumulative impacts 125. Below is a map detailing the updated categories of Oil and Gas concessions along the entire coastline of South Africa:  Information received from Petroleum Agency SA, in line with a PAIA Request submitted by the Legal Resources Centre on 12 October 2022 126. In addition to the abovementioned map, it is noted that the BAR acknowledges that should other seismic survey campaigns be undertaken concurrently with TGS's proposed survey programme, cumulative impacts may be likely and there would be a need for alignment in planning of such concurrent operations to reduce	It is understood that ION GXT has been declared bankrupt and have ceased operations - as such, the ION GXT Reconnaissance Permit is considered to be defunct. Section 9.3.5 of the BA Report states that "three seismic surveys of regional extent, undertaken simultaneously, could be expected to result in an impact of medium negative significance on the large pelagic longline sector, both with and without the application of mitigation measures. This relates to the large pelagic long-line sector only, and only in the event that all three surveys are undertaken simultaneously. It should be noted that the seismic industry typically avoids simultaneous surveys occurring in close proximity to each other as this has the potential to degrade the quality of the recorded survey data. Other cumulative impacts are all expected to be low after mitigation is applied – therefore overall cumulative impacts are considered low post-mitigation. The marine faunal assessment has made efforts to present published results objectively, and nowhere claims that acoustic surveys do not result in impacts. The inference is that, for these whale populations, there is no direct evidence to link the long-term negative change to population size directly to seismic survey activities. The statement is only one regarding the "lack of evidence" with respect to certain whale populations and seismic surveys. The marine fauna report recommends planning seismic surveys to avoid sensitive areas and periods for some marine fauna: Movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (June/July and late October/November), and their aggregation on the summer feeding grounds between St Helena Bay and Dassen Island from late October to late December and ensure that migration paths are not blocked by seismic operations. If possible, the survey should be undertaken from	

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cumulative noise impacts to an acceptable significance.[140] The draft BAR notes that there are two current pending applications with PASA (Searcher Geodata and GX Technology Corporation) which both overlap the proposed TGS 3D seismic survey area, as depicted in the diagram below:	North to South to avoid these feeding aggregations. A discussion of the migration of various cetaceans is provided in Section 8.4.3.6 of the BA Report. It is unlikely that concurrent seismic surveys will be undertaken in the same area during the same survey window however the cumulative impacts associated with multiple surveys needs to be, and was, assessed. The decision-making authority did elaborate on the decision regarding whether concurrent surveys can take place. The proposed seismic activity will not automatically lead to further exploration, production, and utilisation of petroleum resources. The information to be obtained through the seismic survey will provide information as to whether they may be exploitable resources. The climate change impacts of any potential future exploration or production activities would have to be assessed as part of the associated and required Environmental Authorisation applications submitted for those projects, with due consideration of the other climate affecting activities proposed or in place at the time.	

[140] Final BAR 1520, para 9.3.5, p234.

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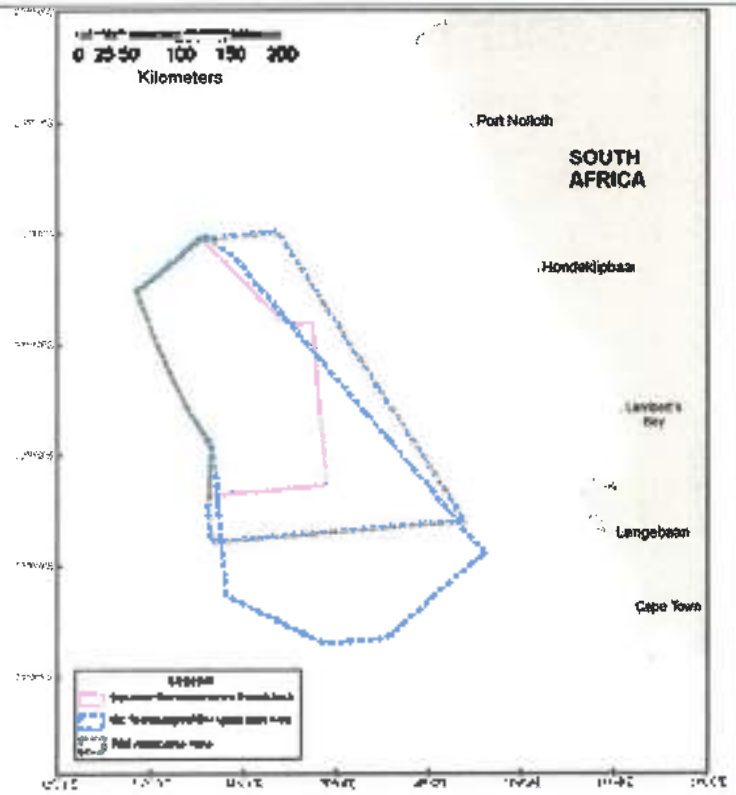

Source: TGS draft BAR, p235.

127. The BAR states that despite the difficulty in undertaking a reliable assessment of the potential cumulative environmental impacts of future seismic acquisition in the Deep Water Orange Basin (due to likely variation in the scope, extent and duration of proposed surveys), the cumulative impacts of three potential surveys occurring

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concurrently needs to be considered. The FBAR thus includes a cumulative assessment which assumes that the three surveys (Searcher, TGS and GX Technologies) occur simultaneously during the summer survey window in 2022/23. In this event, the draft BAR indicates that: 128. Associated impacts to marine fauna would be of high intensity and extend regionally, over the short-term (assuming they take place over the same summer survey window). The impact consequence for cumulative surveys is therefore considered medium. 129. Concurrent activities could also add to the cumulative impact on fisheries. Simultaneous survey operations would result in an increase in the extent and magnitude of the impact on the large pelagic longline sector. The impact duration would remain unchanged. Three seismic surveys of regional extent, undertaken simultaneously, could be expected to result in an impact of **medium negative significance** on the large pelagic longline sector, both with and without the application of mitigation measures. 130. Curiously, the BAR impact table[141] combines cumulative impacts on marine fauna and fisheries and rates the pre-mitigation environmental significance as 'medium' and the post-mitigation impact as 'low'. This does not reconcile with the preceding paragraphs which indicate with regard to cumulative impacts of three concurrent seismic surveys, an impact of medium negative		

[141] At p236.

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significance on the large pelagic sector could be expected 'both with and without the application of mitigation measures. 131. The Final BAR states regarding confounding and cumulative effects that the assessments of impacts of seismic sounds provided in the scientific literature usually consider short-term responses at the level of individual animals only, as the understanding of how such short-term effects relate to adverse residual effects at the population level is limited. The report goes on to state that data on behavioural reactions to seismic noise acquired over the short-term could, however, easily be misinterpreted as being less significant than the cumulative effects over the long-term (i.e. what is initially interpreted as an impact not having a detrimental effect and thus being of low significance, may turn out to result in a long-term decline in the population, particularly when combined with other stressors such as temperature, competition for food, and shipping noise). The report notes that confounding effects are, however, difficult to separate from those due to seismic surveys.[142] 132. The report also states that the potential cumulative impacts on individuals and populations as a result of other seismic surveys undertaken either previously, concurrently or subsequently are difficult to assess. The report indicates that a significant adverse residual environmental effect is considered one that affects marine biota by causing a decline in abundance or change in distribution of a population(s) over more than one generation within an area. The report makes reference to numerous 2D and 3D seismic surveys having been undertaken off the West Coast over the past 17 years, and relies on reported increases in the southern right whale and humpback whale populations over a time when seismic surveying frequency has increased as *'suggesting that, for these populations at*		

[142] Final BAR 1520, para 9.3.1.4 at p209-210.

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least, there is no evidence of long-term negative change to population size as a direct result of seismic survey activities'.[143] The assumption made that an increase in whale populations suggests that there is no evidence of long-term negative change to population sizes as a direct result of seismic activities, is questionable. This is an assumption that cannot be inferred from the facts (the increase could be as a result of any number of other external factors). 133. It cannot simply be assumed that the lack of evidence of long-term negative population changes as a direct result of seismic survey activities means that there are no negative impacts (including potentially significant impacts). In their report relating to the TOSACO EIA appeal, Harris *et al* point out that although the humpback whale population is increasing, there is evidence to suggest that cetaceans in South African waters are being affected by changes in their ecosystem and it is not well understood yet what is driving these changes and what the long terms effects could potentially be to populations.[144] Concerns noted in the report include an observed decrease in southern right whale calving success of the South African population and a strong link between foraging success and reproduction.[145] They suggest an investigation into possible decreases and/or spatial or temporal shifts in their prey availability at higher latitudes due to environmental variability. They also highlight a concern of the continued low numbers of unaccompanied adults		

[143] Final BAR 1520, para 9.3.1.4 at p210.

[144] Wilkinson, C. (2021) *Estimating population changes in humpback whales (Megaptera novaeangliae) migrating past Cape Vidal, South Africa*, MSc thesis, Cape Peninsula University of Technology, p108. Cited in Harris JM, Olbers JM, Wright K (6 April 2022) *Comments on Tosaco Energy Block 1 Exploration Right issued to Tosaco Energy (Pty) Ltd (PASA Reference: 12/3/362).*

[145] Vermeulen, E., Wilkinson, C., & G. van den Berg (2020) *Report of the 2019 South African southern right whale aerial survey*. Report to IWC 10.13140/RG.2.2.29556.37766. Cited in Harris JM, Olbers JM, Wright K (6 April 2022) *Comments on Tosaco Energy Block 1 Exploration Right issued to Tosaco Energy (Pty) Ltd (PASA Reference: 12/3/362).*

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along the South African coast which could potentially have serious consequences for cow-calf pairs in relation to the country's whale-watching industry in the future. 134. The BAR states that in the 'unlikely' event that multiple surveys would take place at the same time within the same survey area, 'the risk of cumulative noise impact must be considered and is suggested to be managed'. The BAR suggests that mitigation should include maintaining a distance of at least 40 km between survey vessels 'until sufficient objective evidence is obtained that a reduced buffer distance is acceptable'. Where this 40 km buffer distance cannot be maintained, the FBAR suggests that each of the additional activities to those described in the technical noise report should be modelled or otherwise considered in terms of the cumulative noise level and with reference to the criteria described in the report.[345] 135. However, as referred above at paragraphs 109-1113, the US Government prohibits the use of a 40 km buffer as a general mitigation measure and therefore, the mitigation measure must be considered in the site-specific content and include any new information at the time as well as "any potential aggregate effects from existing permitted surveys. This mitigation measure has been proven to be scientifically unsound and ineffective and uses an approach inapposite with the base documents upon which the BAR relies. Therefore, there is no basis for the BAR to conclude that a 40 km buffer will mitigate cumulative impacts of concurrent seismic surveys.		

[345] Final BAR, p236.

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136. Given the lack of certainty regarding cumulative impacts of concurrent 3D seismic survey areas, a risk averse and cautious approach should be applied by not authorising concurrent surveys and suggests that should the decision-maker ought to have refused granting the environmental authorisation. 137. In addition, the FBAR does not consider the cumulative impacts of other proposed offshore oil and gas seismic surveys, exploration and production in other Blocks within South Africa's exclusive economic zone. Having regard to the global Climate Emergency[147] and South Africa's international commitment[148] to *'working with others to ensure temperature increases are kept well below 2°C above pre-industrial levels, which could include a further revision of the temperature goal to below 1.5°C in light of emerging science'*[149] by reducing greenhouse gas (GHG) emissions, TGS's proposed 3D seismic survey would, if additional commercially viable resources are identified and developed through to production phase, inevitably add to South Africa's overall GHG emissions (South Africa's energy sector currently contributes an estimated 84% percent to the country's overall GHG emissions).[150] As a reasonably foreseeable future impact that may become more significant, especially in combination with impacts arising from similar offshore oil and gas exploration and		

[147] https://www.unenvironment.org/explore-topics/climate-change/facts-about-climate-emergency

[148] As a party to the United Nations Framework Convention on Climate Change (UNFCC) that ratified the Kyoto Protocol and adopted the Paris Agreement.

[149] See for example South Africa's *Intended Nationally Determined Contribution (INDC)*, available online at: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/South%20Africa%20First/South%20Africa.pdf

[150] https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-south-africa

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production activities, it is submitted that the cumulative impacts[151] of such GHG emissions need to be identified and assessed.		
Ground 4: Failure to conduct meaningful consultation with communities and local people (and in particular small-scale fishers), within the public participation process, including the Social Impact Assessment process 138. It is one of the foundational principles of NEMA that the participation of all interested and affected parties must be promoted and the participation of disadvantaged people must be ensured.[152] Section 24(4)(a)(v) of NEMA provides that interested and affected parties must be given a reasonable opportunity to participate in the environmental impact assessment process. Regulation 41(6) provides that the public participation process must be facilitated in a manner that provides all potential interest and affected parties a reasonable opportunity to comment on the proposed project. Regulation 41(2) of the EIA Regulations requires that the public participation process take into account the relevant guidelines. The 2017 Public Participation Guidelines provide that: 137.1. The level of public participation must be informed by the characteristics of the potentially affected parties.[153] 137.2. The method of communication must be an effective method that will easily reach the intended audiences.[154]	It is our opinion that the Public Participation Process was conducted in line with and exceeded the requirements of the Environmental Impact Assessment (EIA) Regulations (2014), as amended, and that the process followed was reasonable. With reference to Section 7 and Appendix 2 of the BA Report, EIMS has undertaken the public participation and consultation processes in accordance with the requirements of the NEMA EIA Regulations. This process included notification and communication in three different languages, via Radio and Newspaper advertisements, site notices, posters, and direct notification; as well as public and focus group meetings within the potentially affected communities. Opportunity was provided to review and comment on the BA Report and associated documentation to be submitted to the decision maker. It should further be noted that detailed consultations with community members and leadership were conducted by the Social and Heritage Specialists to obtain the views of project affected communities and the potential social and heritage impacts of the proposed project. The applicant is not aware of any additional requests received from I&APs for further avenues or opportunities for	

[151] 'Cumulative impact' is defined in the NEMA EIA Regulations as follows: "in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

[152] NEMA, section 2(4)(f).

[153] At p. 8.

[154] At p. 9.

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137.3. The language used must provide all potential interested and affected parties a reasonable opportunity to comment without unnecessary difficulty.[155] 139. The court in *Sustaining the Wild Coast NPC*[156] has upheld this and stated: "Meaningful consultation entails providing communities with the necessary information on the proposed activities and affording them an opportunity to make informed representations"[157] 140. Coastal communities and the general public have been overwhelmed with the number of offshore oil and gas related applications running in parallel processes, particularly those which may impact the south-west and west coast of South Africa. In the month of May, I&APs have been called upon to respond to no less than four offshore oil and gas EIA processes, without taking into account legislative public participation processes for the Upstream Petroleum Resources Development Bill and the draft Marine Spatial Plans during a similar period. The EAP in the current application, SLR, has been appointed to conduct three of these parallel EIAs. 141. The table below sets out the various EIA processes, in which it is clear that multiple public meetings and submission dates are running during similar time periods:	participation. The public participation requirements and obligations of the NEMA EIA Regulations has been complied with. With Reference to the table presented in point 141 above, it should be noted that EIMS was the EAP and it is unclear whether this comment relates to this application. However, it should be stated that it is clear that the TGS process did not conflict with other concurrent processes and it is anticipated that I&APs had sufficient time to attend the extensive public consultations undertaken during the initial call to register phase, as well as the BAR Review period. Please refer to the Public Participation Report in Appendix 2 of the BAR for further details on the public consultations undertaken. It should be noted that the Ms Mostert was specifically identified as a key Interested and Affected Party (I&AP) and included in the Public Participation throughout the Basic Assessment Process. Ms Mostert's comments were captured in the minutes of the meetings included in Appendix 2-6 and 2-9 of the BAR. As requested during the public meetings, the final BAR was also made available on the EIMS website (and the datafree version thereof) post submission of the final report to the Competent Authority for adjudication and was available throughout the appeal notification period. The EAP therefore, utilized the reasonable and requested methods of communication and transparency and did not receive requests for alternative methods. It is also important to consider that the findings of the BAR were that there is unlikely to be significant adverse impacts. With reference to Section 7 and Appendix 2 of the BA Report, EIMS has undertaken the public participation and consultation processes in	

[155] At p. 9.

[156] Sustaining the Wild Coast NPC and Others v Minister of Mineral Resources and Energy and Others (3491/2021) [2021] ZAECGHC 118

[157] Sustaining the Wild Coast NPC, para 26.

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Project	**EAP**	**Public Participation Meeting Dates**	**Comment/Appeal Due Dates**	accordance with the requirements of the NEMA EIA Regulations. This process included notification and communication in three different languages, via Radio and Newspaper advertisements, site notices, posters, and direct notification; as well as public and focus group meetings within the potentially affected communities. Opportunity was provided to review and comment on the EA Report and associated documentation to be submitted to the decision maker. It should further be noted that detailed consultations with community members and leadership were conducted by the Social and Heritage Specialists to obtain the views of project affected communities and the potential social and heritage impacts of the proposed project. The public participation requirements and obligations of the NEMA EIA Regulations has been complied with. The recommendation of the SIA is that, should the project be approved a representative from TGS must consult with leadership of the community to determine how the communities should be consulted with in future – that is, what is the way the community members prefer to be consulted with for provision of commencement notification and/or daily updates to advise on survey schedules, communication in respect of the proposed research outcomes, etc. The recommendation to include further consultation as part of the conditions of authorisation intends to ensure that the consultation process goes further than just the EIA process, but is continued throughout the entire process, regardless of the outcome. This will assist communities and people on the ground to make informed decisions about technical matters. The intention of the recommendation is not for this condition to be suspensive or determinant on the ultimate decision but rather to function as an additional management/ mitigation measure to be implemented post approval to reduce the significance of the identified impacts and further enhance the community engagements	
TEEPSA Block 5/6/7: exploration drilling	SLR Consulting (Pty) Ltd	June – July 2022	7 December 2022 12 May 2023		
TEEPSA OWOB: exploration drilling	SLR Consulting (Pty) Ltd	November 2022 May 2023	14 December 2022 12 May – 12 June 2023		
TEEPSA 11B/12B: production drilling	WSP Group Africa (Pty) Ltd	January 2023	14 February 2023		
TGS: reconnaissance	EIMS (Pty) Ltd	August / September 2022	25 November 2022 18 May 2023		
Searcher Geodata: reconnaissance	EIMS (Pty) Ltd	July 2022	13 October 2022 9 February 2023		
CGG Services SAS: reconnaissance	SLR Consulting (Pty) Ltd	April 2023	11 April – 31 May 2023		

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Karpowership Saldanha. power generation from gas	Triplo4 Sustainable Solutions	October / November 2022	13 December 2022	during implementation, should the project be implemented. The SIA specialist has made a reasoned opinion that the project can be approved on the basis of the outcomes of the consultations already undertaken. Communities are diverse and there are community members who are supportive of this type of development, as much as there are community members against the development. Communities were asked to suggest mitigation measures that the specialists should consider, and this influenced some of the recommendations made in the SIA. All perspectives were considered during the EIA process and the social impact analysis.	

142. Many members of the public will be confused by the various applications, with different processes, slightly different due dates, slightly different applicants all being branded the same with the same EAPs conducting similar EIA processes. It is inconceivable that affected coastal communities are able to respond to each of these processes in a meaningful way. This means that fishers must fish for a living, requiring them to be out at sea daily or for extended periods of time. Even if they wish to do so, they do not have the time or resources to attend multiple public meetings, engage with voluminous technical information, provide comments, ascertain whether their comments have been addressed in comments and response reports, and thereafter proceed to draft appeals. The result, even if unintended, is that those who have less resources, who are required to be out at sea to make their livelihoods, and/or who are unable to fully understand the different proposals and processes, are not able participate and engage meaningfully. The chilling effect is that they are significantly prejudiced by the onslaught of applications

143. There are many people, particularly those such as small-scale fishing communities and co-operatives who will be impacted by the project, who do not have access to the resources and expertise required to access, consider and comment on the records relating to the project, which are voluminous and technical in nature. The current estimate is

The SIA report makes detailed recommendations about further engagement with the communities, and other mitigation and management measures. The mitigation and management measures should be considered in its entirety within the context of the report. Efficient engagement with a community involves more than merely setting up a meeting and inviting people. In many communities there is an expectation that outsiders should enter the community via the leadership before a community meeting can take place. TGS needs to determine what the most appropriate way would be to interact, and this may differ between communities, in order to engage with the individuals and communities in a decolonised way. Once this is done, TGS can proceed with engaging with the communities as a whole in an appropriate way. Education is suggested as a mitigation measure to empower community members to make informed decisions where they are in a position to weigh up the pros and cons for themselves, as was requested by community members during the public meetings. The updated conditions (omissions) referred to were included for clarity.

The Appellants assertion that the voices of the communities have not been heard by virtue of the inclusion of conditions requiring that ongoing engagements, education and collaboration is unfounded. The purpose of these measures was to ensure that there were ongoing

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that around 136 unitary entities could be defined as 'communities' under the proposed community based rights allocation system. In the Western Cape and Northern Cape in particular, these settlements can seldom be described as 'communities' in the sense of small, spatially defined geographic units with a homogenous social structure and shared norms.[154] This is not recognised nor considered in the BAR or SIA in that the reports appear to limit their analysis by failing to consider the intricate social structures and norms within these "communities" thereby considering these communities as homogenous and disregarding their unique characteristics. 144. We attach hereto a letter from Carmelita Mostert, marked **Annex B5**, which was also separately sent to the Appeals Authority, which clearly sets out opposition to the seismic surveys based on the impact on fisheries, and points out their difficulties associated with having to find hardcopy reports and with having to consider how her community's comments have been considered by the EAP. 145. To ensure access to a reasonable, adequate and fair public participation process, TGS and their appointed EAP should have used reasonably distinctive and appropriate alternative methods to inform and educate affected communities and small-scale fishers of the significant adverse impacts that this project could have on them. Running a public participation process during time period could not achieve meaningful and effective consultation.	interaction, communication and feedback regarding the operational aspects. The EAP has conducted the impact assessment on the basis of the activities proposed by the applicant. Any subsequent authorisation would be restricted to these specifically assessed activities. Should the applicant or other applicants wish to undertake any additional exploration activities which are not addressed in the current Environmental Authorisation (EA) application, there would be a consequent need to apply for the relevant permissions. These would include a formal application for an Exploration or Production Right as well as a new EA. The impacts of such proposed activities would consequently require specific assessment and public consultation prior to approval. It is premature to assess the likely impacts of further invasive exploration activities or production activities as the extent, duration, location, and magnitude applicable to these activities are unknown at this stage. The NEMA EIA Regulations make a clear distinction between the reconnaissance, exploration, and production activities in that these are listed as distinct and separate listed activities. There is provision in law for these activities to be assessed on their merits as and when they are proposed.	

[154] Moenieba Isaacs and Mafaniso Hara. 2015. "Backing small-scale fishers: Opportunities and challenges in transforming the fish sector. Institute for Poverty, Land and Agrarian Studies Rural Status Report 2. University of Western Cape, at page 13. Access link here https://cer.org.za/wp-content/uploads/2016/08/Backing-Small-scale-Fishers_PLAAS.pdf

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146. The BAR included a Social Impact Assessment (SIA) that noted[159] that communities feel that there were significant gaps in the available data, and that from a social perspective the non-technical or social risks can potentially cause significant impacts. The report highlighted that potential social impacts identified included: • Uncertainty; • Further marginalisation of vulnerable groups; • Concerns about cumulative impacts; • Impact on livelihoods; • Impacts on sense and spirit of place; • Impacts on social license to operate; • Stakeholder fatigue and disillusionment; • Community expectations; and • Social unrest. 147. These impacts are rated in the final BAR as being of high or medium significance prior to mitigation, and as being medium significance post-mitigation.[160] 148. The report further pointed out that seismic reconnaissance projects are controversial in South Africa, and that while for many stakeholders it is an emotional matter, for others the potential of		

[159] Appendix 3.4 to the TGS final BAR, Social Impact Assessment, Equispectives Research and Consulting Services (Sept 2022), at p 101.
[160]

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2025

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impacting on their livelihoods is the biggest fear. The report indicates that some stakeholders feel that the exploration for fossil fuels is not in line with sustainable development and the fight against climate change, while other stakeholders feel that it is imperative for the growth and development of the South African economy to engage in these investigations. The expert describes this as a 'complex and wicked problem'.[161] 149. The report went on to state that from a social perspective, it is clear that the communities and the majority of local people are opposed to the project, and that because the project does not happen in a social vacuum, the social environment is much wider than the footprint of the project. The report states further that: *If the social risks and potential damage to cultural and indigenous rights are considered the impact on the social fabric of already vulnerable communities may be significant. At this stage communities feel that they cannot make informed decisions.*[162] *(emphasis added)* 150. Curiously, while this TGS SIA is almost identical to the SIA submitted in the Searcher draft BAR (ref. 1518), the TGS version omits the following sentence from the above paragraph:		

[161] Ibid, p8. In a footnote to the TGS final BAR, a 'wicked problem' is indicated as *'a problem that is difficult or impossible to solve because of incomplete, and changing requirements that are often difficult to recognise'*.
[162] Ibid, p10.

Initial/s:

2003

5078

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
From [a] social perspective the project can only be recommended after meaningful consultation, local research, education, and awareness raising has been done in the project affected communities.[144] *(emphasis added)* 151. An extract from the Searcher SIA is attached marked Annex B4. 152. Instead, the TGS SIA report makes the following recommendation: *From a social perspective it is recommended that the project proceed subject to the mitigation measures (i.e. meaningful consultation, local research, education, and awareness raising in the project-affected communities) forming part of the conditions for authorisation and being implemented prior to the commencement of the actual survey.*[145] 153. This recommendation is strikingly different to the recommendation made in the Searcher SIA, which stated as follows: *The recommendation is therefore that the project can only proceed once the social mitigation measures have been implemented and the community are sufficiently informed and educated to [be] able to engage in a meaningful manner.*[143] *(emphasis added)*		

[143] Searcher 1518 draft BAR SIA, p[illegible].
[144] TGS BAR, p[illegible].
[145] Searcher 1518 draft BAR SIA, p[illegible].

Initials

2004

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
154. The Appellants submitted in their comments on the draft BAR that recommending that the project proceed subject to meaningful consultation being undertaken – and included as a mitigation measure in the environmental authorisation and implemented prior to the commencement of the 'actual survey' – is highly irregular within the context of an environmental impact assessment.[146] There is no legal basis for meaningful consultation to be undertaken after an environmental authorisation is granted, and including such a recommendation as a condition of authorisation undermines the regulatory scheme for prior impact assessment that is subjected to public consultation. 155. Notwithstanding the above mentioned submissions, the environmental authorisation ("EA") approves the BAR and EMPr, and indicates that it is mandatory for the holder to implement all the recommendations and management measures stipulated in the EMPr throughout all phases of the proposed activities.[147] The EA also stipulates as a specific condition that a community engagement protocol that is based on the San Code of Research Ethics be developed, in consultation with the affected communities and must include a community strategy and grievance mechanism.[148] The EMPr in turn includes as mitigation measures various recommendations under the heading 'Socio-Economic Considerations', all of which are indicated as to be implemented 'Prior to Operation and ongoing'.		

[146] Para 120 at page 60 of Green Connection and Natural Justice DBAR comment submission.
[147] EA, section 5.4.1.
[148] EA, section 5.5.15.

Initials

2005

8208

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
156. The Appellants submit that notwithstanding the public participation processes conducted during the BAR and the SIA processes (which the appellants submitted in paragraphs 115- 121 above, were not adequate or meaningful), it is clear from the SIA that communities and the majority of local people are opposed to the project and that seismic survey companies do not have a 'social license to operate'. The SIA indicates that *'If TGS...wants to proceed with the project, they will need to engage in meaningful conversation with the communities and try to restore relationships. From a community and social risk perspective this is not negotiable'.*[169] The inclusion of mitigation measures in the EMPr (and by reference the EA) fails to adequately take into account the needs and values of the communities (and small scale fishers) who are opposed to the seismic survey.[170] Their voices in opposition to the seismic survey remain unheard in the final BAR and EA. Furthermore, it is submitted that the mitigation measure that TGS should (prior to the operation and on an ongoing basis) *'consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in the future'*[171] cannot be a substitute for meaningful consultation with communities and local people during the EIA process. It is submitted further that such an approach violates the principles of fair administrative decision-making and the right of interested and affected communities to be meaningfully consulted prior to a decision on authorisation being made, and is inconsistent with section 2(4)(f) of NEMA, which stipulates that the participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the		

[169] TGS SIA, p107.

[170] Section 2(4)(g) of NEMA requires that decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge.

[171] EMPr, section 13.7 item D.

Initials

2006

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured. 157. The Appellants also note that the SIA states further that the seismic survey industry should reassess their position and social license to operate as an industry in the South African context and should conduct a strategic environmental assessment of the impact of the industry.[172] Notwithstanding this, the report makes a one-sided assumption that the discovery of commercially exploitable fossil oil or gas resources would be beneficial to the economic development of South Africa: *'Potential future benefits and the economic development of the country should the surveys find any significant resources are not disputed'*.[173] The Green Connection and Natural Justice submit that the SIA should have reflected the many negative socio-economic impacts that could or are likely to manifest should commercially exploitable reserves be found and developed through to production and use (including but not limited to the socio-economic costs of climate change[174]). 158. In light of the above, the Appellants submit that the public participation process, including the SIA conducted, did not constitute meaningful consultation with communities and local people (and in particular small-scale fishers), and that the mitigation measures requiring further consultation after the EIA has been conducted and a		

[172] Ibid p109.

[173] Ibid, p109.

[174] In 2021 an international team of scientists published their findings that economic damage from climate change could be six times higher by the end of this century than previously estimated. See:
https://www.ucl.ac.uk/news/2021/sep/economic-cost-climate-change-could-be-six-times-higher-previously-thought

Initials

2007

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
decision on authorisation made (but prior to the operation and ongoing thereafter) does not cure this flaw in the EIA process. As a consequence, it is submitted that the EA should be overturned on appeal.		
Ground 5. The FEAR does not contain a proper and objective assessment of the negative impacts of the project on people's human rights 159. Small-scale or subsistence fishers in coastal communities heavily rely on local fish populations for their livelihood and cultural practices. If seismic surveys lead to a reduction in fish stocks, it can have negative consequences for these fishers. They may experience reduced catch rates, economic losses, and disruptions to their traditional fishing practices. Furthermore, the cultural and heritage aspects tied to fishing may be undermined if fish populations decline significantly, as it can impact the intergenerational transmission of traditional knowledge and practices. 160. To better understand the correlation and potential impacts, comprehensive scientific studies and assessments are necessary. These studies would need to evaluate the specific local conditions, fish populations, and cultural contexts of the coastal communities in question. 161. Mitigation measures that are proposed within the EMPr, the specialist acoustic studies, socio-economic impact studies and	Section 9.3.3.1 of the BAR in dealing with the cultural heritage impacts, details the following: "The cultural heritage and living heritage related to the communities linked to fisheries and ocean subsistence and further identifying as indigenous communities can potentially be impacted by the proposed project. This impact is indirect and is in the community perceived to be primarily linked to their economic existence as a result in the loss of fishing yield." The Marine Ecological Assessment and the fisheries impact Assessment did not find that there would be a significant impact fishing activities as a result of the proposed seismic survey. As a result, the assumption by the Appellant that there would necessarily be an impact on the cultural practices, is questioned. It should further be noted that the specific local conditions, fish populations, and cultural contexts of the coastal communities in question were considered as part of the BAR as detailed in the Section 8 and 9 and Appendix 3 of the BAR. It is not disputed that the "small-scale or subsistence fishers in coastal communities often have deep cultural and heritage associations with fish and the marine environment. Their practices, traditions, and identity are intertwined with these resources." The impacts identified and the mitigation measures proposed in the Cultural Heritage Assessment and Social Impact Assessment, made it clear that the direct impact on fish populations was considered in detail and highlighted the cultural and heritage significance of fishing. Based on the findings of these studies and as detailed in the BAR, it was the	

Initials

2008

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
heritage impact studies such as adjusting survey timing and locations, implementing exclusion zones, and using sound mitigation technologies, can help reduce the potential negative impacts of seismic surveys on marine life. However, when it comes to the cultural and heritage associations of fish and the broader marine environment, proposing the above mentioned mitigation measures which solely focus on reducing direct impacts on fish populations, may fail to address the complex nuances and broader concerns.[175] 162. Small-scale or subsistence fishers in coastal communities often have deep cultural and heritage associations with fish and the marine environment. Their practices, traditions, and identity are intertwined with these resources. Simply mitigating the direct impact on fish populations may not adequately address the cultural and heritage significance of fishing. Preserving cultural practices, traditional knowledge, and the social fabric of coastal communities requires a more holistic approach that recognizes and respects their unique relationships with the marine environment. 163. Small-scale or subsistence fishers in coastal communities understand through their indigenous knowledge of fishing, that the marine ecosystem is capable of sensitivity to outside interferences. As fishers, they have observed that even the slightest interference with the sensitive marine ecosystem will have an impact on every fish in the ocean, and as a result their livelihoods. Plankton, for example, are the most sensitive to any interferences which indirectly have implications for the larger fish species that feed on plankton. Scientific experts have confirmed in their expert assessments that it is likely that the sound blasting in the ocean caused by seismic	opinion of the specialists and the EAP, that the there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the reconnaissance activities, the findings of the specialist studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team and the EAP that the significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures and the project should be authorized. Consequently, and with due consideration of the mitigation measures recommended by the Cultural Heritage and Social Impact Assessments, it was the opinion of the Applicant and the EAP that the proposed survey will not detrimentally affect cultural practices, traditional knowledge, and the social fabric of coastal communities. Specific mitigation measures that point to the robust consideration of the human rights aspects identified in the BAR include the following: • TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism. • TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. • Consult with communities on potential ways in which to make a positive contribution to the communities.	

[175] Page 217-218 of the FBAR

Initials

2009

628

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
surveys will impact on the behaviour of plankton decreasing the number of plankton in the water.[176] Furthermore experts are of the opinion that seismic testing will have a significant adverse impact on numerous species of marine fauna, including endangered and vulnerable species located in the exploration area, and zooplankton.[177] 164. Mitigation measures that solely focus on addressing direct impacts on fish populations may not be appropriate for effectively addressing the indirect and cumulative effects on the broader ecosystem/ecocentric based cultural and heritage rights associated with fishing. Eco-centric based cultural and heritage rights are rights that can be defined as rights that acknowledge that ecosystems, species, and natural elements have their own rights and should be respected and preserved for their inherent worth, beyond their instrumental value to humans. Within this framework, cultural and heritage rights are understood in relation to the natural environment. Ensuring the protection of eco-centric based cultural and heritage rights involves recognizing and safeguarding the cultural practices, knowledge systems, traditions, and spiritual beliefs of indigenous and local small-scale or traditional fishing communities and other groups that have a close relationship with their surrounding ecosystems. These rights encompass the right to maintain and protect cultural landscapes, sacred sites, traditional	• A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with adjusting the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective. The above mitigation measures demonstrate that there is an onus on the applicant to further engage and develop a deeper understanding of the cultural and social aspects and practices within these communities. The nuances associated with potential disruption of fish behaviour, altered migration patterns, and changes to the ecological dynamics that are crucial to the cultural and heritage aspects tied to fishing, was assessed in detail in the Marine Ecological Assessment and included in Section 9 of the BAR for each of the organism groups. The impacts associated with each of these groups were found to be of LOW significance and fully reversable. It should further be noted that in terms of the fishing, the fisheries assessment was duly cognisant of the relationship between the small scale fishers and the application area, as well as the TEK, which some of the community member referred to during the public meetings, and was duly considered by the specialists. This is evidenced by the following extract from Section 8.5.3.10 of the BAR: *"Small-scale fishermen along the Northern Cape and Western Cape coastlines are*	

[176] McCauley et al, *Widely used marine seismic survey air gun operations negatively impact zooplankton* (2017), https://www.nature.com/articles/s41559-017-0195

[177] Fewtrell, J.L. and McCauley R.D., 2012. Impact of air gun noise on the behaviour of marine fish and squid. Marine Pollution Bulletin 64 (2012) 984–993; Harris JM, Olbers JM, and Wright K. 2022. "Report on Scientific basis for concerns of significant harm inflicted to marine wildlife by 2D and 3D Seismic Surveys on the South and West Coasts of South Africa."

Initial

2010

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
ecological knowledge, and sustainable resource management practices.[178] 165. The examples of proposed mitigation measures formulated by the EMPr inadequately acknowledge the substantial impact on ecosystem/ecocentric based cultural and heritage rights resulting from the broader indirect and cumulative consequences on fishing populations. 165.1. Implementing exclusion zones to minimize direct impacts on fish populations and sensitive habitats does not sufficiently address the broader ecosystem/ecosystem based cultural and heritage associations of fishing. While exclusion zones can help protect specific areas from immediate harm, they may not consider the holistic connections between fish populations, migration routes, and the cultural practices of coastal communities that extend beyond specific locations. 165.2. Using sound mitigation technologies, such as acoustic deterrent devices, can help reduce the direct impacts of seismic surveys on marine life. However, these measures may not fully address the indirect and cumulative effects on cultural and heritage rights. They primarily focus on	*unlikely to range beyond 20 km from the coastline; thus, inshore of the Reconnaissance Permit area (refer to Figure 83). This assessment is however cognisant of the ongoing issues related to the perceived areas fished and species targeted by SSF off the West Coast of South Africa e.g. that cultural practice of SSF may occur to 55 km offshore. While SSF regulations clearly specify that fishing is required to take place "nearshore" the actual differentiation between SSF and other fishing operations that might include SSF, such as the commercial "traditional linefish" and "pole and line" and the extent to which these commercial fisheries might include SSF, remains unclear. As such the offshore extent to which SSF may operate requires a precautionary approach in this assessment and consideration that the possibility exists (albeit a remote possibility that cannot be verified through the information made available on these fisheries), that SSF may have occurred historically and potentially in the future further offshore than suggested by the information made available for this assessment i.e. there is a remote possibility that some SSF may have targeted certain species (of which tuna and snoek are the main candidate species) further offshore than 20 km. The distance fished offshore by SSF and the associated risks determined in this assessment further necessarily considers practical aspects, notably that bottom fishing is impractical in waters deeper than 100 m and as such any bottom fishing, whether SSF or commercial, is highly unlikely beyond a precautionary depth being the 100 m depth contour. Further, in regard to migratory species, such as longfin tuna and snoek, economic and regulatory aspects relating to distances fished offshore is pertinent (i.e. such as the requirements of the South African Maritime Safety Authority (SAMSA)) in particular that most SSF are not likely to be "B" class certified (i.e. can operate up to 40 nm offshore and*	

[178] Akwasi-Achemfuour (2021) Balancing the interests of wildlife and humans resulting in sustainable ecotourism: the case of Boabeng-Fiema Monkeys' sanctuary, Ghana. In: McIntyre-Mills JJ, Corcoran Nantes Y (eds) From polarization to multispecies relationships: re-generation of the commons in the era of mass extinctions. Springer, New York, pp 519–536; McIntyre-Mills, J.J., Makaulule, M., Lethole, P. et al Ecocentric Living: A Way Forward Towards Zero Carbon: A Conversation about Indigenous Law and Leadership Based on Custodianship and Praxis. Syst Pract Action Res 36, 275–319 (2023). https://doi.org/10.1007/s11213-022-09604-0

Initials:

2011

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
reducing noise levels and immediate physical harm, but do not consider the potential disruption of fish behavior, altered migration patterns, or changes to the ecological dynamics that are crucial to the cultural and heritage aspects tied to fishing. 165.3. Temporal restrictions, such as conducting seismic surveys during specific seasons or avoiding critical reproductive periods, may help reduce direct impacts on fish populations. However, these restrictions may not fully address the indirect and cumulative effects on the cultural and heritage rights associated with fishing. Cultural practices and traditional knowledge often extend beyond specific seasons and reproductive periods, and the long-term sustainability of fishing traditions and associated rights may depend on the availability of fish populations throughout the year. 165.4. Implementing measures specifically focused on protecting certain fish species or habitats may not comprehensively address the broader cultural and heritage rights tied to fishing. While protecting specific species or habitats is important for biodiversity conservation, cultural and heritage associations with fishing often encompass a diverse range of species, ecosystems, and traditional practices that go beyond the conservation of individual components.	*are longer than 9 m) are likely limited to "C" class being mainly vessels of <9 m21 permitted to only operate < 15 nm offshore."* It should be noted that the ecosystem level impact and interrelationships are described in section 4.3.8 of the Marine Ecological Assessment. The recommendation of the SIA is that, should the project be approved a representative from TGS must consult with leadership of the community to determine how the communities should be consulted with in future – that is, what is the way the community members prefer to be consulted with for provision of commencement notification and/or daily updates to advise on survey schedules, communication in respect of the proposed research outcomes, etc. The recommendation to include further consultation as part of the conditions of authorisation intends to ensure that the consultation process goes further than just the EIA process, but is continued throughout the entire process, regardless of the outcome. This will assist communities and people on the ground to make informed decisions about technical matters. The intention of the recommendation is not for this condition to be suspensive or determinant on the ultimate decision but rather to function as an additional management/ mitigation measure to be implemented post approval to reduce the significance of the identified impacts and further enhance the community engagements during implementation, should the project be implemented. The SIA specialist has made a reasoned opinion that the project can be approved on the basis of the outcomes of the consultations already undertaken. Communities are diverse and there are community members who are supportive of this type of development, as much as there are community members against the development. Communities were asked to suggest mitigation measures that the specialists should consider, and this influenced some of the recommendations made in	

Initials

2012

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
166. To effectively address the indirect and cumulative effects on ecosystem/ecocentric based cultural and heritage rights associated with fishing, mitigation measures should take a more holistic and inclusive approach that consider and incorporate the following aspects: 166.1. Incorporating the perspectives and insights of coastal communities into decision-making processes, ensuring their meaningful participation in the development and implementation of mitigation measures. 166.2. Recognizing and preserving cultural and heritage practices by considering the broader socio-cultural contexts, intergenerational knowledge transfer, and the long-term sustainability of traditional fishing practices. 166.3. Integrating traditional ecological knowledge with scientific research to inform mitigation strategies and ensure that they address the interconnectedness of fish populations, ecosystems, and cultural and heritage rights. 167. While the mitigation measures may focus on reducing direct impacts, there can be indirect and cumulative effects that are not fully addressed. Seismic surveys, even with mitigation, can still cause disturbances, alter fish behavior, or disrupt migration patterns, which may have cascading effects on the broader ecosystem. 168. Given the ecosystem impacts, seismic testing will likely result in a trophic cascade affecting all levels of the food chain and therefore indirectly impacting on small-scale fishing communities. The Fisheries Specialist failed to assess the potential impact of the seismic surveys on zooplankton in and around the survey area, as well as the knock-on effects that zooplankton die-off would have on the fish species on	the SIA. All perspectives were considered during the EIA process and the social impact analysis.	

Initials

2013

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
which small-scale and subsistence fishers rely for their sustenance and livelihood.[179] These indirect knock on and cascading effects on the dynamic and interconnected ecosystem could potentially affect not only food security for local small-scale fishing communities, but could also impact on the ecosystem/ecocentric based cultural and heritage rights associated with fishing. Counter to the requirements of NEMA and the NEM:ICMA, the BAR and the competent authority's decision does not consider impacts from an ecosystem perspective, and as a consequence, the "downstream" impacts have not been adequately assessed and presented to the DG. 169. Additionally, the cumulative impacts of multiple surveys or other anthropogenic activities in the area need to be weighed together. These indirect and cumulative impacts can have implications for cultural and heritage associations, as they may disrupt traditional practices and the functioning balance of the marine ecosystem. 170. Given the absence of a socio-economic impact assessment which adopts an ecocentric and ecosystem approach to the assessment of impacts, and which should have evaluated the cascading impacts on food webs, and how this will impact on the right to access of sufficient food as well as the associated connections of heritage and cultural rights to the practices of fishing, relevant information was not placed before the decision-maker. In the absence of that information, a precautionary approach should have been adopted. This omission is material – the right to food and culture and heritage are constitutionally enshrined – and consequently the authorisation should not have been granted.		

[179] Page 77 -82 of Fisheries Specialist Study

Initials

2014

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMIRE/PASA
171. Small-scale fishers often possess traditional ecological knowledge ("TEK"), which includes their understanding of fish behavior, spawning grounds, and the dynamics of the marine environment. This knowledge is often based on observations passed down through generations and is deeply connected to their cultural heritage. Proposing mitigation measures without considering and incorporating TEK may overlook valuable insights and alternative approaches that could better protect both the fish populations and the ecosystem/ecocentric based cultural and heritage rights of coastal fishing communities. 172. Given the above, it is submitted that the proposed and authorised mitigation measures are inadequate. The mitigation measures set out in the EMPr are designed to re-assess impacts post-project.[187] This is flawed for a number of reasons, including: 172.1. The proposed measures are aimed at providing "resources and support for communities to develop and undertake safeguarding measures or plans to enhance the mitigation capacity of their intangible cultural heritage by fostering dialogue, mutual understanding and reconciliation between and within communities" which in no way holds TGS accountable for any impacts caused by the 3D seismic surveys activities. 172.2. The proposed mitigation measures fail to comprehend and mitigate any of the economic or		

[187] Page 30 of the EMPr

Initials:

2015

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
other harms to livelihoods, and cultural and heritage practices and identity. 173. The pre-mitigation significance given to the socio economic and cultural and heritage impacts are rated as Medium, and then Low post mitigation. If mitigation does not actually change the impacts, then it is implausible that the rating can change significantly as well. There is no rational connection between the results of the arbitrary, and somewhat absurd, mitigation measures and any change in significance with regards to the impacts caused by the reconnaissance activities on coastal communities. 174. The Social Impact Assessment (SIA) and Heritage Impact Assessment urges the need for dialogue and engagement with communities prior to the commencement of these activities as the Expert confirms that the oil and gas companies do not have a social license to continue currently.[161] However, there is evidence of any further dialogue with these communities with regards to addressing issues specifically relating to the indirect and cumulative effects on cultural and heritage rights associated with fishing. 175. Therefore, engaging and involving coastal communities in the decision-making process is crucial. Meaningful consultation and participation allow communities to express their concerns, share their knowledge, and contribute to the development of effective mitigation measures. Failure to include the perspectives and needs of these communities can result in measures that do not adequately		

[161] Page 109-110 of the SIA, and page 56, 58 of HIA.

Initials

2016

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
address their cultural and heritage associations and may lead to further marginalization. 176. Despite the apparent expert knowledge and the level of understanding expressed in the report recommendations regarding the potential effects of the seismic survey proceeding on the communities' identity, sense of place, and spiritual, cultural, and indigenous rights, and that decisions must consider the interests, needs, and values (our emphasis) of all interested and affected parties, including acknowledging all forms of knowledge, including traditional and ordinary knowledge,[182] it is clear that necessary deep conversations with coastal communities were not conducted. Consequently, insufficient information was placed before the decision-maker, and he/she neglected to afford sufficient weight to the indigenous and cultural rights of coastal communities.		
Ground 6: Failure to consider relevant coastal management considerations or to comply with the National Environmental Management: Integrated Coastal Management Act 24 of 2008 177. Section 63(1) of NEM:ICMA requires a competent authority to take account of specific factors when deciding whether or not to grant an environmental authorisation under NEMA for "coastal activities". By virtue of this section, the decision maker ought to have appreciated that in deciding whether to grant an environmental authorisation or not, he or she was required to consider additional	Section 4 of the EAR does list the Integrated Coastal Management Act (ICMA) and the Marine Living Resources Act. The decision-making authority was required to consider the principles and obligations of the ICMA in the decision making process. The marine fauna study assesses the potential impacts of the survey on the marine environment. The proposed survey activities to be undertaken by TGS are expected to result in impacts on marine invertebrate fauna in the Orange Basin, ranging from negligible to very low significance. Only in the case of potential impacts to turtles and marine mammals are impacts of low significance expected. If all	

[182] Section 2(4)(g) of NEMA.

Initials

2017

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
factors specified in section 63 of NEM:ICMA[183] and whether or not the proposed project "would be contrary to the interests of the whole community". This required an eco-centric consideration of the impacts of the proposed project in an area that must be afforded a particularly high standard of protection given the natural functioning of the dynamic coastal processes. 178. Section 12 and 21 set out the State's obligation in relation to the management of the coastal zone, which must be taken into account in taking a decision in respect of this zone. 179. The Director-General's decision makes no mention of section 63 of NEM:ICMA, and the ESIA contains no evidence that the factors set out in section 63 was considered or assessed. Whilst the BARidentifies that section 63 of NEM:ICMA is applicable, it does not assess each of the factors set out in section 63. 180. Read together, this means that there was no factual investigation as required by section 63 of the NEM:ICMA, including a determination of whether the coastal public property and the coastal protection zone would be impacted, and if so, to what extent the proposed activity is consistent with the goal of establishing or protecting those areas.[184]The management plans that are relevant in these areas, like the Coastal Management Programme for the	environmental guidelines, and appropriate mitigation measures recommended in this report are implemented, there is no reason why the proposed seismic survey programme should not proceed. With respect to the management and conservation of protected areas noted in the ICMA and MLRA, this is discussed in Section 8.6 of the BA Report. In terms of protected areas, Child's Bank and Tripp Seamount lie outside of the proposed 3D survey area, and any demersal species associated with these important fishing banks would receive the seismic noise within the far field range, and outside of distances at which physiological injury or avoidance would be expected. Despite the current lack of knowledge of the community structure and endemicity of South African macroinfauna off the edge of the continental shelf, the marine component of the 2018 National Biodiversity Assessment, rated the South Atlantic bathyal and abyssal unconsolidated habitat types that characterise depths beyond 500 m, as being of 'Least concern', with only those communities occurring along the shelf edge (-500 m) being considered 'Vulnerable'. This primarily reflects the great extent of these habitats in the EEZ. Numerous sanctuaries, marine protected area (MPA) exist offshore and along the coastline of the Western Cape, although none of them overlap with the Reconnaissance Permit Area. Seismic surveying is not only used for petroleum and natural gas exploration and development. In addition, the National Coastal and Marine Spatial Biodiversity Plan for the coast and ocean around the South African mainland states that petroleum production may be possible in CBAs using lateral drilling or other techniques that do not result in biodiversity impacts. According	

[183] S 63(1)(c), s 63(1)(h)(i), s 63(1)(h)(iv) and s 63(1)(i) of NEM:ICMA.
[184] Section 63(1)(c) of NEM:ICMA.

Initials

2018

5425

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
Western Cape Province,[185] have also not been taken into consideration. 181 The BAR does not, at any point, consider the interests of the affected human and non-human communities in any collective way. Consequently, the interests of the whole community[186] have not been presented to the decision-maker in the BAR, and without evidence of specific consideration of these interests in the Reasons for the Decision, the decision-maker has not evaluated these interests in their decision to grant environmental authorisation. 182. As set out elsewhere in this appeal, the impacts associated with seismic surveys could have significant impacts on marine life and coastal communities. Oceans play a critical role in regulating the climate and mitigating global warming by absorbing carbon dioxide. Seismic surveys pose a significant threat to functioning marine ecosystems, to living organisms in South Africa's coastal waters, and	to the plan if significant petroleum resources are identified in these areas the selection of the site as a CBA could be re-evaluated, although this would require alternative CBAs to be identified to meet biodiversity targets. No MPAs are located within the proposed survey area. Zero no-go areas within the proposed survey area have been identified in any of the specialist studies conducted. It should further be noted that the interests of the whole community (from and intra- and inter-generational perspective, as well as having regard to potential impacts on living organisms in South Africa's coastal waters) was indeed assessed in the assessing of the marine ecology, the impact on the fishing industry, the detailed social and cultural heritage assessments, and the public consultation undertaken. With regards to the requirements of Section 63 of the NEM:ICMA, the Competent Authority thus had sufficient information at their disposal in order to reach an informed decision regarding the proposed activity.	

[185] Western Cape Coastal Management Programme: 2016 available at https://cer.org.za/wp-content/uploads/2009/12/Western-Cape.pdf
Draft Western Cape Coastal management Programme 2022 – 2027 available at https://www.westerncape.gov.za/eadp/files/atoms/files/DRAFT%20Western%20Cape%20Provincial%20Coastal%20Management%20Programme%202022-2027.pdf.

[186] In terms of the National Environmental Management: Integrated Coastal Management Act 24 of 2008 (NEM:ICMA), the 'interests of the whole community' is defined as meaning the collective interests of the community determined by:

(a) prioritising the collective interests in coastal public property of all persons living in the Republic over the interests of a particular group or sector of society;

(b) adopting a long-term perspective that takes into account the interests of future generations in inheriting coastal public property and a coastal environment characterised by healthy and productive ecosystems and economic activities that are ecologically and socially sustainable; and

taking into account the interests of other living organisms that are dependent on the coastal environment.

Initials:

2019

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
to communities that depend upon the oceans for their livelihoods. Small-scale fishers and fishing-dependent communities are particularly vulnerable to the negative impacts on fish stocks upon which they depend for their livelihoods. 183. The Appellants submit that it is not in the interests of the whole community (from and intra- and inter-generational perspective, as well as having regard to potential impacts on living organisms in South Africa's coastal waters) to expose our oceans and coasts to the increased risks associated with seismic surveys, or associated with further intended exploratory drilling and/or production activities.		
<u>Ground 7</u> *Failure to provide adequate reasons for the decision* 184. The reasons for the DG's decision, as described in Appendix 1 of the Environmental Authorisation ("the EA"), sets out that the following were 'key findings' that resulted in the decision to approve TGS's application for environmental authorisation: 185. The decision concludes as follows: *In view of the above, and having taken into consideration environmental management principles as set out in section 2 of NEMA, this Department is satisfied that the proposed activity will not be in conflict with the objectives of Integrated Environmental Management set out in Chapter 5*	It is the opinion of the Applicant that the Competent Authority thus had sufficient information at their disposal in order to reach an informed decision regarding the proposed activity.	

Initials:

2020

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
of [NEMA] and will not result to any detrimental risks to the environment and public. The environmental authorisation is accordingly granted. 186. These reasons, and the conclusion arising from these reasons are generic and unsubstantiated. The reasons are almost verbatim the same reasons provided by the DG in other oil and gas related applications, such as those contained in the Environmental Authorisations for Searcher Geodata UK Limited and TotalEnergies EP South Africa Block 567 (Pty) Ltd . The EA itself further fails to deal substantively with any of the main issues raised by the Appellants and other I&APs. 187. On the reasons provided, it is impossible to conclude that the DG took all relevant considerations into account, including the submissions made by the Appellants and other interested and affected parties. To the contrary, it appears that the DG failed to consider all relevant information, for the reasons set out elsewhere in this appeal		
Ground 8. Decision to grant authorisation contravenes NEMA Principles, the Constitution and PAIA 190. Section 33 of the Constitution recognises that everyone has the right to administrative action that is lawful, reasonable and procedurally fair. PAIA seeks to give effect to this right.	It is the opinion of the Applicant that the Competent Authority thus had sufficient information at their disposal in order to reach an informed decision regarding the proposed activity.	

Initials

2021

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
191. From what is set out above, it is clear that the decision to grant authorisation to TGS runs contrary to at least the following NEMA principles: 191.1 Decision-makers must apply the precautionary principle when there is uncertainty or lack of scientific consensus regarding potential environmental harm. This principle requires taking preventive action to avoid serious or irreversible environmental damage, even in the absence of full scientific certainty. 191.2. Decision-making should promote equity and fairness in the distribution of environmental benefits and burdens. This principle recognizes the rights of all individuals, particularly disadvantaged and vulnerable groups, to a healthy environment and seeks to avoid disproportionately negative impacts on these groups. 191.3. Decision-makers must protect and conserve ecosystems, biodiversity, and ecological processes. This principle recognizes the intrinsic value of ecosystems and the critical role they play in supporting life and maintaining ecological balance. 192. It is further submitted that 192.1. irrelevant considerations were taken into account or relevant considerations were not considered;		

Initial/s

2022

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
192.2. the action itself contravenes a law or is not authorised by an empowering provision; 192.3. the action itself is not rationally connected to the information before the administrator; and 192.4. the exercise of the power or the performance of the function authorised by the empowering provision, in pursuance of which administrative action was purportedly taken, is so unreasonable that no reasonable person could have so exercised the power or performed the function. 193. The decision is consequently reviewable under section 6(2) of PAJA. CONCLUSION 194. The Appellants have sent out in this appeal a number of grounds on which the decision to grant environmental authorisation to TGS was fatally flawed. The decision to authorise the project is consequently unlawful, in that it failed to comply with, inter alia, the Constitution and NEMA.		

ARR comments by Case Officer

Approved by Supervior

Initials/Date

2023

Name & Surname:

Date:

Signature:

Name & Surname:

Date:

Signature:

7

Initials

2024

Annexure A.

REPORT ON SCIENTIFIC BASIS FOR CONCERNS OF SIGNIFICANT HARM INFLICTED TO MARINE WILDLIFE BY 2D and 3D SEISMIC SURVEYS ON THE SOUTH AND WEST COASTS OF SOUTH AFRICA

Harris JM, Olbers JM, Wright K

14 January 2022

This report provides a summary of key findings in peer-reviewed literature on the physiological and ecological impacts of seismic survey activities on marine wildlife, with specific attention to the relevance of the information to the context of the Reconnaissance Permit Area (~297 089 km^2) applied for by Searcher Geodata UK Limited, located offshore between the South African/Namibian border and Cape Agulhas, as well as with regards to vulnerable and endangered species known to occur in this area, with consideration of the proposed timing of the seismic survey operations being during the austral summer months. Having carefully considered the available information it is our opinion that seismic surveys do cause harm to both species and ecosystems, and that significant direct harm to individual animals and harm to populations of endangered species is the most likely scenario in the case of the seismic surveys off the south and west coasts of South Africa. Of specific concern is the impact on humpback whales and southern right whales which are still frequenting the west coast during the summer months (December – February), the impact on critically endangered (leatherback) turtles (migration routes in the area), the critically endangered African Penguin (changes in foraging behaviour and impacts on fitness) and the Cape fur seal (and consideration of current mass die-offs). We conclude that these seismic surveys are inadvisable in austral summer months due to the presence of these species in the area, the increasing anthropogenic

EXECUTIVE BOARD MEMBERS: Mr A Mzimba (Chairman), Mrs H Newton-King (Vice Chair), Mr P Botha, Mrs P Ellis, Mr E Mahlahla, Mr A Patel, Ms P Radebaya, Mr N Batayi
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forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002

Email: appeals@dffe.gov.za

APPEAL RESPONSE REPORT

PROJECT NAME/TITLE: PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT PROJECT LOCATED OFFSHORE THE WEST COAST, SOUTH AFRICA

PROJECT LOCATION: ORANGE BASIN LOCATED OFFSHORE THE WEST COAST, SOUTH AFRICA

PROJECT REFERENCE NUMBER: PASA REF: 12/1/040

DMRE REF: 1520

DATE PROJECT/ACTIVITY AUTHORISED: 17th of April 2023

DATE NOTIFIED OF DECISION: 26th April 2023

Initials:

DETAILS OF THE APPELLANT	DETAILS OF THE APPLICANT
Name of appellant: The Green Connection and Natural Justice	**Name of applicant:** TGS Geophysical Company (UK) LTD
Appellant's representative (if applicable): Green Connection: Liziwe McDaid Natural Justice: Melissa Groenink-Groves	**Applicant's representative (if applicable):** Mr Jevon Hilder
Postal address: 53 Hout Street, Cape Town	**Postal Address:** 8 Dalmeny Road, Pine Park, Randburg PO Box 2083, Pinegowrie 2123, South Africa
Email Address: liziwe@mweb.co.za / melissa@naturaljustice.org	**Email Address:** EIMS Public Participation Team tgs@eims.co.za; jevon.hilder@tgs.com
Telephone number: 082 731 5643	**Telephone number:** 011 789 7170
Fax Number: N/A	**Fax number:** N/A

Initial/s:

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
INTRODUCTION 1. This is an appeal to the Honourable Minister of Forestry, Fisheries and the Environment ("Appeal" to the "Minister"), directed to the Director: Appeals and Legal Review of the Department of Forestry, Fisheries and the Environment ("DFFE"), to set aside the decision of the Director-General of the Department of Mineral Resources and Energy (as "DG" or "DMRE") dated 17 April 2023 granting environmental authorisation to TGS Geophysical Company (UK) (as "Third Respondent") allowing for a 3D seismic survey off the West Coast of South Africa. 2. The Minister should set aside the decision to grant authorization because the Environmental Basic Assessment Report (FBAR) did not comply with NEMA in several ways. The decision to grant authorization violates various provisions of NEMA, including the requirements for granting environmental authorizations and the National Environmental Management Principles. The FBAR and the decision-maker failed to establish the need and desirability of the Project, failed to adequately consider marine impacts, and neglected to assess the cumulative impacts of the Project. The Second and Third Respondent also failed to engage in meaningful consultation, violating principles of fair administrative decision-making and the right of affected communities to be consulted. This failure to consult is inconsistent with NEMA's requirement to promote participation and take into account the interests of all parties. Moreover, the decision-maker disregarded NEMA Principles, including the precautionary principle and the principle of sustainable development, as well as the constitutional right to a non-harmful environment. The decision therefore to issue the authorization and the reasons provided are deemed irrational and unreasonable. 3. The Appellant submit this appeal on the following grounds:	For the reasons provided in the responses below it is the opinion of TGS Geophysical Company (UK) (TGS) that the Environmental Authorisation (EA) should remain valid, since the Basic Assessment Process was conducted in line with the requirements of the Environmental Impact Assessment (EIA) Regulations, 2014, as amended. This included amongst others that: • The Need and Desirability of the Project was adequately addressed and assessed – Refer to Section 5 of the Basic Assessment Report (BAR)); • Marine and cumulative impacts were considered in detail in the BAR – refer to Section 9 of the BAR; • The EAP appointed for the project conducted an extensive Public Consultation Process, which resulted in meaningful consultation – Refer to Section 7 and Appendix 2 of the BAR; • As stated in Section 11.3 of the BAR, The findings of the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the reconnaissance activities, the findings of the specialist studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team and the EAP that the significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures and the project should be authorized.	

Initials

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3.1. Ground 1: A flawed and misguided need and desirability assessment 3.1.1. Climate Change Impacts. 3.1.2. The climate crisis. 3.1.3. South Africa's international climate change commitments. 3.1.4. Need for seismic data. 3.2. Ground 2: Failure to adequately consider marine impacts 3.2.1. Underwater sound from acoustic seismic surveys. 3.2.2. Harms to marine life. 3.2.3. Acoustic Modelling 3.2.4. Heightened Legislative Requirements are Not Considered for Critical Biodiversity Areas (CBAs), Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs). 3.2.5. CBAs 3.2.6. EBSAs and MPAs. 3.2.7. Cape Fur Seals 3.2.8. Whale and Dolphins. 3.2.9. Fish. 3.2.10. Zooplankton. 3.2.11. The proposed mitigation measures are inadequate to prevent unacceptable harm to marine life. 3.2.12. Simultaneous Surveys. 3.2.13. Lack of baseline noise assessment. 3.2.14. Chronic Noise Impacts.	It is not clear from the evidence presented by Appellant, that they have sufficient mandate from the communities that they claim to represent.	

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3.3. Ground 3: Failure to adequately assess cumulative impacts 3.4. Ground 4: Failure to conduct meaningful consultation with communities and local people (and in particular small-scale fishers), within the public participation process, including the Social Impact Assessment process. 3.5. Ground 5: The FBAR does not contain a proper and objective assessment of the negative impacts of the project on people's human rights 3.6. Ground 6: Failure to consider relevant coastal management considerations or to comply with the National Environmental Management: Integrated Coastal Management Act 24 of 2008 3.7. Ground 7: Failure to provide adequate reasons for the decision 4. The Authorisation, with reference number 12/1/040, was granted in terms of regulation 24 of the National Environmental Management Act, 1998 ("NEMA") Environmental Impact Assessment Regulations, 2014 ("EIA Regulations"). 5. The Appeal is lodged in terms of section 43(1A) of NEMA, which provides that: "*Any person may appeal to the Minister against a decision made in terms of this Act or any specific environmental management Act by the Minister responsible for mineral resources or any person acting under his or her delegated authority*", read with the NEMA National Appeal Regulations, 2014[1] ("the Appeal Regulations"), which provide for the submission of an appeal within 20 days from the date that the notification of the decision for an application for environmental authorisation was sent to the registered interested and affected parties (I&APs) by the Applicant (26 April 2023).[2]		

[1] GN R 993 GG 38303 of 8 December 2014.
[2] Regulation 4(1)(a) NEMA National Appeal Regulations, 2014.

Initial/s:

GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
6. In accordance with the requirements of Regulation 4(2)(a) of the Appeal Regulations: 6.1. this Appeal is submitted in writing in the form obtained from the Appeal Administrator, and accompanied by this more detailed appeal document, being a statement setting out the grounds of appeal ("the Grounds of Appeal"). The Appellants are entitled to also submit these more detailed Grounds of Appeal as the Appeal submission. This submission must be taken into account by the Minister in making a decision on the Appeal; 6.2. to the extent possible, the Appeal is accompanied by relevant supporting documentation which is referred to in this Appeal submission - attached as Annexure B; and 6.3. we confirm, in compliance with Regulation 4(1) of the Appeal Regulations, that this Appeal is submitted within 20 days[1] from the date of notification to I&APs to the Appeal Administrator. A copy of the Appeal will be provided to the Applicant and to those registered I&APs, and organs of state with an interest in the matter, insofar as possible and within time and cost constraints. The statement regarding compliance with Regulation 4(1) is contained in the cover letter to which these Grounds of Appeal are attached. In any event, we confirm compliance with Regulation 4(1). 7. The Appellants further submit that there are grounds for judicial review under the Promotion of Administrative Justice Act, 2000 ("PAJA") because the Authorisation comprises administrative action that *inter alia*.		

[1] The Appellants submit that the process provided for in the Appeal Regulations, in particular the requirement to submit an appeal in 20 days of the notification, severely prejudices the Appellants and infringes on their rights to a fair process. The Appellants continue to assert that the unreasonably short timeframes and onerous notification requirements of regulation 4(1), among others, render the Appeal Regulations a violation of the rights to just administrative action, and are thus unconstitutional.

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GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
7.1. is unconstitutional or unlawful;[4] 7.2. was taken because of the failure to consider relevant considerations;[5] 7.3. is not rationally connected to the information before the decision-maker in making the Decision or to the reasons provided by the decision-maker for the Decision;[6] and 7.4. is so unreasonable that no reasonable person could have granted it.[7] **PARTIES** 8. **The First Appellant is Natural Justice.** 8.1. Natural Justice: Lawyers for Communities and the Environment is a non-profit organization specializing in environmental and human rights law in Africa – with a focus on the pursuit of social and environmental justice for local and indigenous communities. Natural Justice offers direct support to local and indigenous communities impacted by the ever-increasing demand for land and natural resources.. 9. **The Second Appellant is the Green Connection.** 9.1. Green Connection is a registered non-governmental organisation, that believes that economic growth and development, improvement of socio-economic status and conservation of natural resources can only take place within a commonly understood framework of sustainable development. The Green Connection aims to provide practical support to both		

[4] PAJA section 6(2)(d),(f)(i) and (i).
[5] PAJA section 6(e)(iii).
[6] PAJA section 6(f)(ii)(cc) and (dd).
[7] PAJA section 6(h).

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GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
the government and non-governmental/civil society sectors, which are an integral part of sustainable development. 10. The Appellants have legal standing to bring the Appeal not only in terms of section 43 of NEMA, but also to enforce environmental laws in terms of NEMA section 32, in that they *inter alia* act: *"(c) in the interest of or on behalf of a group or class of persons whose interests are affected; (d) in the public interest; and (e) in the interest of protecting the environment."*[8] The Appellants act in the interest of, or on behalf of, persons who, for practical reasons, are unable to institute such proceedings, including members of coastal communities who do not have the capacity or resources to do so, in the interests of coastal communities who are affected by the proposed seismic activities, in the public interest, and in the interest of protecting the environment, to further the objectives of section 24 of the Constitution of the Republic of South Africa, 1996 ("the Constitution") and NEMA. 11. The Appellants are also Registered Interested and Affected parties (I&AP) in respect of the application process for this authorisation. **BACKGROUND AND DESCRIPTION OF THE PROJECT** 12. The proposed project area is located between approximately 120 km offshore of St Helena Bay, extending north along the western coastline to approximately 230 km offshore of Hondeklip Bay over a number of petroleum licence blocks. The application area for the proposed 3D seismic survey is approximately 57 400 km² in extent. TGS proposes that a single survey vessel equipped with seismic sources and streamers be used. The proposed 3D survey would be supported by two escort vessels. It is estimated that the 3D survey will take 70 days (including downtime).[9] The area proposed for the		

[8] NEMA section 33(1)(c)-(d).

[9] BAR Executive Summary, pxvi.

Initials

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seismic survey is a large under-explored area with potential for both oil and gas. 13. On the 25th of November 2022, the Applicants submitted comments on the draft Basic Assessment Report prepared as part of the Environmental Impact Assessment (EIA) process. As mentioned above, the DG granted the Project an Environmental Authorisation on 17 April 2023, and the Appellants received notification of the decision on 26 April 2022. 14. The Reasons for the Decision are set out in Annexure 1 to the Authorisation. GROUNDS OF APPEAL 15. The decision to grant the Authorisation should be set aside by the Minister because the final Environmental Basic Assessment Report ("FBAR") failed to comply with NEMA in various respects; and the Director General's decision to grant the Authorisation contravenes various provisions of NEMA, including the requirements for granting environmental authorisations, the requirements of the National Environmental Management Act and the National Environmental Management Principles (section 2 of NEMA) ("NEMA Principles"), in that: 15.1. the need and desirability of the Project has not been established, as required by regulation 18 of the EIA Regulations read with regulation 23(3) and Appendix 3 to the EIA Regulations. 15.2. the FBAR and the DG failed to adequately consider the marine impacts and therefore have failed to meet the requirements of, inter alia, section 240(1) NEMA to account for all relevant factors,[20] in particular those regarding the pollution,		

[20] NEMA, section 2401(b).

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GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
environmental impacts or environmental degradation *"likely to be caused if the application is approved"*,[11] as well as any guidelines, departmental policies, and environmental management instruments and any other information in the possession of the competent authority relevant to the Application.[12] This is also in contravention of the NEMA requirement to ensure that the activity's potential environmental impacts are properly assessed;[13] 15.3. The FBAR and DG have failed to adequately assess and consider the cumulative impacts of the Project, as required by the NEMA EIA Regulations, Appendix 3 section 3(j)(ii). 15.4. TGS, and its appointed Environmental Assessment Practitioner ("EAP", has failed to engage in meaningful consultation in violation of the principles of fair administrative decision-making and the right of interested and affected communities to be meaningfully consulted prior to a decision on authorisation being made, and in violation of section 2(4)(f) of NEMA, which stipulates that the participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured. It is also inconsistent with section 2(4)(g) of NEMA, which requires that decisions must take into account the interests, needs and values of all interested and affected parties, and this includes		

[11] NEMA, section 24O1(b)(i).
[12] NEMA, section 24O1(b)(viii).
[13] NEMA, section 24(4)(a)(iv).

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GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
recognising all forms of knowledge, including traditional and ordinary knowledge. 15.5. the DG failed to consider and/or give effect to: the NEMA Principles, including the precautionary principle and the principle that requires development to be environmentally, socially and economically sustainable; and the Constitutional rights to an environment that is not harmful to health or wellbeing – as enshrined in section 24 of the Constitution of the Republic of South Africa, 1996 ("the Constitution"). The decision to issue the Authorisation and the reasons provided therefore are, furthermore irrational and unreasonable, and thus in contravention of PAJA. 15.6. The DG failed to consider relevant coastal management considerations or to comply with the National Environmental Management: Integrated Coastal Management Act 24 of 2008. 15.7. Ground 7: The DG failed to provide adequate reasons for the decision.		
Ground 1: A flawed and misguided need and desirability assessment 16 The NEMA EIA Regulations stipulate that a basic assessment report must include a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location.[14] 17. Section 5 of the FBAR includes a motivation of need and desirability for the proposed 3D seismic survey. Unsurprisingly, the FBAR	The EAP has conducted the impact assessment on the basis of the activities proposed by the applicant. Any subsequent authorisation would be restricted to these specifically assessed activities. Should the applicant or other applicants wish to undertake any additional exploration activities which are not addressed in the current Environmental Authorisation (EA) application, there would be a consequent need to apply for the relevant permissions. These would include a formal application for an Exploration or Production Right as	

[14] NEMA EIA Regulations, Appendix 1, section 2(c). With regard to need and desirability, a distinction is drawn between the 'general purpose and requirements' of the proposed activity and 'need and desirability'. The 2017 Guideline on Need and Desirability states as follows (at p10):

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focuses on justifying the 'need and desirability' of the proposed project and fails to reflect views critical to 3D seismic surveys and offshore oil and gas exploration (and ultimately production). As a consequence, the 'need and desirability' assessment provided in the FBAR follows the pattern of previous seismic survey EIAs by (among other things) limiting the assessment of potential impacts to the proposed 3D seismic survey, with no assessment of the need and desirability of exploring for (and ultimately producing and using) new oil and gas reserves (including in the context of the climate change crisis and the right to food). The assessment also includes a section motivating the 'need' for seismic data. 18. It is noted that the FBAR Needs and Desirability analysis indicates that the proposed project '*aims to identify oil and gas resources to be used in... energy production and/or processing or manufacturing of materials*'.[15] The FBAR also claims in passing that "seismic surveying is not only used for petroleum and natural gas exploration and development, it can in certain instances also be used for	well as a new EA. The impacts of such proposed activities would consequently require specific assessment and public consultation prior to approval. It is premature to assess the likely impacts of further invasive exploration activities or production activities as the extent, duration, location, and magnitude applicable to these activities are unknown at this stage. The NEMA EIA Regulations make a clear distinction between the reconnaissance, exploration, and production activities in that these are listed as distinct and separate listed activities. There is provision in law for these activities to be assessed on their merits as and when they are proposed. Please refer to Section 5 of the BA Report in regard to the need and desirability for the proposed activities. According to the Integrated Resource Plan 2019 (IRP 2019), which is the country's electricity planning strategy, there is a need for gas in South Africa's energy mix in the future. This need is driven in part by the expectation that natural gas may act as a transition fuel, whilst other greener technologies mature. According to the National Department of Forestry, Fisheries	

In order to properly interpret the EIA Regulations' requirement to consider "need and desirability", it is necessary to turn to the principles contained in NEMA, which serve as a guide for the interpretation, administration and implementation of NEMA and the EIA Regulations. With regard to the issue of "need", it is important to note that this "need" is not the same as the "general purpose and requirements" of the activity. While the "general purpose and requirements" of the activity might to some extent relate to the specific requirements, intentions and reasons that the applicant has for proposing the specific activity, the "need" relates to the interests and needs of the broader public.

...

The consideration of "need and desirability" in EIA decision-making therefore requires the consideration of the strategic context of the development proposal along with the broader societal needs and the public interest. The government decision-makers, together with the environmental assessment practitioners and planners, are therefore accountable to the public and must serve their social, economic and ecological needs equitably. Ultimately development must not exceed ecological limits in order to secure ecological integrity, while the proposed actions of individuals must be measured against the short-term and long-term public interest in order to promote justifiable social and economic development – i.e. ensuring the simultaneous achievement of the triple bottom-line. Considering the merits of a specific application in terms of the need and desirability considerations, it must be decided which alternatives represent the 'most practicable environmental option', which in terms of the definition in NEMA and the purpose of the EIA Regulations are that option that provides the most benefit and causes the least damage to the environment as a whole, at a cost acceptable to society, in the long-term as well as in the short-term. (emphasis added)

The Guideline requires need and desirability assessments to address the impact of planned activities on global and international responsibilities relating to the environment, including climate change (at p11).

[15] FBAR, item 1.7.1, p24.

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development of offshore wind, geothermal energy, and low-carbon solutions such as carbon capture and storage and also more generally for providing more insight and understanding into the regional geology of the area for scientific purposes." This statement about other uses is misguided and irrelevant. These other purposes of the projects surveying results are speculative at best, and have far less impacts on the ocean than oil and gas surveying.[16] It is also abundantly clear from the FBAR that the main purpose of this project is to survey for oil and gas deposits. 19. The FBAR concludes that *'[a]s a result of the fact that this project entails only survey activities, it is anticipated that this project will not lead to a significant impact on the receiving environment'*.[17] In line with this, the FBAR does not consider or assess the potential climate and other negative impacts of subsequent oil and gas exploration, production and use. In other words, it fails to consider the lifecycle impacts associated with exploring for and exploiting oil and gas resources. Yet, at the same time, it does consider the positive impacts should oil and gas be eventually produced, such as the claim that it will provide energy security to South Africa. This self-serving analysis is not only deceiving, it is unlawful. ***Climate change impacts***	and the Environment (DFFE), targets have been determined to achieve our national GHG emissions commitments. These targets consider the likely GHG emissions outcome of the implementation of current South African policies including the IRP. The proposed seismic activities may be used to determine whether a viable gas or oil resource is present. The outcomes of this could provide insight into potential alternative supply options to inform the future energy planning and policy for South Africa. Considering this, and other new information on supply options, as well as the rapid technological advancements in the energy sector (and specifically in the low carbon alternatives), it is crucial that the energy planning for South Africa is continually reassessed and revised to ensure that the most suitable and sustainable strategy is defined. The 2021 NDC's are aligned with the IRP 2019. The GHG emissions and associated climate change impacts associated with the seismic survey itself would be negligible. There are no significant GHG emissions directly related to the proposed activity nor significant climate change vulnerability risks. As such, the life-cycle of the project would be limited to the Reconnaissance activities only (i.e. identification only – and does not necessarily imply actual exploration or further production of oil and gas resources) and	

[16] For example, the offshore wind industry does not use airguns, and instead relies on High Resolution Geophysical (HRG) surveys to map the ocean bottom and its shallow geological features. That technology, such as echosounders, sidescan sonar, and sparkers, uses considerably less power as compared to seismic airguns and also tends to operate at higher frequencies. Not only do higher frequency sounds dissipate more quickly in the ocean but they also tend to fall outside of the general hearing range of baleen whales, such as humpbacks and right whales. The use of seismic surveying to develop offshore wind is the equivalent of using a hammer when a feather could do the job. The area that is being surveyed is also 120 – 230 km offshore and includes deep to ultradeep depths between 1,500 – 4,000m. It would not be feasible to install a fixed nor floating turbines at those depths, as they are more suitable for depths of less than 50m and 50 to 1,000m, respectively Lastly, a World Bank analysis does not find the area TGS is surveying to be ideal for offshore wind generation. ESMAP. 2019. Going Global: Expanding Offshore Wind to Emerging Markets at p. 20-21. Washington, DC: World Bank ("fixed foundation is considered technically viable in areas with water depth less than 50 m and average wind speeds over 7 m/s. Floating wind is considered technically viable with water depths from 50 m up to 1,000 m.").

[17] Ibid, item 1.8.3, p24.

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20. The FBAR states that from a climate change perspective, it is '*not currently possible to accurately assess the risks associated with oil and gas activities, given that the specific details of these potential future activities are not known and therefore climate change impacts would need to be assessed in detail during any subsequent Scoping and EIA processes for any potential subsequent oil and gas production projects*'.[18] As a result, the FBAR does not conduct any climate change impact assessment, even in broad terms. 21. It is relevant to note that the issue of whether the decision-maker properly considered climate change impacts was referred to in the judgment of the full bench of the Makhanda High Court in the Shell Wild Coast seismic survey case.[19] The court stated in its judgement that the intervening parties' contention that the decision-maker gave no proper consideration to climate change impacts of the decision to grant the exploration right is an important factor to be considered in the process of granting an exploration right. The court referred to expert testimony relied upon to support this contention, which showed that '*most of the discovered reserves of oil and gas cannot be burnt if we are to stay on the pathway to keep global average temperature increases below 1.5 degrees Celsius. Authorising new oil and gas exploration, with its goal of finding exploitable oil and/or gas reserves and consequently leading to production, is not consistent with South Africa complying with its international climate change commitments*'.[20] 22 The court noted that according to the respondents in that case, climate change considerations are irrelevant when considering an	this has been specified and defined in the Need and Desirability, and the associated impacts identified and assessed. The statement made by the Appellent that the Need and Desirability is misleading and unlawful in that it considers "*positive impacts should oil and gas be eventually produced, such as the claim that it will provide energy security to South Africa*" is in itself misleading and inaccurate. In fact, the Need and Desirability clearly states that "*The proposed project aims to identify oil and gas resources and will not, at this stage, involve the use of the natural resources identified as part of the proposed survey project*" and furthermore makes no claims of any significant positive impacts and states on numerous occasions that "*The proposed activities are anticipated to have low negative ecological impacts. Refer to the impact assessment in Section 9 in this report.*" Also noted is that TGS is a seismic data acquisition company and is in the business of data acquisition, and are not an Oil & Gas Exploration or Production company. Data from TGS' seismic libraries are not only used for petroleum and natural gas exploration and development, data may also be used for development of offshore wind, geothermal energy, low-carbon solutions such as carbon capture and storage and also more generally for providing more insight and understanding into the regional geology of the area for scientific purposes.	

[18] FBAR, p33.
[19] *Sustainling the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021, at paras 120 to 125.
[20] Ibid, at para 121.

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application for an exploration right, and these considerations are premature because they fall to be considered at a much later stage. 23. The court pointed out that on the authority of the *Save the Vaal* case,[21] the '*processes are discrete stages in a single process that culminates in the production and combustion of oil and gas, and the emission of greenhouse gases that will exacerbate the climate crisis and impact communities' livelihoods and access to food*'.[22] The court went on to state that the respondent's thesis does not find support in *Earthlife Africa Johannesburg v Minister of Environmental Affairs and Others* either, and referred approvingly to the following passage in Murphy J's judgement: The absence of express provision in the statute requiring a climate change impact assessment does not entail that there is no legal duty to consider climate change as a relevant consideration and does not answer the interpretative question of whether such a duty exists in administrative law. Allowing for the respondents' argument that no empowering vision in NEMA or the regulations explicitly prescribes a mandatory procedure or condition to conduct a formal climate change assessment, the climate change impacts are undoubtedly a relevant consideration as contemplated by section 240 of NEMA for the reasons already discussed. A formal expert report on climate change impacts will be the best evidentiary means of establishing that this relevant factor in its multifaceted dimensions was indeed considered, while the absence of one will be symptomatic of the fact that it was not.[23] 24. The court in the Shell Wild Coast seismic survey case went on to state the following:	The Earthlife Africa case referred to relates to the EA issued to construct and operate a new coal fired power station which bears no resemblance to seismic survey data acquisition. It is agreed that pending the outcome of an appraisal on the viability of extracting any oil or gas resource, which this seismic survey is likely to inform, due caution will need to be taken to avoid overcommitments and stranded assets. In terms of the "Need for Seismic Data", the main aim of the Needs and Desirability Section of the BA Report is to determine the need for the activity, and it is argued for that the survey is desirable given the current energy planning of the country, amongst other factors. It is agreed, considering the rapid technological advancements in the energy sector, that there is a need to continually reassess and revise where relevant the energy planning and policy for South Africa. Pending the outcome of an appraisal on the viability of extracting any oil or gas resource, which this seismic survey is likely to inform, due caution will need to be taken to avoid overcommitments and stranded assets associated with the timing of South Africa's prevailing climate change commitments. The potential for methane leaks during resource extraction, processing, and utilisation will need to be assessed as and when such is proposed. It should further be noted that the acquisition of seismic survey data is considered important with respect to understanding the potential for future oil and gas production as part of the energy mix of the country	

[21] *Director: Mineral Development, Gauteng Region and Another v Save the Vaal Environment and Others* (133/98)[1999] ZASCA 9 (12 March 1999).
[22] Ibid, para 123.
[23] Ibid, para 124.

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It seems clear from the aforegoing, even taking into account the contentions raised by the respondents, that, had the decision-maker had the benefit of considering a comprehensive assessment of the need and desirability of exploring for new oil and gas reserves for climate change and the right to food perspective, the decision-maker may well have concluded that the exploration is neither needed nor desirable.[24] (emphasis added) 25. The Green Connection and Natural Justice submit that the FBAR is deficient, and the Needs and Desirability analysis incomplete, without at the very least a broad assessment of the climate change impacts should commercially exploitable oil and gas resources be identified through the proposed seismic survey (and should these resources be produced and utilised). It would be pointless to authorise this (and other) 3D seismic surveys should such an assessment conclude that the development of new oil and gas fields is incompatible with South Africa's climate change commitments. ***The 'climate crisis'*** 26 The need and desirability (from a climate change perspective) of conducting a 3D seismic survey (which – as mentioned above – the FBAR aims to identify oil and gas resources to be used in energy production and/or processing or manufacturing of materials) is particularly important given that climate change has been acknowledged as a 'crisis' with human-induced climate change impacts being experienced in every region. It is also recognised that the climate change 'crisis' requires immediate, rapid and large-scale reductions in greenhouse gas (GHG) emissions to limit global warming to 1.5°C (including accelerated action in this decade to reduce global carbon dioxide emissions by 45 per cent by 2030 relative to the 2010 level and to net-zero around mid-century). In	going forward. The seismic data will provide information with which future decisions can be made. The South African legislation requires the payment of royalties and taxes to the South African government associated with the extraction of resources. There are further obligations on holders of mineral and petroleum rights to contribute to local economic development. The Draft Upstream Petroleum Resources Development Bill also provides for the state to receive a 20% carried interest in exploration and production rights. According to the specialist investigations undertaken, there is unlikely to be a significant impact on the marine environment and therefore there is not anticipated to be a consequent impact on the right to food. It should further be noted that, in the recent Presidential Climate Commission (PCC) recommendations on the electricity system which also specifically considered many local and international studies (including some of those cited by the appellant), the PCC expects a policy adjusted IRP to promote approximately 50 to 60 GW of variable renewable energy by 2050, supported by co-located storage, and between 3 and 5 GW of peaking support (for example gas, running at low utilisations). Therefore, although the PCC doesn't advocate for large scale new coal or gas the PCC does recommend the inclusion of up to 5GW of peaking support (typically to be provided in part by gas). In summary, the re-evaluation of South Africa's energy planning and policy falls beyond the scope of this assessment. The current policy provides for a portion of the electricity mix to be provided by gas, and that such has been accounted for and included in the countries climate change commitments (NDC's). The source of the gas to meet this need would either be imported of produced locally. The feasibility of the later can only be defined once the extent if the resources have been defined.	

[24] Ibid, para 125.

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support of these submissions, some of the recent developments relating to the climate crisis are discussed briefly below. 27. In August 2021, the Intergovernmental Panel on Climate Change (IPCC) (an international body for assessing the science related to climate change) released its 6th Assessment Report (AR6).[25] In its summary for policymakers, the IPCC indicates (among other things) that: 27.1. it is unequivocal that human influence has warmed the atmosphere, ocean and land, and that widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred;[26] 27.2. the scale of recent changes across the climate system as a whole – and the present state of many aspects of the climate system – are unprecedented over many centuries to many thousands of years;[27] 27.3. human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since AR5;[28] 27.4. global surface temperature will continue to increase until at least mid-century under all emissions scenarios considered, and that global warming of 1.5°C and 2°C will be exceeded during	Thereafter a decision can be taken as to whether the resource should be extracted or produced. This EA was issued for seismic survey only and does not result in any stranded assets, but aims to provide information on potential resources. Assessment and analysis of the data acquired by this survey will help inform the Government's decisions on the viability and impact of producing any located assets compared to importing equivalent energy resources.	

[25] Climate Change 2021: The Physical Science Basis, available online at: https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/
[26] Para A.1
[27] Para A.2
[28] Para A.3

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the 21st century unless deep reductions in CO_2 and other GHG emissions occur in the coming decades;[29] 27.5. Many changes in the climate system become larger in direct relation to increasing global warming. They include increases in the frequency and intensity of hot extremes, marine heatwaves, heavy precipitation, and, in some regions, agricultural and ecological droughts; an increase in the proportion of intense tropical cyclones; and reductions in Arctic sea ice, snow cover and permafrost;[30] 27.6. Continued global warming is projected to further intensify the global water cycle, including its variability, global monsoon precipitation and the severity of wet and dry events;[31] 27.7. Many changes due to past and future GHG emissions are irreversible for centuries to millennia, especially changes in the ocean, ice sheets and global sea level;[32] 27.8. From a physical science perspective, limiting human-induced global warming to a specific level requires limiting cumulative CO_2 emissions, reaching at least net zero CO_2 emissions, along with strong reductions in other GHG emissions. Strong, rapid and sustained reductions in CH_4 emissions would also limit the warming effect resulting from declining aerosol pollution and would improve air quality.[33] 28. On 9 August 2021, the IPCC issued a press release relating to its AR6 report. It states that the report provides new estimates of the		

[29] Para B.1
[30] Para B.2
[31] Para B.3
[32] Para B.5
[33] Para D.1

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chances of crossing the global warming level of 1.5°C in the next decades, and finds that unless there are immediate, rapid and large-scale reductions in GHG emissions, limiting warming to close to 1.5°C or even 2°C will be beyond reach.[34] 29. Also on 9 August 2021, UN Secretary-General António Guterres described the AR6 report as nothing less than "*a code red for humanity. The alarm bells are deafening, and the evidence is irrefutable*". (emphasis added) 30. Guterres is reported as noting that the internationally agreed threshold of 1.5 degrees above pre-industrial levels of global heating was perilously close, and that we are at imminent risk of hitting this threshold in the near term. Guterres is indicated as advising that the only way to prevent exceeding this threshold, is by urgently stepping up our efforts, and pursuing the most ambitious path. Guterres is reported as stating that solutions are clear: "*inclusive and green economies, prosperity, cleaner air and better health are possible for all, if we respond to this crisis with solidarity and courage*". Ahead of the COP26 climate conference in Glasgow in November 2021, Guterres stated that all nations needed to join the net zero emissions coalition, and reinforce their promises on slowing down and reversing global heating "*with credible, concrete, and enhanced Nationally Determined Contributions (NDCs)*" that lay out detailed steps. 31. In April 2022, Guterres tweeted that *'[c]limate activists are sometimes depicted as dangerous radicals. But the truly dangerous radicals are the countries that are increasing the production of fossil fuels. Investing in new fossil fuels infrastructure is moral and economic madness'.*[35] Addressing graduate students in May 2022, Guterres expressed the view that investing in fossil fuels is now "*a*		

[34] https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/

[35] https://twitter.com/antonioguterres/status/1511294073474367488?lang=en

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dead end - economically and environmentally. No amount of greenwashing or spin can change that. So, we must put them on notice: Accountability is coming for those who liquidate our future."[36] 32. The 26th Conference of the Parties of the UNFCCC (COP26) was held in Glasgow in the last quarter of 2021. Recognition of the climate 'crisis', as well as the urgent need to increase effort and to accelerate action to address climate change (including by developing nations), are reflected in the outcome of COP26 and recorded in the Glasgow Climate Pact. The Glasgow Climate Pact (among other things): 32.1. Expresses alarm and utmost concern that human activities have caused around 1.1°C of global warming to date and that impacts are already being felt in every region; 32.2. Reaffirms the long-term global goal to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; 32.3. Recognizes that the impacts of climate change will be much lower at the temperature increase of 1.5°C compared with 2°C and resolves to pursue efforts to limit the temperature increase to 1.5°C; 32.4. Recognizes that limiting global warming to 1.5°C requires rapid, deep and sustained reductions in global GHG emissions, including reducing global carbon dioxide emissions by 45 per cent by 2030 relative to the 2010 level and to net zero around mid-century as well as deep reductions in other GHGs;		

[36] https://news.un.org/en/story/2022/05/1118932

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32.5. Also recognizes that this requires accelerated action in this critical decade, on the basis of the best available scientific knowledge and equity, reflecting common but differentiated responsibilities and respective capabilities and in the context of sustainable development and efforts to eradicate poverty; 32.6. Invites Parties to consider further actions to reduce by 2030 non-carbon dioxide GHG emissions, including methane which has been identified as a driver of climate change and the main polluting emission from natural gas; 32.7. Calls upon Parties to accelerate the development, deployment and dissemination of technologies, and the adoption of policies, to transition towards low-emission energy systems, including by rapidly scaling up the deployment of clean power generation and energy efficiency measures, including accelerating efforts towards the phasedown of unabated coal power and phase-out of inefficient fossil fuel subsidies, while providing targeted support to the poorest and most vulnerable in line with national circumstances and recognizing the need for support towards a just transition; 32.8. Emphasizes the importance of protecting, conserving and restoring nature and ecosystems, including forests and other terrestrial and marine ecosystems, to achieve the long-term global goal of the Convention by acting as sinks and reservoirs of GHGs and protecting biodiversity, while ensuring social and environmental safeguards. 33. The climate 'crisis' is also recognised by the International Energy Agency (IEA), of which South Africa is an IEA associated country. During or about July 2021, the IEA published its *Net Zero by 2050 – A Roadmap for the Global Energy Sector* report. In the foreword to this report, the Executive Director of the IEA states (among other things) as follows:		

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We are approaching a decisive moment for international efforts to tackle the climate crisis – a great challenge of our times. The number of countries that have pledged to reach net-zero emissions by mid-century or soon after continues to grow, but so do global greenhouse gas emissions. This gap between rhetoric and action needs to close if we are to have a fighting chance of reaching net zero by 2050 and limiting the rise in global temperatures to 1.5 °C. Doing so requires nothing short of a total transformation of the energy systems that underpin our economies. Despite the current gap between rhetoric and reality on emissions, our Roadmap shows that there are still pathways to reach net zero by 2050. The one on which we focus is – in our analysis – the most technically feasible, cost-effective and socially acceptable. Even so, that pathway remains narrow and extremely challenging, requiring all stakeholders – governments, businesses, investors and citizens – to take action this year and every year after so that the goal does not slip out of reach. This report sets out clear milestones – more than 400 in total, spanning all sectors and technologies – for what needs to happen, and when, to transform the global economy from one dominated by fossil fuels into one powered predominantly by renewable energy like solar and wind. Our pathway requires vast amounts of investment, innovation, skilful policy design and implementation, technology deployment, infrastructure building, international co-operation and efforts across many other areas. Since the IEA's founding in 1974, one of its core missions has been to promote secure and affordable energy supplies to foster economic growth. This has remained a key concern of our Roadmap, drawing on special analysis carried out with the International Monetary Fund and the International Institute for Applied Systems Analysis. It shows that the enormous challenge of transforming our energy system is also a huge opportunity for our economies, with the potential to create millions of new jobs and boost economic growth.		

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Another guiding principle of the Roadmap is that clean energy transitions must be fair and inclusive, leaving nobody behind. We have to ensure that developing economies receive the financing and technological know-how they need to continue building their energy systems to meet the needs of their expanding populations and economies in a sustainable way. It is a moral imperative to bring electricity to the hundreds of millions of people who currently re deprived of access to it, the majority in of them in Africa... 34. On fossil fuels used in energy production, the report states that: ***There is no need for investment in new fossil fuel supply in our net zero pathway.*** Beyond projects already committed as of 2021, there are no new oil and gas fields approved for development in our pathway, and no new coal mines or mine extensions are required. 35. When natural gas is burned for energy, it releases carbon dioxide into the atmosphere. More importantly, the extraction, processing, transport and use of natural gas cause significant amounts of methane to be released into the atmosphere too. *According to the United Nations, methane is a 84-86 times more potent greenhouse gas than carbon dioxide over a 20-year period, and 28-34 times more potent over 100-year period.*[37] More research is also showing that methane often leaks during the production, transport and use of natural gas. Therefore, its contribution to climate change is significantly unaccounted for.[38] Drones, laser absorption spectroscopy, and satellites, among other new methane monitoring technologies, have improved the identification and quantification of emissions across the gas lifecycle, leading researchers to conclude		

[37] International Energy Agency, Global Methane Tracker 2022- Overview, https://www.iea.org/reports/global-methane-tracker-2022/overview. See also International Energy Agency, Global Energy Review: CO2 Emissions in 2021,(2022), https://iea.blob.core.windows.net/assets/c3086240-732b-4f6a-89d7-db01be018f5e/GlobalEnergyReviewCO2EmissionsIn2021.pdf.

[38] South Africa is likely among those that are underreporting because the Technical Guidelines for GHG reporting uses outdated emission factors from the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines

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that national governments have almost universally underestimated these emissions.[39] 36. If 3,000 megawatts of new gas-to-power plants were built to meet South Africa's 2019 Integrated Resource Plan for Electricity, and the plants were fuelled by imported LNG, the annual emissions from this fuel use would be more than 2.5 million tonnes of CO2e (carbon dioxide equivalent) if the plants ran at 75% capacity. This is the equivalent of driving over half a million gasoline-powered vehicles for a year.[40] For gas or any other fossil fuel, a life-cycle analysis is therefore necessary to quantify the total amounts of GHG emissions (predominantly carbon dioxide and methane) that result from every step in the energy production process: from extracting the fossil fuel at the well or mine to burning it at a power plant or other facility. This is therefore important because all these processes are linked and should not be viewed in isolation. ***South Africa's international climate change commitments*** 37. South Africa is a Party to the United Nations Framework Convention on Climate Change (UNFCCC), which enjoins State Parties to take precautionary measures to anticipate, prevent or minimize the causes of climate change (Article 3.3). 38. South Africa, as a Party to the UNFCCC that ratified the Kyoto Protocol and adopted the Paris Agreement, has committed to *'working with others to ensure temperature increases are kept well below 2°C above pre-industrial levels, which could include a further revision of the temperature goal to below 1.5°C in light of emerging*		

[39] Jonathan Mingle, Methane Detectives: Can a Wave of New Technology Slash Natural Gas Leaks?, YALE E360, (2019), https://e360.yale.edu/features/methanedetectives-can-a-wave-of-new-technology-slash-natural-gas-leaks.

[40] EPA, EPA equivalency calculator, https://www.epa.gov/energy/greenhouse-gasequivalencies-calculatorResults

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science' by reducing GHG emissions. South Africa has also committed (among other things) to: 38.1. Preparing, communicating and maintaining Nationally Determined Contributions (NDCs) that it intends to achieve reach global peaking of GHG emissions as soon as possible, and to undertake rapid reductions thereafter;[41] and 38.2. Striving to formulate and communicate long-term GHG emission development strategies.[42] 39. There have been various Conferences of the Parties and meetings since, with decisions related to Nationally Determined Contributions (NDCs) contained in decisions 4/CMA.1 and 18/CMA.1 and their annexes. 40. South Africa submitted its first intended Nationally Determined Contribution under the Paris Agreement on 25 September 2015, which became the country's first NDC on 1 November 2016. Subsequently, South Africa revised its first NDC in 2021:[43]\ [illegible]		

[illegible]

[illegible]	[illegible]	[illegible]
2025	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[41] Paris Agreement, Article 4.1 – 4.3.

[42] Paris Agreement, Article 4.19

[43] Available online at: https://www.dffe.gov.za/sites/default/files/reports/draftnationallydeterminedcontributions_2021updated.pdf#:~:text=South%20Africa%E2%80%99s%20intended%20nationally%20determined%20contribution%20%28INDC%29%28RSA%2C%20n.d.%29,Agreement.%20The%20INDC%20and%20first%20NDC%20are%20identical. This revised NDC is indicated as an enhancement and update of South Africa's NDC under the Paris Agreement, 'meeting its obligation under Article 4.9 to communicate NDC's every 5 years, and responding to requests in paragraphs 23 to 25 of decision 1/CP.21'. South Africa's second (next) NDC is intended to be communicated in 2025.

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41. South Africa's energy sector is estimated at contributing about 84% percent to the country's overall GHG emissions (including Carbon Dioxide and Methane).[44] 42. In February 2020, South Africa submitted to the UNFCCC its first long-term low GHG emission development strategy titled *South Africa's Low Emission Development Strategy 2050*. It is indicated in the executive summary of this strategy that South Africa, as one of the top 20 global GHG emitters and with a high dependency on fossil fuels, will need to make substantial emission cuts to contribute its fair share to global GHG emission reductions.[45] 43. The FBAR does not provide any indication (or estimation) of how future GHG emissions (resulting from future exploitation of oil and gas that may be discovered through the exploration drilling project) would impact on South Africa's ability to achieve its GHG emissions targets (as set out in South Africa's NDC) or its updated GHG emissions targets (as set out in South Africa's revised NDC). This is particularly relevant given that the emissions targets for the 2026-2030 period are lower than the targets for the 2021-2025 period, while offshore oil and gas developments could take at least a decade to reach the production stage. This could result in offshore oil and gas investments (as well as associated gas infrastructure developments) in the future becoming unneeded 'stranded assets' and a burden on future generations. There is also a risk that in the future tariffs will be levied on various goods exported by fossil-fuel dependent countries – the European Union is reported to be		

[44] https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-south-africa

[45] South Africa's Low Emission Development Strategy 2050, pviii.

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gradually phasing in its Border Adjustment Mechanism as part of the EU's Green Deal.[45] *Need for seismic data* 44. Under the sub-heading 'Need for seismic data', the FBAR states that a discussion of the needs and desirability of the project '*would not be complete without understanding the need for acquisition of the seismic data and possible oil and gas exploration and production that could potentially take place in the future as a result of the survey*'.[47] 45. Ironically, the FBAR then quickly goes on to state that '*It cannot be said with absolute certainty that exploration drilling, let alone production activities, will be undertaken in the future. As such, it is not currently possible to accurately assess the risks associated with these activities, given that the specific details of these potential future activities are not known. While it is acknowledged that the risks mentioned would need assessment, such assessment falls outside of the scope of the current application and would need to be assessed in detail during subsequent Scoping and EIA processes, should exploration drilling or production be proposed. The environmental consequences applicable to the planned survey activities have been identified and assessed in this BA Report*'.[48] The views of the Makhanda High Court in this regard (in the context of future production, climate change and the right to food) have been traversed earlier in the Green Connection and Natural Justice's comments (see paragraphs 27 to 30 above) and are not repeated here. The Green Connection and Natural Justice stands by their view that at the very least a broad assessment of the impacts and risks		

[46] See for example *Just Energy Transitions and Natural Gas in Africa: Balancing Climate Action and Structural Transformation*, The African Climate Foundation, August 2022, at p14. Available online at: https://africanclimatefoundation.org/wp-content/uploads/2022/10/ACF-GAS-REPORT-V7.indd-final-1.pdf
[47] FBAR, p33-34.
[48] Ibid.

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associated with future invasive exploration activities, production activities and use of any discovered oil reserves should be included in the BAR. 46. The FBAR report then proceeds with a glowing (and one-sided) endorsement of the use of natural gas: **The fastest growing sector for the use of natural gas is for the generation of electric power. Natural gas power plants usually generate electricity in gas turbines, directly using the hot exhaust gases from the combustion of the gas.. Of the three fossil fuels used for electric power generation (coal, oil and natural gas), natural gas emits the least carbon dioxide per unit of energy produced. Natural gas emits 30% and 45% less carbon dioxide than burning oil and coal, respectively. Burning natural gas also releases lower amounts of nitrogen oxides, sulphur dioxide, particulates and mercury when compared to coal and oil.** **The increased use of natural gas can, in the short term, serve as a transition fuel on the path to the carbon-neutral goal of the Paris Agreement. In addition to gas as a key transitional fuel reducing reliance on coal, the benefits of oil and gas could include significant amount of job creation, especially if local beneficiation takes place. An increase in domestic natural gas reserves would enable South Africa to take steps to secure the countries' energy supply (through diversification), assist in reducing the emissions of greenhouse gases (by reducing the country's reliance on coal for electricity generation) and reduce the need for the importation of gas. As such, exploration for additional domestic hydrocarbon reserves is considered important and supported by national policy, and any discoveries would be well received by the local market and are consistent with the objectives stated in the 2019 IRP. Natural gas emits 30% and 45% less carbon dioxide than burning oil and coal, respectively, and 65% less carbon dioxide than coal when the increased efficiency of Combined Cycle Gas Turbines versus coal fired power stations is considered. Eskom produces over 200MtCO2/yr, over 40% of South Africa's total. South Africa also has SASOL's Secunda coal to liquids**		

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plant, the biggest single source of CO2 in the world at 57MtCO2/yr (~12.5% of South Africa's total) to produce 160k barrels of products per day. Supplying these products from conventional oil production and refining would generate approximately 10% of those emissions, 5 to 6MtCO2/yr. According to the 2019 IRP the availability of gas in the short to medium term is a risk as South Africa does not currently have gas resources. There is also a supply and foreign exchange risk associated with likely increase in gas volumes depending on the energy mix adopted post 2030 when a large number of coal fired power stations are decommissioned. South Africa's economic growth is dependent on the availability of energy, ensuring a sustainable and reliable supply of electricity with sufficient capacity is a key aspect to growing the economy of South Africa in the future. The electricity shortages experienced in South Africa over the past decade are a contributing factor to the significant slowdown in economic growth rate. To enable economic growth within the target rate of between 6% and 8% to be achieved, it will be necessary for Government to continue increasing electricity generating capacity in the country. The use of natural gas for electricity generation is identified in national policy, together with renewable energy technologies, as an alternative in diversifying the domestic energy supply away from its current reliance on coal. Gas is identified in the draft Integrated Resources Plan as significant contributor to South Africa's energy mix in the period up to 2050. Availability of gas also provides an opportunity to convert to Combined Cycle Gas Turbine and run open-cycle gas turbine plants at Ankerlig (Saldanha Bay), Gourikwa (Mossel Bay), Avon (Outside Durban) and Dedisa (Coega IDZ) on gas (IRP 2019).[49] 47. Perhaps concerned that it is making the case that seismic surveys are indeed the 'thin edge of the wedge' that will lead to increased fossil fuel extraction, production and use (with associated climate change		

[49] Ibid.

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impacts), the BAR steps back from its natural gas endorsement to repeat the point that *'[f]rom a climate change perspective, it is not currently possible to accurately assess the risks associated with oil and gas activities, given that the specific details of these potential future activities are not known and therefore climate change impacts would need to be assessed in detail during any subsequent Scoping and EIA processes for any potential subsequent oil and gas production projects'.*[50] 48. The FBAR then proceeds to argue that: The feasibility of using natural gas for domestic power generation is considered to be dependent on the extent of available domestic reserves of natural gas, as well as the financial cost of importing natural gas should those reserves be insufficient. The acquisition of seismic survey data is therefore considered important with respect to understanding the potential for future oil and gas production as part of the energy mix of the country going forward and the need and desirability of the project is therefore supported from an energy security perspective.[51] 49. We note here that despite reliance on the IRP to motivate for the project, the FBAR fails to assess whether the amount of gas called for in the IRP would in any event require the exploitation of the resources sought by TGS. 50. Two recent independent studies (among others) challenge the view that fossil gas is necessary for electricity generation and as a transition fuel. 51. The International Institute for Sustainable Development's (IISD) *Gas Pressure: Exploring the case for gas-fired power in South Africa* (March 2022) report points out that while there used to be a rational view that fossil gas would be necessary either during a transition to		

[50] Ibid.
[51] Ibid.

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low-carbon energy or as part of the long-term energy mix for electricity production: "...revolutions first in renewable energy costs and then in battery storage costs have upended this view. Analysis of the South African electricity system shows that gas supply is not technically necessary until at least 2035, if ever. In the last few years, either the risks associated with gas have increased, or the understanding of existing risks has increased. Consequently, South Africa may see significant negative outcomes from developing a large gas-to-power system now... the trend toward decarbonization, coupled with cost reductions for renewable energy and storage, creates risks for gas investment. Investment in gas can reasonably be expected to lead to higher costs for consumers, just transition challenges for workers, and losses for investors."[52] 52. The ISSD report highlights some of the risks associated with gas-to-power investment in South Africa. These risks include significant contributions to climate change (as a consequence of CO_2 and methane emissions when gas is burned), increasing international pressure to move away from gas due to climate impacts, financial risks linked with gas-to-power, the risk of reduced security of affordable gas supply, the risk of stranded assets, and the risk of creating an additional just transition burden (future gas workers and communities face a repeat of the transition hardships currently faced by the coal sector).[53] 53. Meridian Economics' *'Hot Air about Gas – An Economic Analysis of the Scope and Role for Gas-Fired Power Generation in South Africa'* (June 2022) report points out that while South Africa's large-scale use of gas appears to be central to current energy policy direction in South Africa, *'this rests on a 2012 vision which pre-dates dramatic*		

[52] ISSD report, p iv. Available online at: https://www.iisd.org/publications/report/south-africa-no-need-for-gas
[53] ISSD report, pages 8 – 12.

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reductions in renewable energy costs and carbon emissions space'.[54] The report goes on to state that independent analysis of the power sector across multiple recent studies shows that South Africa's power needs can be met both now and in the future with very little use of gas, and that there is *'no evidence to support the large-scale gas envisaged in the GMP; this is uneconomical even before carbon emissions are considered'.*[55] Meridian point out that *'the assumption that gas-fired power generation would replace coal ignores the fact that other technology combinations are now better at replacing coal-fired power than gas, and it is against these technologies that gas-fired generation should actually be compared'.*[56] Meridian demonstrate that existing modelling provides no economic rationale for "big gas" in the power sector, and that *'the impact of using large volumes of gas to generate power will be borne by electricity consumers and will essentially be a subsidy provided by power consumers to otherwise enviable gas use in other sectors'.*[57] 54. The Vital Ambition Report[58] by Meridian Economics in collaboration with the Council for Scientific and Industrial Research ("CSIR") Energy Centre ("Vital Ambition Report") states that gas to power is only justified in the South African energy mix in so far as it is required for low-utilisation flexible capacity (peaker plants) for balancing the system during peak power demand. The report confirms that no investments in gas infrastructure for energy production and generation is needed now or in the near future.[59] Furthermore the		

[54] Meridian report, page ii. Available online at: https://meridianeconomics.co.za/wp-content/uploads/2022/06/Hot-Air-About-Gas.pdf
[55] Ibid.
[56] Ibid, p1.
[57] Ibid, p37.
[58] Meridian Economics, 2020. A Vital Ambition: Determining the Cost of Additional CO2 Emission Mitigation in the South African Electricity System. See at https://meridianeconomics.co.za/wp-content/uploads/2020/07/Ambition.pdf
[59] Gas and peaking resources contribute just 1.1% of total electricity generation in 2025, and 2.4% by 2035 according to the same Meridian report.

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2019 IRP will likely need to be updated in the foreseeable future to align with South Africa's 2021 Nationally Determined Contribution under the Paris Agreement and to keep pace with quickly evolving science and significant reductions in price for solar and wind energy. However, even the 2019 IRP, which is rooted in an outdated and scientifically and economically unsound understanding of the necessity for any gas in the energy mix[60], only projects the collective contribution of gas and diesel to the 2030 energy mix to be 1.3% combined.[61] 55. According to a recent report prepared by Robert W. Howarth titled "Methane emissions and climate warming risk from hydraulic fracturing and shale gas development: implications for policy"[62] the climate impacts of gas are greater than those of coal per unit of energy produced when evaluated over a 20-year timeframe, the period most relevant for climate change if humans are to avoid catastrophic run-away warming. Though gas emits less carbon dioxide per unit energy than coal, its upstream GHG emissions are more problematic for the climate, as it leaks and vents potent methane throughout its lifecycle; researchers have been able to better detect emissions across the lifecycle of gas ever more accurately thanks to new methodologies and technologies (particularly "top-down" measurements using satellite and aerial assessments). 56. The use of fossil fuels must be phased out quickly due to the urgent need to address global warming. A recent study published in *Nature*,		

[60] Meridian Economics, Hot Air About Gas: An Economic Analysis of the Scope and Role for Gas-Fired Power Generation in South Africa (2022), pages 2-3, https://meridianeconomics.co.za/wp-content/uploads/2022/06/Hot-Air-About-Gas.pdf

[61] 2019 Integrated Resource Plan, page 42.

[62] Robert W Howarth. 2015. Methane emissions and climate warming risk from hydraulic fracturing and shale gas development: implications for policy" Energy and Emissions Control Technologies at pages 47-50. See https://www.research.howarthlab.org/publications/f_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100815_27470.pdf

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the world's leading multidisciplinary science journal, discovered that "by 2050, we find that nearly 60% of oil and fossil methane gas, and 90% of coal, must remain unextracted to stay within a 1.5 °C carbon budget." According to the study, "most regions must reach peak production now or within the next decade, making many operational and planned fossil fuel projects unviable."[63] It is common practice that proposed exploration activities such as reconnaissance, only commence months and sometimes years after the need and desirability assessment is undertaken, with extraction and production only commencing years later.[64] According to one study, the world's largest oil and gas fields took an average of 5.5 years from discovery to first production and 17 years to reach peak output.[65] Chevron Corporation's (CVX) Gorgon natural gas development project off the coast of Australia took 30 years to complete, and another six years to begin producing liquefied natural gas.[66] Therefore exploration projects whose objectives are to locate gas deposits for energy companies to exploit through the construction and production of fossil fuels, run the risk of creating risks for such infrastructure to become stranded assets which invariably impacts on the development potential of South Africa in achieving its climate goals. With no economic justification for large-scale gas use in power, such a strategy would result in assets that are stranded before their first kWh of power is generated. Given this, the proposed reconnaissance		

[63] Welsby, D., Price, J., Pye, S. et al. Unextractable fossil fuels in a 1.5 °C world. Nature 597, 230–234 (2021). https://doi.org/10.1038/s41586- 021-03821-8.

[64] While new wells in developed reservoirs can be drilled and brought online in a matter of months, production from new fields can take years due to complex permitting requirements and the construction of infrastructure such as pipelines and storage facilities

[65] Henrik Wachtmeister, Mikael Höök, "Investment and production dynamics of conventional oil and unconventional tight oil: Implications for oil markets and climate strategies" Energy and Climate Change,
Volume 1, 2020, 100010, ISSN 2666-2787, https://doi.org/10.1016/j.egycc.2020.100010.
(https://www.sciencedirect.com/science/article/pii/S2666278720300106

[66] https://australia.chevron.com/-/media/australia/our-businesses/documents/Gorgon-Project-Milestones-Fact-Sheet.pdf

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project in no way provides a remedy nor will address in the immediate future South Africa's current energy insecurity issues. 57. Importantly, seismic surveys to explore for oil and gas will not have any immediate impact on South Africa's energy security, as any oil and gas extracted would not belong to South Africa, but would invariably belong to the companies that extract for profit.[57] Energy companies compete for access to mineral rights granted by governments by either entering a concession agreement, meaning any discovered oil and gas are the property of the producers, or form part of a production-sharing agreement which favours the interest of the producers and ultimately diminishing the general interests of the broader South African Republic. 58. The oil and gas that will be eventually extracted by oil and gas companies is ultimately exploited for profit. It is not used to generate a benefit that results in broad based security for energy production nor does it lead to the production of energy for South Africa and its citizens. If oil and gas found following a successful reconnaissance, and that are ultimately exploited, are not used to produce energy for South Africa, this invariably undermines the sole stated goal underpinning the need and desirability of this proposed reconnaissance project—its supposed contribution to energy security for South Africa—and provides no tangible benefit for South Africans. 59. While the increased use of gas as a 'transitional fuel' is promoted by government and vested interest groups, the Green Connection and Natural Justice submit that the increased use of fossil gas (especially in electricity generation) will lead to increased emissions of climate warming GHGs, and methane (CH_4) in particular. While natural gas combustion is less carbon-intensive than that of coal, fugitive emissions arising from the production, transport, storage and use of natural gas have a much greater climate impact than CO_2. In		

[57] Stewart Glickman and Shang Yang Chuah, Oil, Gas & Consumable Fuels Industry Surveys (New York: CFRA, 2019)

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particular, over a 20-year period (which is particularly relevant since the next 20 years are a critical window for addressing the climate crisis) methane emissions, which make up approximately 70-90% of natural gas emissions, are projected to be 82.5 times as impactful as those of CO_2.[68] The desirability of using gas as a 'transitional' fuel is also questionable having regard to volatile international gas prices, as well as the potential risk of Carbon Border Taxes being introduced in the future.[69] This risk will impose restrictions on the export of products with a high carbon footprint, putting South Africa's economy at greater risk of developing gas to power rather than clean renewable alternatives. This invariably diminishes the need and desirability for promoting new gas development projects, as the negative climate impacts and financial risks undermine the potential for gas to represent a viable solution for South Africa's ambitions to address development whilst respecting universal and regional climate change obligations. 60. The fundamental outcome of the need and desirability assessment should not be centred on the determination of whether gas technology will ensure security of supply for electricity. Instead, due to the climate crisis, this assessment should be centred on whether South Africa needs, or should rely on, gas to provide security of supply of electricity and whether alternative technologies could meet the same supply objectives with less harm and risk. Renewable energy and/or storage can replace gas to provide reliable and cost-effective generating capacity while greatly reducing the environmental and health risks associated with gas.[70]		

[68] See the IPCC's 6th Assessment Report (AR6), Working Group 1, Chapter 6 *The Earth's Energy Budget, Climate Feedbacks and Climate Sensitivity*, Table 7.15 at p1017. Available online at: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter07.pdf

[69] https://car.org.za/wp-content/uploads/2022/10/Natural-Gas-factsheet.pdf

[70] See, e.g., Union of Concerned Scientists, Turning Down the Gas in California (13 July 2018), https://www.ucsusa.org/resources/turningdown-gas-california?_ga=2.79265367.2135392956.1587590973-34786515.1587590973#ucs-report-downloads

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61. The call for gas as part of the energy mix set forth in the 2019 IRP does not excuse the decision-maker from taking climate change impacts into account, including as part of the need and desirability assessment. The case for need and desirability must address climate impacts and cannot simply rest on the 2019 IRP as evidence of need or desirability as relied upon by the EAP in the BAR. In the judgment of the High Court in *Earthlife Africa*[71], the court expressed that with respect to a decision maker's reliance on the IRP when rendering a decision on an application for environmental authorisation, the following is important to acknowledge: (a) "Policy instruments developed by the Department of Energy cannot alter the requirements of environmental legislation for relevant climate change factors to be considered".[72] (b) Establishing the need and desirability of a proposed project, is a key objective of each stage of scoping and impact assessment and must account for South Africa's 2021 NDC under the Paris Agreement. The EAP must therefore provide a broad and robust analysis of multiple alternative literature on renewable energy resources and make a justifiable and reasonable case for a project's need and desirability having considered the available literature, without relying solely on the 2019 IRP and other policy documents. This invariably assists the decision maker to prioritise the granting of the best decision which will prioritize the integrity of the environment, and the social welfare, health and safety aspects of the socio-economic environment for present and future generations.		
Ground 2: Failure to adequately consider marine impacts. *Underwater sound from seismic surveys*	The importance of sound is clearly acknowledged in the BAR and consequently a dedicated acoustic modelling assessment was prepared as part of the BAR. EIMS appointed experienced and qualified scientists	

[71] Earthlife Johannesburg and Another v. Minister of Energy and Others 2017 2 All SA 519 (GP)

[72] See above at para 97.

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62. The ocean is an acoustic world. This is because water is a dense medium, and sound travels faster and farther underwater. Marine species, from larvae to whales, utilise this efficiency and have evolved to depend on sound for essential biological functions, including feeding, breeding, communicating, navigating, and socializing.[73] 63. Sound is also a fundamental component of marine habitats. Different ocean environments have distinct acoustic signatures that comprise their acoustic habitat. These acoustic habitats are created from a combination of biological sounds (e.g., fish choruses, snapping shrimp, urchin movement, whale calls) and environmental sounds (e.g. waves crashing, rain, earthquakes). The addition of anthropogenic noise to these soundscapes disrupts the abilities of marine species to use naturally occurring acoustic cues and has detrimental effects on individual organisms, populations, and communities.[74] 64. Seismic airgun blast are the loudest human-created noises introduced into the ocean environment and they travel long distances through seawater. Studies have shown that seismic blasts are at least detectable at distances greater than 500-700 km, even up	to assess the likely impacts from seismic noise. The associated noise impacts were a key focus of the BAR and this clearly indicated in Section 9 of the BAR. It should be noted that a qualified and experienced marine ecology specialist was appointed to conduct an assessment of the likely impacts as identified and described in Section 9.3.1of the BAR. The significance rating for each impact is determined through consideration of the nature, extent, duration, magnitude and probability of each impact. Please refer to section 9.1 of the BAR for an explanation of the assessment methodology utilised. The significance of all identified impacts in the marine ecology report, which included the impacts associated with the underwater sound from the proposed seismic survey, were considered to be of low significance once mitigation has been applied. The significance of environmental impacts varies depending amongst others on the specific location, prevailing sensitivities, receptors, timing, and extent of the proposed activities. The EAP and the specialists identified and assessed potential environmental impacts (supported by inputs from the public consultation process) and has	

[73] Supporting Affidavit of Dr. Aaron N. Rice at paras. 8, *Sustaining the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021, attached marked **Annex B1**; Supporting Affidavit of Dr. Douglas P. Nowacek at paras. 9 & 13, *Sustaining the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021, attached marked **Annex B2**.

This appeal incorporates the expert opinions of Dr. Rice and Dr. Nowacek who submitted affidavits in the matter of *Sustaining the Wild Coast NPC & Others v Minister of Mineral Resources and Energy & Others*, High Court of South Africa, Eastern Cape Division, Makhanda – Case No. 3491/2021. Both of the affidavits provide expert insight on underwater acoustics, how marine species utilize acoustic cues for biological processes, and how seismic surveys may impact different taxa. The declarations will be used to assist the court to understand general principles and processes and will not be used to support specific impacts that were associated with that case on the east coast of South Africa.

[74] Rice Supporting Affidavit at para. 12.

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to 4,000 km.[75] Other studies have detected seismic surveys at levels sufficient to mask, or obscure, baleen whale calls at distances of thousands of kilometres away from the source.[76] Airgun noise influences and degrades the acoustic habitat of marine species over a far greater area than the metres and kilometres that the EBAR considers and in fact, according to the science, can easily reach coastal areas 120 – 230 km from the survey area. 65. In addition, the noise produced by airgun arrays becomes virtually continuous at greater distances from the source creating chronic noise impacts. This is because the sounds emanating from a seismic airgun array do not behave as individual and finite sound source *in situ* but reflect off the ocean surface and seafloor as they travel, leading to a continuous increase in the sound level through reverberation. The effect has repeatedly been documented.[77] Studies have found seismic surveys causing elevated ambient noise levels by more than 25 dB (approximately a 4-fold increase in noise levels) across distances of 40 km and these sound levels remain elevated during the periods between airgun blasts.[78] Open ocean condition observations have found that the noise produced and were sustained for months at a time.[79] 66. Because of several flaws in its approach, the BAR does not fully identify and assess the risk posed to marine species and ecosystems and does not effectively mitigate the risks from the proposed the proposed surveying.	proposed management and mitigation measures. The impacts are, by virtue of the fact that the impact assessment is a predictive assessment, regarded as 'potential'. All impacts identified in the process can be reduced to a low or medium significance with the implementation of the management and mitigation measures. All impacts associated with a proposed project are considered potential impacts until the impact actually occurs. The studies undertaken internationally over the past ~70 years on the impacts of noise on marine fauna (of which some 400 peer-reviewed publications have been summarised and cited in the marine faunal specialist study) have concluded that the effects of underwater sounds vary substantially and depend on a wide variety of physical and biological factors. When writing articles on the effects of seismic acquisition on marine fauna it is therefore not difficult to bias the literature cited to either demonstrate detrimental and irreversible impacts or only very limited impacts, depending on the personal view of the author(s) and/or the targeted readership. The marine faunal assessment has made efforts to present published results objectively, and nowhere claims that acoustic surveys do not result in impacts. Injury is likely at very short range, with behavioural disturbance occurring over greater distances. The final significance ratings are determined using information from the peer-reviewed literature together with the noise modelling results (which put the threshold distances from the source array to mortality and	

[75] Rice Supporting Affidavit at para. 18; Nowacek Supporting Affidavit at paras. 9-10.
[76] Rice Supporting Affidavit at para. 18; Nowacek Supporting Affidavit at paras. 13.
[77] Rice Supporting Affidavit at para. 19-20; Nowacek Supporting Affidavit at para. 10.
[78] Rice Supporting Affidavit at para. 19-20; Nowacek Supporting Affidavit at para. 10.
[79] Rice Supporting Affidavit at para. 19-20; Nowacek Supporting Affidavit at para. 10.

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Harms to marine life 67. It is well established that marine seismic surveys cause serious and irreparable harms to marine life. The Biodiversity and Ecosystem Services Assessment Report[24] ("Pisces Report") prepared for the Project acknowledges the a wide range of impacts on numerous species: • Physiological injury and/or mortality; • Behavioural avoidance; • Reduced reproductive success/spawning; • Masking of environmental sounds and communication; • Collision of turtles/marine mammals with the survey and support vessels or entanglement in towed acoustic apparatus; and • Indirect impacts on piscivorous predators due to seismic effects on prey species 68. According to the Pisces Report, the following species are present in the Project area and face the highest risk of harm from the proposed survey: • humpback whales, which migrate through the area between June and November (inclusive); • sperm whales, beaked whales and other odontocetes that frequent offshore waters; • large migratory pelagic fish and shark species that show seasonal association with Child's Bank and Tripp Seamount;	potential mortal injury into perspective), adopting the precautionary principle as is required when undertaking such impact assessments, and taking into account the sensitivity of receptors present in southern African waters. Given all of the evidence, the conclusion reached for the various assessments is that impacts are either of low or very low significance. The Noise impact on plankton is assessed in Section 9.3.1.1.7 of the BA report. The reconnaissance permit area is located far offshore (120 km at its closest point) and therefore beyond the influence of coastal upwelling, which will influence both plankton abundance and the abundance of fish species that depend on plankton as a food source. From Figures 17, 18 and 19 in the marine ecology specialist assessment it is evident that the project area lies well beyond major fish spawning and recruitment area (and therefore zooplankton and ichthyoplankton abundance). An EIA is a risk-assessment based study and is a process of evaluating the likely environmental impacts of a proposed project or development. It is not possible to provide conclusive evidence of the fact that impacts will be negligible. However, it can be stated with regards to the uncertainties and gaps in knowledge that these have specifically been taken into consideration during the assessment of the particular impacts. The confidence level of the rating has been stated and the level and type of mitigation proposed has followed the clear mitigation hierarchy presented in the Specialist reports and also the EIA Report. Accordingly, the mitigation measures proposed are deemed to be sufficient to account for the eventuality that unforeseen events or organism responses are encountered during the actual survey operations, and will ensure that there is independent oversight and feedback to ensure compliance with the EMPr.	

[24] PISCES Environmental Svcs (Pty) Ltd (for TGS Geophysical Company). *Biodiversity and Ecosystem Services Assessment Report* ("Pisces Report") (Sept. 2022).

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• leatherback turtles which frequent offshore waters in low numbers and aggregate around seamounts to feed on jellyfish; and • various pelagic Albatross, Petrel, Storm Petrel and Shearwater species (the Pisces report indicates that pelagic seabirds are likely to be relatively frequently encountered in the offshore waters of the Reconnaissance Permit area).[81] 69. A 2022 review of peer-reviewed literature on the physiological, behavioural and ecological impacts of the 3D seismic survey activities on marine wildlife[82] ("Harris Report", attached marked Annex B3) found that the type of sound emitted during seismic surveys has been directly linked to physical damage to marine animals, including soft tissue trauma damage, emboliems, damage to organs used in balance and orientation, concussions, haemorrhaging, decompression sickness and both temporary and permanent threshold shifts to hearing ability. The Harris Report also found that some species display physiological stress responses and behavioural changes to seismic activities, such as moving away rapidly, diving or remaining still. These responses are likely to increase their energy consumption and energy costs, reduce their time to forage, and/or affect their vulnerability to predation, thus having negative impacts on the survival of individuals (especially young or compromised animals) as well as the overall population growth and survival of a species (especially for threatened species that are already at risk of extinction). **Acoustic Modelling**	The extent of the TGS survey area is substantively different from that applied for by Searcher in 2021 and which was the focus of the Harris (2002) review. The TGS Application Area is located further from shore and avoids many of the identified sensitive areas and sensitive times of the year. A team of similarly qualified specialists considered the proposed activity, identified and assessed potential impacts, and where applicable made recommendations to manage and mitigate the impacts. All impacts assessed can be reduced to a medium or low significance with the implementation of management and mitigation measures described in the BA report and accompanying EMPr. Please refer to Section 9.3.1 of the BA Report for the assessment of the potential impact on marine fauna (including impact on humpback whales, southern right whales, leatherback turtles, African penguin, and cape fur seal) in the context of the proposed activity. The Appellant's submission that the Acoustic Modelling, is largely a desktop assessment is correct. However, it cannot be stated that the model failed to provide meaningful information as is claimed by the Appellant. The technical noise report relies on predictive modelling to predict the noise impacts associated with the seismic survey. In order to refine and confirm this information, the underwater noise modelling study recommends that "Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented	

[81] Pisces Report at 45.

[82] Harris, Olbers & Wright, *Report on Scientific Basis for concerns of significant harm inflicted to marine wildlife by 2D and 3D seismic surveys on the South and West Coasts of South Africa* (14 January 2022).

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70. The Appellants submit that the underwater noise modelling was largely a desktop study rather than a meaningful examination of the acoustic harms that seismic surveying will have. 71. The acoustic modelling failed to provide meaningful information in several ways: 71.1. The model should have included in situ testing to 'ground truth' the modelling and accurately determine the potential noise impacts associated with various aspects of the proposed 3D seismic survey (sound in the ocean is affected by pressure, salinity, temperature and temperature gradients, and can travel many kilometres from the source). 71.2. The model should have assessed the impacts of noise on all species (different species have different sensitivities to noise) during the environmental impact assessment process (not ex post factor). 71.3. The assessment should include (but not be limited to) potential impacts on the migration of snoek (a species that is important to the livelihoods of small-scale fishers) and juvenile turtles (which are significant from a biodiversity perspective given their endangered status) that are in turn dependent on other species. **Heightened Legislative Requirements are Not Considered for Critical Biodiversity Areas (CBAs), Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs)** 72. The National Environmental Management: Biodiversity Act, 2004 ("NEMBA") provides for ecosystems that warrant special conservation attention. These include ecosystems identified as Critical Biodiversity Areas ("CBAs") or Ecological Support Areas ("ESAs") in a bioregional plan, biodiversity sector plan or provincial spatial biodiversity plan.	that would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior to the commencement of the survey and then operational levels of noise during the survey." The migration of snoek has been described in Section 8.5.3.10 of the BA Report. Additionally, the impact of the proposed activity on juvenile turtles is described detail in Section 4.3.3 (Impacts of Seismic Noise on Turtles) of the Marine Ecological Assessment. It is also already recommended in Section 9.3.4.2 of the BA Report as well as the EMPr that TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. The NEM:BA, NEM:PAA and NEM:ICMA are all identified as key pieces of legislation applicable to the proposed project in Section 4 of the BAR. Furthermore, the BAR goes on to discuss CBAs and ESAs in Section 6.2 – CBA 1 indicates irreplaceable or near-irreplaceable sites that are required to meet biodiversity targets with limited, if any, option to meet targets elsewhere, whereas CBA 2 are "best design sites" and there are often alternative areas where feature targets can be met; however, these will be of higher cost to other sectors and / or will be larger areas. Activities within these management zones are classified into those that are "compatible", those that are "not compatible", and those that have "restricted compatibility". Non-invasive (e.g. seismic surveys) and invasive (e.g. exploration wells) exploration activities are classified as having "restricted compatibility". Activities with restricted compatibility require a detailed assessment to determine whether the recommendation is that they should be permitted (general), permitted subject to additional regulations (consent), or prohibited, depending on a variety of factors. Petroleum production is, however, classified as "not	

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73. The Appellants contend that the Minister ignored the critical importance of NEMBA, NEM:PAA and relevant provisions of NEM:ICMA in terms of protecting and conserving the identified CBAs within the survey area, as well as the EBSAs and MPAs. At the very least, the value of these areas and the extent of potential negative impacts of exploratory activities on these areas should have been considered. The BAR failed to provide any assessments for the CBAs contained within the Application Area or the EBSAs and MPAs that are adjacent to the area. CBAs 74. The FBAR failed to meet even minimal standards of providing a "detailed assessment" and relevant mitigation in order to protect irreplaceable and near-irreplaceable CBAs from the intense and chronic blasts of the seismic survey. In fact, the Sound Transmission Loss Modelling report makes no reference to critical biodiversity areas. 75. FBAR acknowledges that there are several CBAs within the Application Area itself: *The Application Area overlaps with areas mapped as Critical Biodiversity Area 1 (CBA 1): Natural and Critical Biodiversity Area 2: (CBA 2) Natural. Approximately 32.25 % of the proposed 3D acquisition area is covered by CBA 1 and CBA 2 Natural, 0.22% by CBA 1 and CBA 2 Restore, and 1.75% by ESA (see Figure 91).*[83] 76. CBA 1 are irreplaceable or near-irreplaceable sites that are "required to meet biodiversity targets with limited, if any options to meet targets elsewhere."[84] CBA 2 are best design sites where there may be alternative areas where biodiversity targets can be met at a higher	compatible" in CBAs, but may be compatible, subject to certain conditions, in ESAs. Seismic surveying is not only used for petroleum and natural gas exploration and development. It is also used for development of offshore wind, geothermal energy, and low-carbon solutions such as carbon capture and storage and also more generally for providing more insight and understanding into the regional geology of the area for scientific purposes. Therefore the CBA areas are not considered no-go areas for the purposes of seismic survey activities. In addition, the National Coastal and Marine Spatial Biodiversity Plan for the coast and ocean around the South African mainland states that petroleum production may be possible in CBAs using lateral drilling or other techniques that do not result in biodiversity impacts. According to the plan if significant petroleum resources are identified in these areas the selection of the site as a CBA could be re-evaluated, although this would require alternative CBAs to be identified to meet biodiversity targets. The potential impact on MPAs, CBA's and EBSA's is specifically noted in the BAR. A buffer of at least 5 km is recommended around MPAs, as stated in the EMPr. No buffer requirements are proposed by the marine fauna specialist for CBAs or ESBAs as the impact on these areas is expected to be low – negligible. Section 8.6 of the BAR presents the proximity of the planned activities in relation to ecologically or biologically significant areas. There is one Ecologically or Biologically Significant Marine Area (EBSA) overlapping the application area, and this was considered through the selection of the L1 point in order to gauge the effects on the Tripp Seamount to the	

[83] BAR at 162.
[84] BAR at 162.

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cost or requiring the allocation of additional area to achieve the targets.[85] 77. The FBAR recognizes that the exploration activities, including seismic surveys, are classified as having restricted compatibility with CBAs, which require a "detailed assessment to determine whether the recommendation is that they should be permitted (general – as is the case for this assessment), permitted subject to additional regulations (consent), or prohibited, depending on a variety of factors."[86] The BAR fails to even identify the unique and irreplaceable features of the CBAs in order to be able to assess whether this activity should be permitted. 78. CBA areas have been identified and set aside, and resources have been invested, in order to protect these biologically critical habitats and the marine species that depend on them. Seismic surveys will run directly over these critical biodiversity areas designated as irreplaceable and near-irreplaceable, causing severe and potentially irreversible impacts. 79. The FBAR has failed to look in detail at the CBAs, understanding why they were identified as critical biodiversity areas, and then propose specific mitigation measures in order to make an informed assessment as to the "restricted capability." <u>EBSAs and MPAs</u> 80. The underwater Sound Transmission Loss Modelling report conducted for the BAR indicates in its introduction that the proposed survey areas are adjacent to a few Ecologically or Biologically Significant Marine Areas (EBSAs), and Marine Protected Areas (MPAs) including Childs Bank and Shelf Edge, and Cape Canyon and	north. A number of Marine Protected Areas (MPAs) are located adjacent to the proposed survey areas. Section 9.3.1.1.2 of the BAR identifies and assesses the potential impact on Cape Fur Seals. Figure 37 in the marine ecology specialist assessment illustrates the foraging ranges of seals on the West Coast from tracking data. From this it is evident that the survey area lies offshore of these foraging ranges. Additionally, suitable mitigation measures have been proposed to monitor for and protect the seals should they be encountered during the survey in Section 9.3.1.1.2 of the BAR. Section 9.3.1.1.1 and Appendix 3-5 of the BAR identifies and assesses the potential impact on beaked and other whales. This includes a description of the potential impact on: • Physiological injury and mortality; • Behavioural avoidance; • Masking of Sounds and Communication; and • Indirect impacts due to effects on predators or prey. Section 9.3.1.1.1 of the BAR then goes on to state that *"The potential impacts cannot be eliminated due to the nature of the seismic sound source required during surveying. The proposed mitigation measures, which are essentially designed to keep animals out of the immediate area of impact and thereby reduce the risk of deliberate injury to marine mammals would reduce the intensity of most impacts to medium, and the residual impacts will reduce to low consequence and LOW significance, except for the effects on prey which remains of VERY LOW significance."*	

[85] BAR at 162.
[86] BAR at 162.

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Associated Islands, Bays and Lagoon.[37] The BAR expands that list adding important areas such as the Benguela Muds MPA, Robben Island MPA, Southeast Atlantic Seamounts MPA and additional MPAs "that fall within the broader project area."[38] The Bar also identifies and describes eight EBSAs, including transboundary relevant to the seismic survey area.[39] 81. Although these protected areas do not fall within the seismic survey area itself, the nature of seismic survey will cause impacts on the habitats and the marine species that these areas are meant to protect. These include endangered and protected species, breeding areas, sensitive and vulnerable habitat, resident whales, and many other features which make the spaces fragile and sometimes slow to recover, which has warranted their protection. 82. The FBAR makes no effort to identify impacts to these sensitive areas and to mitigate the potentially irreversible harms that the seismic survey will cause. As noted above, the sound from seismic surveys can travel hundreds of kilometres and will penetrate into the MPAs and EBSAs. Further, the seismic surveys will increase the ambient noise beyond the survery area. The chronic blasting every 6-20 seconds for months (70 days) will cause behavioural disturbances and possibly more damage to these sensitive areas, which the BAR did not take into account. **Cape fur seals** 83. In South Africa, since October 2021, thousands of dead and/or dying Cape fur seals, have washed ashore along the south and west coasts. The cause of these die-offs remains unknown but avian flu has been ruled out and malnourishment appears to be the most widely	Section 9.3.1.1.5 of the BAR identifies and assesses the potential impact on pelagic fish. It was concluded that the location of the Application Area well to the west of the 'ring-fenced' area and proposed mitigation measures, which are essentially designed to keep animals out of the immediate area of impact and thereby reduce the risk of deliberate injury to fish, reduces the intensity of the impacts relating to physiological injury / mortality to medium, the residual impact will reduce to low consequence and be of LOW significance. All other impacts on fish remain of LOW significance. Avoidance effects or behavioural alterations from seismic surveys involving many fish species do not automatically imply risk factors and thus do not necessarily cause a disturbance to the fishery (McCauley et al., 2000). A recent large-scale experiment conducted by Meekan et al. (2021) in Australia showed no short-term or long-term effects on the abundance or behaviour of demersal fish assemblages in response to a commercial seismic source. This suggests that seismic surveys have little impact on demersal fishes. Other studies that found no evidence of significant changes in catch rates or fish abundance include Hassel et al. 2004, Picket et al. 1994, Miller and Cripps 2013 and Thomson et al. 2014. Noise modelling was undertaken for the proposed survey and the transmission of sound at various threshold levels was taken into account. In terms of the Russell Report, inputs from the fisheries specialist points to the fact that tuna catches globally were under stress mainly from fishing effort and also due to climate variability. In fact, the data, if interrogated further, shows that the variability in catches in Namibia	

[37] TGS: South Africa Orange Basin 3D Seismic Survey, Sound Transmission Loss Modelling at at 1-2
[38] BAR at 157-59.
[39] BAR at 159-61.

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accepted reason. Activities associated with the Project could further pressure this species by physically harming individual seals, and by disrupting the seals' food supply. 84. The Pisces Report states that Cape fur seals are unlikely to be found in the project area, citing map that shows generalized foraging areas that extend nearly exactly to the edge of the reconnaissance area.[90] However, the report also states, "[s]eals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles (~220 km) offshore,"[91] meaning a large part of the reconnaissance area is well within the foraging range of Cape fur seals. Moreover, the Based on the questionable assumption that Cape fur seals are unlikely to occur within the reconnaissance area, the Pisces Report authors deemed their sensitivity to the proposed seismic operations to be "LOW," in spite of the finding that "The potential impact of physiological injury to seals as a result of seismic noise is deemed to be of HIGH intensity."[92] **Whales and dolphins** 85. There is genuine conservation concern for beaked whales that are particularly sensitive to anthropogenic noise, including seismic surveys. It has been demonstrated that even minor, non-lethal disturbances, resulting in changes in behaviour such as displacement from preferred habitats, could impact a population.[93] 86. The phenomenon of energy-cost (from stress and avoidance behaviour) is of particular concern for some of the species expected to be encountered in the survey area in question, particularly the humpback whales and southern right whales who are at risk of the	were more associated with operational dynamics of the Namibian fleets and their licensing conditions that had reduced their effort (as South African vessels were not permitted to fish in Namibian waters). Cumulative impacts are assessed in Section 9 of the EA report. For both technical and commercial reasons, it is unlikely that concurrent seismic surveys will be undertaken in the same area during the same survey window. However, the cumulative impacts associated with multiple surveys was assessed and detailed in Section 9.3.5 of the EAR. Section 9.3.5 of the EA Report states that "three seismic surveys of regional extent, undertaken simultaneously, could be expected to result in an impact of medium negative significance on the large pelagic longline sector, both with and without the application of mitigation measures. This relates to the large pelagic long-line sector only, and only in the event that all three surveys are undertaken simultaneously. It should be noted that the seismic industry typically avoids simultaneous surveys occurring in close proximity to each other as this has the potential to degrade the quality of the recorded survey data. Other cumulative impacts are all expected to be low after mitigation is applied – therefore overall cumulative impacts are considered low post-mitigation. It should also be noted that of the three potential surveys cited by the Appellants, the GX Technologies survey should be disregarded as the company went into liquidation in 2022. The appellants' contention that up to 30% of the revenue generated by the impacted fisheries would be lost during the 70 day period is unsubstantiated and vague for the following reasons:	

[90] Pisces Report at 69 (Fig. 37).
[91] *Id.* at 111.
[92] *Id.*
[93] Harris Report

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airgun noise affecting their behaviour or interfering with the communication between mother and calf. Any impact on their energy reserves could impact on their condition (weight-loss and physiological condition) and affect survival of the animals during a vulnerable time (especially for lactating mothers and their calves) on their long migration to feeding grounds in Antarctica.[34] **Fish** 87. The BAR downplays the impacts of seismic surveys on fish and the fisheries they support, particularly in the case of the large pelagic longline fishery and the tuna pole-line fishery. While the BAR assesses the exclusion of fishing vessels due to temporary safety zones during seismic surveys, it fails to adequately assess the actual impacts of seismic activities on the target fish species themselves, both in the short and long-term. During the seismic survey, fishing vessels would be required to maintain a safe operational distance from the survey vessel and streamer array, which may extend up to 6 nautical miles. The FBAR assessed the impact of potential exclusion for each commercial sector based on the affected area of fishing ground and the amount of catch reported within the Reconnaissance Permit area. Given the location of the Reconnaissance Permit application area, two high-value fisheries are directly impacted: the large pelagic longline fishery (targeting tuna, swordfish and shark) and the tuna pole-line fishery. 88. The FBAR concluded that the Project's activities will result in exclusion to fishing grounds for at least the large pelagic longline fishery. The FBAR states that "[t]here is a high probability that the large pelagic longline sector (targeting tuna, swordfish and shark) will experience loss of access to fishing ground over the duration of the	• The four-month window is proposed to coincide with the period of lowest activities for the fisheries that operate in the potentially affected sectors; • It should further be noted that the survey will not be undertaken over the entire tuna fisheries area or the whole application area at the same time and will thus not lead to a complete shutdown of the fishing activities in the pelagic longline sector during the 70 day period of the survey; and • The mitigation measures included in Section 9.3.2 of the BAR provide for avoidance of the peak fishing periods and, furthermore, for the establishment of clear communication channels to be established with the other users of the survey area and to ensure that the disturbance within this sector is reduced to the absolute minimum. The impact on the affected fishing sectors was assessed to be of low significance and short duration and it could thus not be stated that "The FBAR fails to consider the long-term behavioural or migration impacts that seismic activity could have on the pelagic longline fishery, which include several species of tuna." Impacts of cumulative sound exposure on marine mammals are evaluated using disturbance and injury threshold, defined as temporary threshold shifts (TTS) and permanent threshold shifts (PTS) (Southall et al. 2019). The audibility of a noise pertains only to the perception or detection of a sound above background levels of ambient noise. The thresholds established by Southall et al. (2019) are internationally regarded as standard references for environmental impact assessment of underwater noise. Although the modelling report doesn't specifically reference the CBA areas, the purpose of the modelling was to model the likely sound transmission and contours. The outputs of the model were then	

[34] Harris Report

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proposed 70-day survey," and that [t]he impact of exclusion is assessed to be of high magnitude."[95] 89. In terms of noise impacts to the target fish of the large pelagic longline fishery and the tuna pole-line fishery, the Pisces Report acknowledges that "[s]eismic activities have been predicted to possibly affect the migration patterns of tuna leading to substantially reduced catches of albacore and southern bluefin tuna in southern Namibia and the Great Australian Bight, respectively,"[96] yet ultimately the Report concludes that "[a]s there is currently a dearth of information on the impacts of seismic noise on truly pelagic species such as swordfish and tuna (Evans et al. 2018; Webster et al. 2018), links between changes in migration patterns and subsequent catches thus remains speculative."[97] The FBAR thus maintains that potential impact on individual fish behaviour is of MEDIUM consequence and that "the residual impact due to seismic noise is considered to be of LOW NEGATIVE significance for the large pelagic longline and tuna pole-line sectors."[98] 90. Overall, the FBAR concludes that with mitigation (timing of the surveys to avoid peak fishing periods), the following overall impact significance: Based on the combination of extent, duration and magnitude of the impact, and considering the high probability that the impact would occur, the overall significance of the impact is considered to be MEDIUM	considered and assessed by the marine ecology specialist who specifically considered the CBA areas. The Appellants' submission that mitigation measures proposed only focus on marine mammals, is not substantiated by the large number of mitigation measures as detailed in Section 9 and 11.4 of the BAR. The use of infra-red cameras was discussed during the various public meetings held during the BAR review phase and included in the Public Participation Report in Appendix 2. It should further be noted that the Appellants' commented on the lack of inclusion of infra-red cameras during the BAR review phase, and subsequently the EAP included this as a specific mitigation measure in the final BAR. It is therefore strange that the Appellant now disputes the use of this technology and lists this as a supporting factor in this grounds of appeal. The Noise impact on plankton is assessed in Section 9.3.1.1.7 of the BA report. The study by McCauley et al. (2017) generated significant public attention, but the paper has not been widely accepted by the scientific expert community as the findings are considered severely flawed. Details on the independent reviews of the paper are provided in the EnerGeo response to a publication by the Scientific Advisory Group on Emergencies (SAGE). Follow-up studies by Richardson et al (2017) failed to conclusively demonstrate discernible effects on zooplankton biomass on a regional scale and Fields et al. (2019) detected no significant behavioural differences in the copepod species *Calanus*	

[95] BAR, pg. 212.
[96] Pisces Report, pg. 132.
[97] Pisces Report, pg. 132.
[98] BAR, pg. 244.

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NEGATIVE. Due to the low probability of the operations of the tuna pole-line sector within the Reconnaissance Permit area, the overall significance of the impact on the sector is considered to be LOW NEGATIVE. 91. The EBAR fails to adequately assess the vulnerability of the targeted fish species (including tuna and sharks) to noise impacts, and any decision based on it would be unreasonable. This is a major flaw because many of the large pelagic fish and shark species likely to occur in the offshore regions of the Orange Basin are considered globally 'Vulnerable' (e.g., bigeye tuna, blue marlin, Oceanic Whitetip shark, dusky shark, great white shark, longfin mako), 'Endangered' (e.g., shortfin mako, whale shark) and 'Critically Endangered' (Southern bluefin tuna). 92. The impact on fish assemblages is difficult to interpret, due to multiple factors at play including but not limited to the ability of a species to move from an area as well as the receiving habitat. A global review of the effect of seismic activities on fish and invertebrates acknowledged the limits of the current research due to experimental designs used or due to the focus on single species during investigations. A key concern is a lack of research focused on confounding effects and multiple stressors, therefore potential impacts of seismic surveys that have been previously identified may be reflective of underestimation or overestimation and would depend on the type of interaction (synergistic, additive, or antagonistic).[99] 93. Sounds pollution from seismic surveys may have a wide range of effects on fish species. Exposure to intense sounds can result in mortal injury, but over longer distances issues are associated with sounds that are detectable by fish and which may affect their behaviour, causing them to move away from their migration routes, flee important habitats in which they feed or breed, interfere with	*fimmanchilus* based on distance to the source or control vs. exposed groups. The reconnaissance permit area is located far offshore (120 km at its closest point) and therefore beyond the influence of coastal upwelling, which will influence both plankton abundance and the abundance of fish species that depend on plankton as a food source. From Figures 17, 18 and 19 in the marine ecology specialist assessment it is evident that the project area lies well beyond major fish spawning and recruitment area (and therefore zooplankton and ichthyoplankton abundance); Figure 27 shows the area in relation to Cape Gannet and African Penguin distribution; Figure 37 shows the area in relation to seal foraging areas and Figure 47 shows the area in relation to virtual turtle hatchling trajectories. The survey area in relation to various marine mammal distributions is also provided and in all cases it is evident that interaction with marine fauna in those offshore waters should be minimal. The impact assessment shows that these impacts are of a medium-low significance even before any mitigation measures are applied. Regarding the supplementation with respect to the operating hours of the PAM monitoring: This would require the survey to likely run over two (or more) seasons. This is not only not cost effective for the seismic operator, but would extend the duration of the acoustic impacts (and others) associated with surveying. Considering that the survey area is located within the major shipping lanes and that ambient sound levels (dominated by the noise of vessels) will be persistent throughout the day and night, it seems more appropriate to undertake the survey in as	

[99] Harris Report

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their communications, affect reproductive behaviour (where sound is used to attract mates and facilitate spawning), or prevent or mask the detection of other biologically important sounds. Because of these many-pronged affects, seismic surveys can have compounding negative impacts on marine fish. 94. In his expert affidavit filed in a recent seismic survey case,[100] Dr Alexander Claus Winkler provided testimony regarding evidence of direct, lasting behavioural effects of seismic surveys on the rhythmic behavioural foraging patterns of cod in the North Sea. Winkler points out that both hake and snoek perform rhythmic diel foraging migrations off the seafloor at night and onto the seabed during the day. Given that seismic surveys are conducted both during the day and night, it is likely that these benthic fish species will migrate higher up the water column at night, bringing them within distances that may expose them to direct injury and mortality impacts from seismic surveys. It is noted that the Pisces report indicates that species most likely to be found in the area of interest include large migratory fish (such as tuna, billfish and sharks), many of which are considered threatened by the IUCN due to overfishing.[101] 95. In addition, contrary to the EBAR's conclusions that there is only LOW NEGATIVE significance for the large pelagic longline and tuna pole-line sectors,[102] a 2018 desktop survey of South Africa fisheries impacts from seismic surveying by Namibian fisheries expert David Russell ("Russell Report") concluded the following: [W]here there are cumulative impacts from repetitive surveys in the same area, as has occurred off Southern Namibia tuna fishing grounds, where	short a time as possible, in which case night-time operations are necessary. The studies undertaken internationally over the past ~70 years on the impacts of noise on marine fauna (of which some 400 peer-reviewed publications have been summarised and cited in the marine faunal specialist study) have concluded that the effects of underwater sounds vary substantially and depend on a wide variety of physical and biological factors. When writing articles on the effects of seismic acquisition on marine fauna it is therefore not difficult to bias the literature cited to either demonstrate detrimental and irreversible impacts or only very limited impacts, depending on the personal view of the author(s) and/or the targeted readership. The marine faunal assessment has made efforts to present published results objectively, and nowhere claims that acoustic surveys do not result in impacts. Injury is likely at very short range, with behavioural disturbance occurring over greater distances. The final significance ratings are determined using information from the peer-reviewed literature together with the noise modelling results (which put the threshold distances from the source array to mortality and potential mortal injury into perspective), adopting the precautionary principle as is required when undertaking such impact assessments, and taking into account the sensitivity of receptors present in southern African waters. Given all of the evidence, the conclusion reached for the various assessments is that impacts are either of low or very low significance. It is not disputed that MMO sightings are not 100% efficient. Various approaches have been adopted over the years to improve observer	

[100] Available online at: https://drive.google.com/drive/folders/1m-h8MoKfdNJfKHLB_uID1KX-dBktua12 (Alexander Winkler).

[101] Pisces Report at 40.

[102] Capricorn Report, pg. xxv.

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catches have severely declined since 2011, and in 2017 dropped off to non-commercial catch rates, there is the ominous possibility that the tunas change their migration path. Environmental factors such as El Nino appear to also have contributed significantly, but combined with regular seismic surveys, the environmental signals are potentially devastating.[103] 96. There is a possibility that up to three seismic surveys (Searcher, TGS, and GX Technologies) would take place simultaneously in the area, which would further increase geographic exclusion of the fishery. If multiple 3D seismic surveys were not undertaken simultaneously, then sequential surveys in the same area would prolong the loss of access to the pelagic longline sector and duration of seismic impacts to fisheries. Yet the FBAR does not directly assess the impacts of simultaneous surveys on the fisheries. 97. The FBAR concludes, without citing any evidence, that after months of up to three simultaneous seismic surveys in the pelagic longline sector, "[o]nce completed there is not expected to be any residual impact."[104] As noted above, the Russell report identified potential long-term impacts of repeat seismic activity on Southern Namibian tuna fisheries, with implications that tuna may change their migration patterns to avoid noise pollution.[105] The BAR fails to adequately consider or mitigate impacts to the pelagic longline sector that are both short-term (potentially closing the fishery for 70 days or longer given multiple surveys in a single year) and long-term (inflicting behavioural and migration shifts).	efficiency, particularly at night, with infra-red binoculars and mast-mounted infra-red (IR) cameras being tested. These have, however, not proven as effective as initially anticipated, due to lack of detectable temperature differences, resulting in the implementation of the 24/7 PAM surveillance. From a seismic operator's perspective, it is not feasible or cost-effective to cease airgun operations at night as this would prolong the duration of the survey possibly requiring multiple seasons to complete the acquisition. This would also add substantially to the overall survey duration and cumulative impacts.	

[103] Assessing the Impact of Seismic Surveys on South African Fisheries, 2018. David Russell Fisheries Consultancy for the Responsible Fisheries Alliance ("Russell Report"), pg. 6.

[104] BAR, pg. 236.

[105] Russell Report.

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98. The sector had an estimated wholesale value of R124 Million in 2018, or 1.2% of the total value of all fisheries combined. For tuna pole-line, the fishery runs predominantly from November through June, while the large pelagic longline fishery runs highest from May to November.[196] The FBAR lists a proposed window of January – May for its 70-day 3D seismic survey, meaning a large fraction (up to 30% with an approximate wholesale value of R40 Million) of the fishery year stands to be excluded. Because its assessment did not adequately consider the longer-term residual impacts on the fisheries from seismic activity, this monetary loss stands to be much greater than that estimated from fishery exclusion alone. 99. The FBAR fails to consider the long-term behavioural or migration impacts that seismic activity could have on the pelagic longline fishery, which include several species of tuna. Such changes in the fishery could have severe and lasting implications for communities dependent on this important fishery for many years to come and should have been included in the impact assessment. 100. The FBAR states that "[t]he zones of TTS [temporary threshold shift] effect for fish species with and without swim bladders are predicted to be within 3.5 km from the survey lines for the 3D survey 24-hour operation scenarios considered."[197] This predicted zone of TTS for fish both with and without swim bladders is a gross underestimation and based on minimal and non-regional specific data, including data from riverine 2D seismic activity on freshwater species (e.g. Popper et al., 2006). As the Capricorn Report admits, "[t]o date there have		

[196] BAR App. 3.2 PROPOSED 3D MULTI-CLIENT SEISMIC SURVEY IN THE ORANGE BASIN, OFFSHORE SOUTH AFRICA Fisheries Specialist Study, September 2022 ("Capricorn Report"), pg. 66.
[197] BAR, pg. 235.

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been no studies focused directly on the [fish] species found locally."[108]		
101. Most of the mitigation measures proposed in the BAR are designed to minimise impacts to marine mammals. As admitted in the Pisces Report, vastly less is known about how such mitigation measures alleviate sound impacts experienced by marine fish species.[109] Large pelagic fish (e.g. tuna, sunfish, or sharks) would not be detected by PAM (which would be tuned for marine mammal vocalisations) and would not likely be detected visually at night by observers or using an infrared thermal imaging camera (since cold-blooded fish, as opposed to warm-blooded mammals, do not have high enough temperature differences from the water).		
102. The FBAR further fails to provide evidence that infrared thermal imaging is effective as a mitigation measure.		
103. TGS takes no preventative mitigation measures to minimise impacts to marine fish species during 3D surveying and has a single and insignificant mitigation measure (7.1) to shut down seismic shooting in the case the following is observed: "mass mortalities of squid and fish (specifically large shoals of tuna or surface shoaling small pelagic species such as sardine, anchovy and mackerel) when estimated by the MMO (marine mammal observer) to be as a direct result of the survey."[110]		
104. Although it has been suggested that the sound energy from air guns may harm fish species with swim bladders and those without, there are very few studies directly examining the potential effects on fish physiology or behaviour, and even fewer focusing on pelagic fish species. Unknown impacts are not the same as no impacts, and the		

[108] Capricorn Report, pg. 10.
[109] PISCES Report, pg. 192.
[110] PISCES Report, pg. 197.

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precautionary principle should be invoked. There are significant knowledge gaps regarding the impact of 3D seismic surveys on marine fish species, particularly those that would be impacted by the Project. Specifically, there is currently not enough information about the fish species in the area or their response to sound to be able to make any meaningful assessment of the impacts. Therefore, the precautionary approach set out in NEMA suggests that this lack of knowledge should weigh against the proposed 3D seismic surveying in a vital and valuable offshore fishery. **Zooplankton** 105. The FBAR disregards the precautionary approach at every step in the analysis of impacts on plankton, which it concludes does not warrant mitigation measures and will have a medium pre-mitigation impact, yet a very low residual impact.[111] Yet, as demonstrated below, there is a significant concern that the BAR underestimates the impacts of seismic surveys on plankton, which form the base of the ocean food chain. 106. The FBAR does not provide actual data to demonstrate that there is not significant or even medium plankton abundance in the survey area. The BAR "expects" that plankton abundance to be low with seasonal peaks may occur associate with MPAs.[112] Yet, the surveying is meant to have temporal overlap with speak spawning products of commercially important species.[113] 107. Studies by McCauley et al. (2017) referenced in the Pisces Report indicates that seismic blasts may kill various species of zooplankton in Australia at distances of up to 1200 m from an airgun[114], and more		

[111] Marine Ecology Impact Assessment at 144.

[112] Marine Ecology Impact Assessment at 141.

[113] Marine Ecology Impact Assessment at 144.

[114] Robert D. McCauley *et al.*, *Widely used marine seismic survey air gun operations negatively impact zooplankton*, 1, Nat. Ecol. Evol., 1–8 (2017).

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recent research shows lethal and behavioral impacts to zooplankton from airgun discharges.[115] Still, other studies (Fields et al., 2019), report no measured mortality or sublethal effect on copepods at distances >10 m from a seismic blast in Norwegian waters.[116] And other studies (Richardson 2017) found "substantial impact of seismic activity on zooplankton populations on a local scale within or close to the survey area."[117] While noting that zooplankton mortality can be difficult to assess in the field (in situ) and that realistic conditions are very difficult to reproduce in a laboratory setting, nevertheless these highly contradictory results suggest that effects may be variable and highly dependent on zooplankton species and/or marine geographical area. Research should be undertaken to survey the current literature on zooplankton types in the Benguela Upwelling Zone and better link this knowledge to the airgun impacts literature available. The BAR fails to take these steps, making it impossible to assess the impacts of seismic surveys to the zooplankton communities underpinning the food webs that support fish, marine mammals, and fisheries. 108. As noted, zooplankton forms the base of many important food webs in the marine environment. Depletion of zooplankton could thus have an impact on food for their predators (such as fish) as well as impact fish eggs and larvae (ichthyoplankton) with potential local impacts on species important in fisheries. This damage to zooplankton as found by studies over 1km away (McCauley 2017) and within 15km (Richardson 2017) from the survey array raises concern		

[115] Emilie Hennes Vereide *et al., Effects of airgun discharges used in seismic surveys on development and mortality in nauplii of the copepod Acartia tonsa*, 327, Environ. Pollut., 121469 (2023).

[116] *Id.*

[117] Rice Supporting Expert Affidavit at para. 29 (restating the conclusion from the study's authors: "We found there was substantial impact of seismic activity on zooplankton populations on a local scale within or close to the survey area, with a maximum decline of 22% in zooplankton populations in the survey area, 14% within 15 km of the survey area.").

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that a 500m buffer for other animals that are unable to move away from the sound, is far too small to ensure that damage is not inflicted (even if they were able to evade it).[118] **The proposed mitigation measures are inadequate to prevent unacceptable harm to marine life** Simultaneous Surveys 109. The FBAR proposes the use of a 40 km buffer between vessels during concurrent simultaneous surveys (p. 211) as a mitigation measure, relying on "advice from the US Department of Interior (2014)." The purpose of the buffer is to mitigate "the cumulative impacts of three potential surveys occurring concurrently."[119] The 40 km buffer mitigation measure, first proposed in the United States, originally purported to avoid harassment of marine mammals during simultaneous surveys. This was expected to be achieved through a distance between vessels that would provide a corridor where "airgun noise is below [harassment] thresholds and approaching ambient levels such that animals may pass through rather than go larger distances to go around the survey vessels."[120] However, the mitigation measure neither provides a corridor below harassing levels of acoustic noise for marine mammals between vessels seismic surveying, nor does it mitigate cumulative impacts as portrayed in the FBAR. In fact, the mitigation measure is not even used in the US, making the FBAR reliance upon this measure deeply flawed. 110. First, the 40 km buffer is based upon a threshold of 160 dB for harassment, a standard that the U.S. government has since abandoned as appropriate to provide adequate protections. For		

[118] Harris Report

[119] BAR at 211.

[120] US Department of Interior, Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas, Final Programmatic Environmental Impact Statement at 2-37 (2014).

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example, the US government found in 2018 in reviewing harms to marine mammals during oil and gas geophysical surveys that, "[s]tudies of marine mammals in the wild and in experimental settings do not support" use of a single 160-decibel threshold and that "that an approach reflecting a more complex probabilistic function is better reflective of available scientific information," because it "takes the fundamental step of acknowledging the potential for . . . harassment at exposures to received levels below 160 [decibels]."[121] 111. Second, as noted above, scientists recognize that this 160 decibel threshold is not supported by science. In addition, in his expert declaration Dr. Nowacek noted that "seismic surveys can disrupt important behaviors in baleen whales at exposure levels far below the 160 dB threshold".[122] 112. Third, the application of a 40 km buffer as a wholesale solution for simultaneous surveys is incompatible with even the 2014 Department of Interior document that the BAR is relying upon. In fact, the US Government prohibits the use of a 40 km buffer as a general mitigation measure. It instead found that new science demonstrated that "airgun noise can be detected at great distances from the sound source, such as across ocean basins," and that therefore, the mitigation measure must be considered in the site-specific context and include any new information at the time as well as "any potential aggregate effects from existing permitted		

[121] See Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Geophysical Surveys Related to Oil and Gas Activities in the Gulf of Mexico, 83 Fed. Reg. 29,212, 29,247-48 (June 22, 2018).
[122] See Nowacek Supporting Affidavit at para. 18.

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surveys."[123] The BAR does none of this analysis and in fact proposes potentially reducing the buffer zone.[124] 113. This mitigation measure has been proven to be scientifically unsound and ineffective and uses an approach inapposite with the base documents upon which the BAR relies, inconsistent with the current practice of the US Government, and inconsistent with the science. Therefore, there is no basis for the BAR to conclude that a 40 km buffer will mitigate cumulative impacts of concurrent seismic surveys. <u>Inefficacy of Proposed Mitigation Measures</u> 114. Several of the proposed mitigation measures are ineffective to mitigate the harms related to the impacts of the seismic surveys. Consequently, the significance of the post mitigation impacts are understated, exposing marine species, in particular marine mammals and to more injury and harm than indicated in the conclusions of the BAR. 115. Soft Starts and Ramp Ups: Harris *et al.* found that the soft starts are "are likely to reduce the impact for highly mobile large animals, this is unlikely to be adequate for the many species that are prevalent in the area over the austral summer months and are unable to avoid the array or leave the area due to their lower mobility, such as smaller turtles, penguins, invertebrates, some fish species and zooplankton."[125] Moreso, Dr. Nowacek found that soft starts or ramp ups do not protect highly mobile cetaceans, finding them "inadequate to protect cetaceans present year-round or deep-diving		

[123] US Department of Interior, Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas, Final Programmatic Environmental Impact Statement at 2-38 (2014).

[124] BAR at 211.

[125] Harris Report at Summary of Findings.

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beaked whales."[126] Dr. Nowacek further expounded "there has been no experimental confirmation that this procedure is broadly effective at reducing overall exposure."[127] In considering a situation where soft starts or ramp ups worked perfectly, Dr. Nowacek found that "this mitigation measure would reduce only the number of injuries incurred in the vicinity of the seismic vessel and does not address at all the larger body of effects."[128] 116. Observers: Harris *et al*. explain that visual observers, although important to mitigation, have deficiencies, which brings into question the SAR's conclusions regarding the level of impacts post-mitigation: *"The finding of observer efficiency (from a scientific monitoring study conducted during the 2018/19 and 2019/2020 seasons on the humpback whales on the east coast) suggests that even with trained observers up to 44% of humpback whales in an area went undetected. This casts doubt on the effectiveness and success of Marine Mammal Observer (MMO) sightings of the largest species (humpbacks) as a mitigation measure, indicating that it is most likely that whales go undetected. Furthermore, the detection rate for smaller species, such as dolphins, seals, turtles and flightless birds (penguins), would be expected to be much lower, obviating the effectiveness of visual observations to prevent harm to these species."*[129] 117. Dr. Nowacek reiterates that the mitigation measure of visual observers is "inadequate to protect cetaceans present year-round or deep-diving beaked whales."[130] Dr. Nowacek further explains that the use of visual observers to detect whales "is imperfect at best"		

[126] Nowacek Supporting Affidavit at para. 13.4.
[127] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 47 of expert declaration by reference).
[128] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 47 of expert declaration by reference).
[129] Harris Report at Summary of Findings.
[130] Nowacek Supporting Affidavit at para. 13.4.

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because low light and other poor visibility conditions (such as fog or high-sea states) impair the ability to spot whales and, as Dr. Nowacek goes into further detail, even in ideal conditions it is very difficult to spot whales.[131] This is echoed by Harris et al. stating the "efficacy of a MMO is likely to be low due to the nature of the offshore marine environment in the survey area (frequent high swells and winds affecting surface visibility), putting species who are missed by MMOs and PAM operators at extreme risk, particularly at night or during adverse weather conditions."[132] 118. Passive Acoustic Monitoring (PAM): Harris *et al.* discuss how "the reliance on observers to do visual sightings to supplement the PAM monitoring during the day, as a mandated mitigation measure, necessitates questioning the acceptability of continuing with survey activities at night. If the visual observations are useful (perhaps sighting large animals around 65% of the time) in addition to PAM, then relying on PAM alone at night cannot be an effective mitigation measure. The authors express the opinion that surveys should not occur between sunset and sunrise each day if a real attempt of maximum avoidance of cetaceans is the objective of this mitigation measure."[133] 119. Dr. Nowacek discusses as well the limited benefit of PAM. With PAM, "whales will not be detected even when present if they are quiet or not vocalizing or if background noise is too high." Dr. Nowacek also noted that "studies show that baleen whales cease vocalizing in the presence of even low levels of seismic survey noise."[134]		

[131] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 45 of expert declaration by reference).
[132] Harris Report at Summary of Findings.
[133] Harris Report at Summary of Findings.
[134] Nowacek Supporting Affidavit at para. 13.4 (incorporating para. 46 of expert declaration by reference).

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120. The FBAR's attempts to address this shortcoming in mitigation by equipping MMOs "with infra-red cameras in order to observe mammals at night."[135] However, this is an undeveloped technology for spotting cetaceans. It is not reliable, so much so that it is not typically used by scientists as part of their surveys. Further, there are questions with the scope of view, range/distance, as well as the impact of conditions on the ability to use the technology. In short, it is encouraging to bring new technologies to the table, however it requires more testing and improvement before it could be considered suitably reliable and certainly before it could be factored into the the mitigation of harms to cetaceans. **Lack of baseline noise assessment** 121. The FBAR fails to establish an acoustic baseline assessment of the area, and furthermore fails to present a plan to conduct an adequate baseline noise assessment. As part of its recommendations to minimise impacts to marine fauna, the BAR lists: Baseline noise measurements can provide useful information (prior to operations) when interpreting underwater noise predictions for the introduction of a new noise source. As such, it is recommended that underwater noise measurements be implemented that would include the deployment of underwater sound monitoring equipment to establish an actual baseline prior to the commencement of the survey and then operational levels of noise during the survey.[136] 122. The FBAR provides no guidance for the recommended baseline noise measurement, including the duration of monitoring period, or a		

[135] BAR at 251.
[136] Final BAR, pg. 241

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range or frequency for detection. This lack of detail means it remains impossible to assess if this mitigation step would meet best practice standards such as those put forward by the Marine Mammal Observers Association. 123. The current lack of a baseline assessment means that the ambient background noise considered in the noise modelling falls short of best practices. Best practice acoustical modelling entails collecting site-specific data to calibrate acoustic models that can then be applied to characterize acoustic exposure of marine fauna in a given study area.[137] **Chronic Noise Impacts** 124. The seismic survey's airguns consist of 24 active airguns that will blast sound loud enough to penetrate the seabed floor every 6-20 seconds, 24 hours a day, for 70 days. Each acute blast will create direct harms to marine species. In addition, besides the direct harm that the pulse will create, the repetitive blasting will increase ambient noise, even at a distance of 100 kilometres.[138] These two factors expose marine species to chronic noise impacts over a large distance, as the sound travels hundreds and even thousands of kilometres.[139] The EBAR fails to take into account the increased stress and behavioural impacts that this chronic noise will cause on marine species in the area of seismic surveying and beyond		

[137] Alexander M. Rutenko *et al., Acoustic monitoring and analyses of air gun, pile driving, vessel, and ambient sounds during the 2015 seismic surveys on the Sakhalin shelf*, 194, Environ. Monit. Assess., 744 (2022).
[138] Nowacek Supporting Affidavit at para. 13.
[139] Rice Supporting Affidavit at paras. 16, 24 & 36; Nowacek Supporting Affidavit at paras. 9-10, 13.

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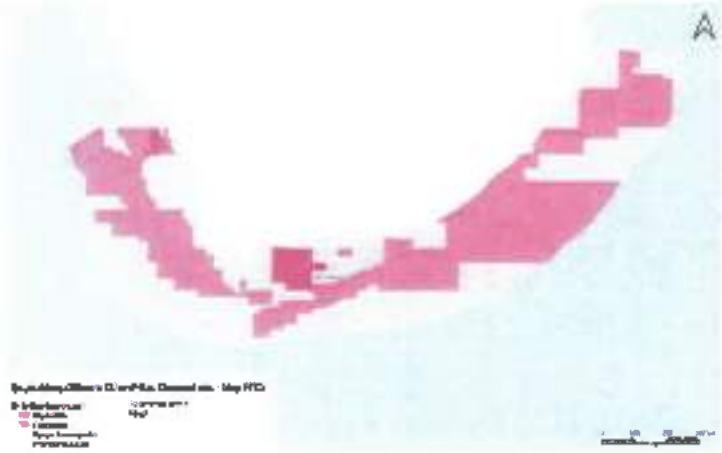
Ground 3: Failure to adequately assess cumulative impacts 125. Below is a map detailing the updated categories of Oil and Gas concessions along the entire coastline of South Africa:  Information received from Petroleum Agency SA, in line with a PAIA Request submitted by the Legal Resources Centre on 12 October 2022 126. In addition to the abovementioned map, it is noted that the BAR acknowledges that should other seismic survey campaigns be undertaken concurrently with TGS's proposed survey programme, cumulative impacts may be likely and there would be a need for alignment in planning of such concurrent operations to reduce	It is understood that ION GXT has been declared bankrupt and have ceased operations - as such, the ION GXT Reconnaissance Permit is considered to be defunct. Section 9.3.5 of the BA Report states that "three seismic surveys of regional extent, undertaken simultaneously, could be expected to result in an impact of medium negative significance on the large pelagic longline sector, both with and without the application of mitigation measures. This relates to the large pelagic long-line sector only, and only in the event that all three surveys are undertaken simultaneously. It should be noted that the seismic industry typically avoids simultaneous surveys occurring in close proximity to each other as this has the potential to degrade the quality of the recorded survey data. Other cumulative impacts are all expected to be low after mitigation is applied – therefore overall cumulative impacts are considered low post-mitigation. The marine faunal assessment has made efforts to present published results objectively, and nowhere claims that acoustic surveys do not result in impacts. The inference is that, for these whale populations, there is no direct evidence to link the long-term negative change to population size directly to seismic survey activities. The statement is only one regarding the "lack of evidence" with respect to certain whale populations and seismic surveys. The marine fauna report recommends planning seismic surveys to avoid sensitive areas and periods for some marine fauna: Movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (June/July and late October/November), and their aggregation on the summer feeding grounds between St Helena Bay and Dassen Island from late October to late December and ensure that migration paths are not blocked by seismic operations. If possible, the survey should be undertaken from	

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cumulative noise impacts to an acceptable significance.[140] The draft BAR notes that there are two current pending applications with PASA (Searcher Geodata and GX Technology Corporation) which both overlap the proposed TGS 3D seismic survey area, as depicted in the diagram below:	North to South to avoid these feeding aggregations. A discussion of the migration of various cetaceans is provided in Section 8.4.3.6 of the BA Report. It is unlikely that concurrent seismic surveys will be undertaken in the same area during the same survey window however the cumulative impacts associated with multiple surveys needs to be, and was, assessed. The decision-making authority did elaborate on the decision regarding whether concurrent surveys can take place. The proposed seismic activity will not automatically lead to further exploration, production, and utilisation of petroleum resources. The information to be obtained through the seismic survey will provide information as to whether they may be exploitable resources. The climate change impacts of any potential future exploration or production activities would have to be assessed as part of the associated and required Environmental Authorisation applications submitted for those projects, with due consideration of the other climate affecting activities proposed or in place at the time.	

[140] Final BAR 1520, para 9.3.5, p234.

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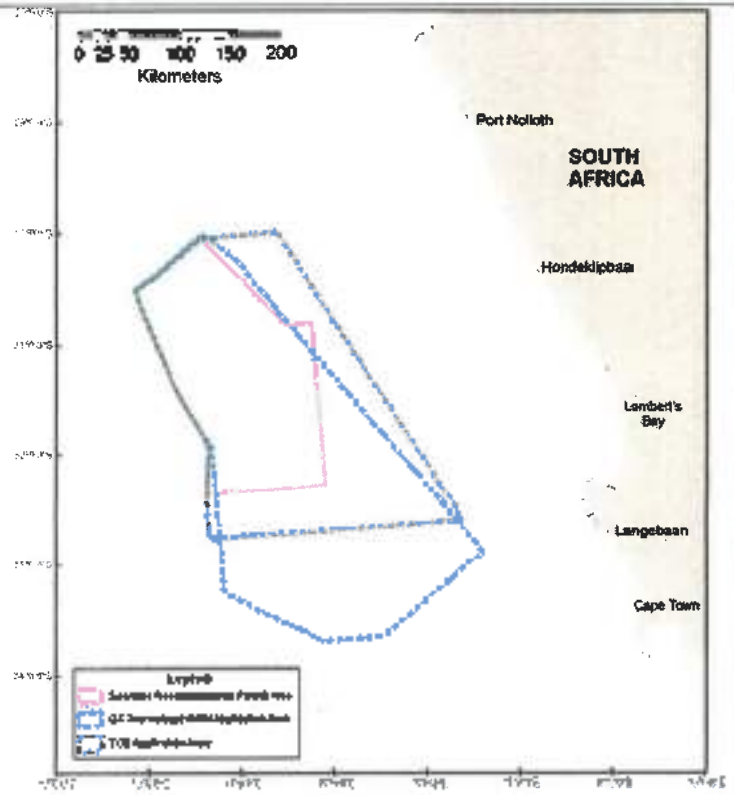

Source: TGS draft BAR, p235.

127. The BAR states that despite the difficulty in undertaking a reliable assessment of the potential cumulative environmental impacts of future seismic acquisition in the Deep Water Orange Basin (due to likely variation in the scope, extent and duration of proposed surveys), the cumulative impacts of three potential surveys occurring

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concurrently needs to be considered. The FBAR thus includes a cumulative assessment which assumes that the three surveys (Searcher, TGS and GX Technologies) occur simultaneously during the summer survey window in 2022/23. In this event, the draft BAR indicates that: 125. Associated impacts to marine fauna would be of high intensity and extend regionally, over the short-term (assuming they take place over the same summer survey window). The impact consequence for cumulative surveys is therefore considered medium. 129. Concurrent activities could also add to the cumulative impact on fisheries. Simultaneous survey operations would result in an increase in the extent and magnitude of the impact on the large pelagic longline sector. The impact duration would remain unchanged. Three seismic surveys of regional extent, undertaken simultaneously, could be expected to result in an impact of medium negative significance on the large pelagic longline sector, both with and without the application of mitigation measures. 130. Curiously, the BAR impact table[141] combines cumulative impacts on marine fauna and fisheries and rates the pre-mitigation environmental significance as 'medium' and the post-mitigation impact as 'low'. This does not reconcile with the preceding paragraphs which indicate with regard to cumulative impacts of three concurrent seismic surveys, an impact of medium negative		

[141] At p236.

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significance on the large pelagic sector could be expected 'both with and without the application of mitigation measures. 131. The Final BAR states regarding confounding and cumulative effects that the assessments of impacts of seismic sounds provided in the scientific literature usually consider short-term responses at the level of individual animals only, as the understanding of how such short-term effects relate to adverse residual effects at the population level is limited. The report goes on to state that data on behavioural reactions to seismic noise acquired over the short-term could, however, easily be misinterpreted as being less significant than the cumulative effects over the long-term (i.e. what is initially interpreted as an impact not having a detrimental effect and thus being of low significance, may turn out to result in a long-term decline in the population, particularly when combined with other stressors such as temperature, competition for food, and shipping noise). The report notes that confounding effects are, however, difficult to separate from those due to seismic surveys.[142] 132. The report also states that the potential cumulative impacts on individuals and populations as a result of other seismic surveys undertaken either previously, concurrently or subsequently are difficult to assess. The report indicates that a significant adverse residual environmental effect is considered one that affects marine biota by causing a decline in abundance or change in distribution of a population(s) over more than one generation within an area. The report makes reference to numerous 2D and 3D seismic surveys having been undertaken off the West Coast over the past 17 years, and relies on reported increases in the southern right whale and humpback whale populations over a time when seismic surveying frequency has increased as 'suggesting that, for these populations at		

[142] Final BAR 1520, para 9.3.1.4 at p209-210.

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least, there is no evidence of long-term negative change to population size as a direct result of seismic survey activities'.[143] The assumption made that an increase in whale populations suggests that there is no evidence of long-term negative change to population sizes as a direct result of seismic activities, is questionable. This is an assumption that cannot be inferred from the facts (the increase could be as a result of any number of other external factors). 133. It cannot simply be assumed that the lack of evidence of long-term negative population changes as a direct result of seismic survey activities means that there are no negative impacts (including potentially significant impacts). In their report relating to the TOSACO EIA appeal, Harris *et al* point out that although the humpback whale population is increasing, there is evidence to suggest that cetaceans in South African waters are being affected by changes in their ecosystem and it is not well understood yet what is driving these changes and what the long terms effects could potentially be to populations.[144] Concerns noted in the report include an observed decrease in southern right whale calving success of the South African population and a strong link between foraging success and reproduction.[145] They suggest an investigation into possible decreases and/or spatial or temporal shifts in their prey availability at higher latitudes due to environmental variability. They also highlight a concern of the continued low numbers of unaccompanied adults		

[143] Final BAR 1520, para 9.3.1.4 at p210.

[144] Wilkinson, C. (2021) *Estimating population changes in humpback whales (Megaptera novaeangliae) migrating past Cape Vidal, South Africa*, MSc thesis, Cape Peninsula University of Technology, p108. Cited in Harris IM, Olbers IM, Wright K (6 April 2022) *Comments on Tosaco Energy Block 1 Exploration Right issued to Tosaco Energy (Pty) Ltd (PASA Reference: 12/3/362).*

[145] Vermeulen, E., Wilkinson, C., & G. van den Berg (2020) *Report of the 2019 South African southern right whale aerial survey*. Report to IWC 10.13140/RG.2.2.29556.37766. Cited in Harris IM, Olbers IM, Wright K (6 April 2022) *Comments on Tosaco Energy Block 1 Exploration Right issued to Tosaco Energy (Pty) Ltd (PASA Reference: 12/3/362).*

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along the South African coast which could potentially have serious consequences for cow-calf pairs in relation to the country's whale-watching industry in the future. 134. The BAR states that in the 'unlikely' event that multiple surveys would take place at the same time within the same survey area, 'the risk of cumulative noise impact must be considered and is suggested to be managed'. The BAR suggests that mitigation should include maintaining a distance of at least 40 km between survey vessels 'until sufficient objective evidence is obtained that a reduced buffer distance is acceptable'. Where this 40 km buffer distance cannot be maintained, the FBAR suggests that each of the additional activities to those described in the technical noise report should be modelled or otherwise considered in terms of the cumulative noise level and with reference to the criteria described in the report.'[146] 135. However, as referred above at paragraphs 109-1113, the US Government prohibits the use of a 40 km buffer as a general mitigation measure and therefore, the mitigation measure must be considered in the site-specific context and include any new information at the time as well as "any potential aggregate effects from existing permitted surveys. This mitigation measure has been proven to be scientifically unsound and ineffective and uses an approach inapposite with the base documents upon which the BAR relies. Therefore, there is no basis for the BAR to conclude that a 40 km buffer will mitigate cumulative impacts of concurrent seismic surveys.		

[146] Final BAR, p236.

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136. Given the lack of certainty regarding cumulative impacts of concurrent 3D seismic survey areas, a risk averse and cautious approach should be applied by not authorising concurrent surveys and suggests that should the decision-maker ought to have refused granting the environmental authorisation. 137. In addition, the FBAR does not consider the cumulative impacts of other proposed offshore oil and gas seismic surveys, exploration and production in other Blocks within South Africa's exclusive economic zone. Having regard to the global Climate Emergency[147] and South Africa's international commitment[148] to *'working with others to ensure temperature increases are kept well below 2°C above pre-industrial levels, which could include a further revision of the temperature goal to below 1.5°C in light of emerging science'*[149] by reducing greenhouse gas (GHG) emissions, TGS's proposed 3D seismic survey would, if additional commercially viable resources are identified and developed through to production phase, inevitably add to South Africa's overall GHG emissions (South Africa's energy sector currently contributes an estimated 84% percent to the country's overall GHG emissions).[150] As a reasonably foreseeable future impact that may become more significant, especially in combination with impacts arising from similar offshore oil and gas exploration and		

[147] https://www.unenvironment.org/explore-topics/climate-change/facts-about-climate-emergency

[148] As a party to the United Nations Framework Convention on Climate Change (UNFCC) that ratified the Kyoto Protocol and adopted the Paris Agreement.

[149] See for example South Africa's *Intended Nationally Determined Contribution (INDC)*, available online at: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/South%20Africa%20First/South%20Africa.pdf

[150] https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-south-africa

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production activities, it is submitted that the cumulative impacts[151] of such GHG emissions need to be identified and assessed.		
Ground 4: Failure to conduct meaningful consultation with communities and local people (and in particular small-scale fishers), within the public participation process, including the Social Impact Assessment process 138.It is one of the foundational principles of NEMA that the participation of all interested and affected parties must be promoted and the participation of disadvantaged people must be ensured.[152] Section 24(4)(a)(v) of NEMA provides that interested and affected parties must be given a reasonable opportunity to participate in the environmental impact assessment process. Regulation 41(6) provides that the public participation process must be facilitated in a manner that provides all potential interest and affected parties a reasonable opportunity to comment on the proposed project. Regulation 41(2) of the EIA Regulations requires that the public participation process take into account the relevant guidelines. The 2017 Public Participation Guidelines provide that: 137.1. The level of public participation must be informed by the characteristics of the potentially affected parties.[153] 137.2. The method of communication must be an effective method that will easily reach the intended audiences.[154]	It is our opinion that the Public Participation Process was conducted in line with and exceeded the requirements of the Environmental Impact Assessment (EIA) Regulations (2014), as amended, and that the process followed was reasonable. With reference to Section 7 and Appendix 2 of the BA Report, EMS has undertaken the public participation and consultation processes in accordance with the requirements of the NEMA EIA Regulations. This process included notification and communication in three different languages, via Radio and Newspaper advertisements, site notices, posters, and direct notification; as well as public and focus group meetings within the potentially affected communities. Opportunity was provided to review and comment on the BA Report and associated documentation to be submitted to the decision maker. It should further be noted that detailed consultations with community members and leadership were conducted by the Social and Heritage Specialists to obtain the views of project affected communities and the potential social and heritage impacts of the proposed project. The applicant is not aware of any additional requests received from I&APs for further avenues or opportunities for	

[151] 'Cumulative impact' is defined in the NEMA EIA Regulations as follows: 'in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

[152] NEMA, section 2(4)(f).

[153] At p. 8.

[154] At p. 9.

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137.3. The language used must provide all potential interested and affected parties a reasonable opportunity to comment without unnecessary difficulty.[155] 139. The court in *Sustaining the Wild Coast NPC*[156] has upheld this and stated: "Meaningful consultation entails providing communities with the necessary information on the proposed activities and affording them an opportunity to make informed representations"[157] 140. Coastal communities and the general public have been overwhelmed with the number of offshore oil and gas related applications running in parallel processes, particularly those which may impact the south-west and west coast of South Africa. In the month of May, I&APs have been called upon to respond to no less than four offshore oil and gas EIA processes, without taking into account legislative public participation processes for the Upstream Petroleum Resources Development Bill and the draft Marine Spatial Plans during a similar period. The EAP in the current application, SLR, has been appointed to conduct three of these parallel EIAs. 141. The table below sets out the various EIA processes, in which it is clear that multiple public meetings and submission dates are running during similar time periods:	participation. The public participation requirements and obligations of the NEMA EIA Regulations has been complied with. With Reference to the table presented in point 141 above, it should be noted that EIMS was the EAP and it is unclear whether this comment relates to this application. However, it should be stated that it is clear that the TGS process did not conflict with other concurrent processes and it is anticipated that I&APs had sufficient time to attend the extensive public consultations undertaken during the initial call to register phase, as well as the BAR Review period. Please refer to the Public Participation Report in Appendix 2 of the BAR for further details on the public consultations undertaken. It should be noted that the Ms Mostert was specifically identified as a key Interested and Affected Party (I&AP) and included in the Public Participation throughout the Basic Assessment Process. Ms Mostert's comments were captured in the minutes of the meetings included in Appendix 2-6 and 2-9 of the BAR. As requested during the public meetings, the final BAR was also made available on the EIMS website (and the datafree version thereof) post submission of the final report to the Competent Authority for adjudication and was available throughout the appeal notification period. The EAP therefore, utilized the reasonable and requested methods of communication and transparency and did not receive requests for alternative methods. It is also important to consider that the findings of the BAR were that there is unlikely to be significant adverse impacts. With reference to Section 7 and Appendix 2 of the BA Report, EIMS has undertaken the public participation and consultation processes in	

[155] At p. 9.

[156] Sustaining the Wild Coast NPV and Others v Minister of Mineral Resources and Energy and Others (3491/2021) [2021] ZAECGHC 118

[157] Sustaining the Wild Coast NPC, para 26.

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Project	**EAP**	**Public Participation Meeting Dates**	**Comment/Appeal Due Dates**		accordance with the requirements of the NEMA EIA Regulations. This process included notification and communication in three different languages, via Radio and Newspaper advertisements, site notices, posters, and direct notification; as well as public and focus group meetings within the potentially affected communities. Opportunity was provided to review and comment on the BA Report and associated documentation to be submitted to the decision maker. It should further be noted that detailed consultations with community members and leadership were conducted by the Social and Heritage Specialists to obtain the views of project affected communities and the potential social and heritage impacts of the proposed project. The public participation requirements and obligations of the NEMA EIA Regulations has been complied with.	
TEEPSA Block 5/6/7: exploration drilling	SLR Consulting (Pty) Ltd	June – July 2022	7 December 2022 12 May 2023		The recommendation of the SIA is that, should the project be approved a representative from TGS must consult with leadership of the community to determine how the communities should be consulted with in future – that is, what is the way the community members prefer to be consulted with for provision of commencement notification and/or daily updates to advise on survey schedules, communication in respect of the proposed research outcomes, etc. The recommendation to include further consultation as part of the conditions of authorisation intends to ensure that the consultation process goes further than just the EIA process, but is continued throughout the entire process, regardless of the outcome. This will assist communities and people on the ground to make informed decisions about technical matters. The intention of the recommendation is not for this condition to be suspensive or determinant on the ultimate decision but rather to function as an additional management/ mitigation measure to be implemented post approval to reduce the significance of the identified impacts and further enhance the community engagements	
TEEPSA DWOB: exploration drilling	SLR Consulting (Pty) Ltd	November 2022 May 2023	14 December 2022 12 May – 12 June 2023			
TEEPSA 11B/12B: production drilling	WSP Group Africa (Pty) Ltd	January 2023	14 February 2023			
TGS: reconnaissance	EIMS (Pty) Ltd	August / September 2022	25 November 2022 18 May 2023			
Searcher Geodata: reconnaissance	EIMS (Pty) Ltd	July 2022	13 October 2022 9 February 2023			
CGG Services SAS: reconnaissance	SLR Consulting (Pty) Ltd	April 2023	11 April – 31 May 2023			

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Karpowership Saldanha: power generation from gas	Triple4 Sustainable Solutions	October / November 2022	13 December 2022		

142. Many members of the public will be confused by the various applications, with different processes, slightly different due dates, slightly different applicants all being branded the same with the same EAPs conducting similar EIA processes. It is inconceivable that affected coastal communities are able to respond to each of these processes in a meaningful way. This means that fishers must fish for a living, requiring them to be out at sea daily or for extended periods of time. Even if they wish to do so, they do not have the time or resources to attend multiple public meetings, engage with voluminous technical information, provide comments, ascertain whether their comments have been addressed in comments and response reports, and thereafter proceed to draft appeals. The result, even if unintended, is that those who have less resources, who are required to be out at sea to make their livelihoods, and/or who are unable to fully understand the different proposals and processes, are not able participate and engage meaningfully. The chilling effect is that they are significantly prejudiced by the onslaught of applications

143. There are many people, particularly those such as small-scale fishing communities and co-operatives who will be impacted by the project, who do not have access to the resources and expertise required to access, consider and comment on the records relating to the project, which are voluminous and technical in nature. The current estimate is

during implementation, should the project be implemented. The SIA specialist has made a reasoned opinion that the project can be approved on the basis of the outcomes of the consultations already undertaken. Communities are diverse and there are community members who are supportive of this type of development, as much as there are community members against the development. Communities were asked to suggest mitigation measures that the specialists should consider, and this influenced some of the recommendations made in the SIA. All perspectives were considered during the EIA process and the social impact analysis.

The SIA report makes detailed recommendations about further engagement with the communities, and other mitigation and management measures. The mitigation and management measures should be considered in its entirety within the context of the report. Efficient engagement with a community involves more than merely setting up a meeting and inviting people. In many communities there is an expectation that outsiders should enter the community via the leadership before a community meeting can take place. TGS needs to determine what the most appropriate way would be to interact, and this may differ between communities, in order to engage with the individuals and communities in a decolonised way. Once this is done, TGS can proceed with engaging with the communities as a whole in an appropriate way. Education is suggested as a mitigation measure to empower community members to make informed decisions where they are in a position to weigh up the pros and cons for themselves, as was requested by community members during the public meetings. The updated conditions (omissions) referred to were included for clarity.

The Appellants assertion that the voices of the communities have not been heard by virtue of the inclusion of conditions requiring that ongoing engagements, education and collaboration is unfounded. The purpose of these measures was to ensure that there were ongoing

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that around 136 unitary entities could be defined as 'communities' under the proposed community based rights allocation system. In the Western Cape and Northern Cape in particular, these settlements can seldom be described as 'communities' in the sense of small, spatially defined geographic units with a homogenous social structure and shared norms.[134] This is not recognised nor considered in the BAR or SIA in that the reports appear to limit their analysis by failing to consider the intricate social structures and norms within these "communities" thereby considering these communities as homogenous and disregarding their unique characteristics. 144. We attach hereto a letter from Carmelita Mostert, marked **Annex B5**, which was also separately sent to the Appeals Authority, which clearly sets out opposition to the seismic surveys based on the impact on fisheries, and points out their difficulties associated with having to find hardcopy reports and with having to consider how her community's comments have been considered by the EAP. 145. To ensure access to a reasonable, adequate and fair public participation process, TGS and their appointed EAP should have used reasonably distinctive and appropriate alternative methods to inform and educate affected communities and small-scale fishers of the significant adverse impacts that this project could have on them. Running a public participation process during time period could not achieve meaningful and effective consultation.	interaction, communication and feedback regarding the operational aspects. The EAP has conducted the impact assessment on the basis of the activities proposed by the applicant. Any subsequent authorisation would be restricted to these specifically assessed activities. Should the applicant or other applicants wish to undertake any additional exploration activities which are not addressed in the current Environmental Authorisation (EA) application, there would be a consequent need to apply for the relevant permissions. These would include a formal application for an Exploration or Production Right as well as a new EA. The impacts of such proposed activities would consequently require specific assessment and public consultation prior to approval. It is premature to assess the likely impacts of further invasive exploration activities or production activities as the extent, duration, location, and magnitude applicable to these activities are unknown at this stage. The NEMA EIA Regulations make a clear distinction between the reconnaissance, exploration, and production activities in that these are listed as distinct and separate listed activities. There is provision in law for these activities to be assessed on their merits as and when they are proposed.	

[134] Moenieba Isaacs and Mafaniso Hara. 2015. "Backing small-scale fishers: Opportunities and challenges in transforming the fish sector. Institute for Poverty, Land and Agrarian Studies Rural Status Report 2. University of Western Cape, at page 13. Access link here https://cer.org.za/wp-content/uploads/2016/08/Backing-Small-scale-Fishers_PLAAS.pdf

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146. The BAR included a Social Impact Assessment (SIA) that noted[159] that communities feel that there were significant gaps in the available data, and that from a social perspective the non-technical or social risks can potentially cause significant impacts. The report highlighted that potential social impacts identified included: • Uncertainty; • Further marginalisation of vulnerable groups; • Concerns about cumulative impacts; • Impact on livelihoods; • Impacts on sense and spirit of place; • Impacts on social license to operate; • Stakeholder fatigue and disillusionment; • Community expectations; and • Social unrest. 147. These impacts are rated in the final BAR as being of high or medium significance prior to mitigation, and as being medium significance post-mitigation.[160] 148. The report further pointed out that seismic reconnaissance projects are controversial in South Africa, and that while for many stakeholders it is an emotional matter, for others the potential of		

[159] Appendix 3.4 to the TGS final BAR, Social Impact Assessment, Equispectives Research and Consulting Services (Sept 2022), at p 101.
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impacting on their livelihoods is the biggest fear. The report indicates that some stakeholders feel that the exploration for fossil fuels is not in line with sustainable development and the fight against climate change, while other stakeholders feel that it is imperative for the growth and development of the South African economy to engage in these investigations. The expert describes this as a 'complex and wicked problem'.[141] 149. The report went on to state that from a social perspective, it is clear that the communities and the majority of local people are opposed to the project, and that because the project does not happen in a social vacuum, the social environment is much wider than the footprint of the project. The report states further that: *If the social risks and potential damage to cultural and indigenous rights are considered the impact on the social fabric of already vulnerable communities may be significant. At this stage communities feel that they cannot make informed decisions.*[142] *(emphasis added)* 150. Curiously, while this TGS SIA is almost identical to the SIA submitted in the Searcher draft BAR (ref. 1518), the TGS version omits the following sentence from the above paragraph:		

[141] Ibid, p8, in a footnote to the TGS final BAR, a 'wicked problem' is indicated as *'a problem that is difficult or impossible to solve because of incomplete, and changing requirements that are often difficult to recognise'*.
[142] Ibid, p8.

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From [a] social perspective the project can only be recommended after meaningful consultation, local research, education, and awareness raising has been done in the project affected communities.[163] *(emphasis added)* 151. An extract from the Searcher SIA is attached marked Annex B4. 152. Instead, the TGS SIA report makes the following recommendation: *From a social perspective it is recommended that the project proceed subject to the mitigation measures (i.e. meaningful consultation, local research, education, and awareness raising in the project-affected communities) forming part of the conditions for authorisation and being implemented prior to the commencement of the actual survey.*[164] 153. This recommendation is strikingly different to the recommendation made in the Searcher SIA, which stated as follows: *The recommendation is therefore that the project can only proceed once the social mitigation measures have been implemented and the community are sufficiently informed and educated to [be] able to engage in a meaningful manner.*[165] *(emphasis added)*		

[163] Searcher 1518 draft BAR SIA, pii.
[164] TGS BAR, pii.
[165] Searcher 1518 draft BAR SIA, pii.

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154. The Appellants submitted in their comments on the draft BAR that recommending that the project proceed subject to meaningful consultation being undertaken – and included as a mitigation measure in the environmental authorisation and implemented prior to the commencement of the 'actual survey' – is highly irregular within the context of an environmental impact assessment.[366] There is no legal basis for meaningful consultation to be undertaken after an environmental authorisation is granted, and including such a recommendation as a condition of authorisation undermines the regulatory scheme for prior impact assessment that is subjected to public consultation.		
155. Notwithstanding the above mentioned submissions, the environmental authorisation ("EA") approves the BAR and EMPr, and indicates that it is mandatory for the holder to implement all the recommendations and management measures stipulated in the EMPr throughout all phases of the proposed activities.[367] The EA also stipulates as a specific condition that a community engagement protocol that is based on the San Code of Research Ethics be developed, in consultation with the affected communities and must include a community strategy and grievance mechanism.[368] The EMPr in turn includes as mitigation measures various recommendations under the heading 'Socio-Economic Considerations', all of which are indicated as to be implemented 'Prior to Operation and ongoing'.		

[366] Para 120 at page 60 of Green Connection and Natural Justice DBAR comment submission.
[367] EA, section 5.4.1.
[368] EA, section 5.5.15.

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156. The Appellants submit that notwithstanding the public participation processes conducted during the BAR and the SIA processes (which the appellants submitted in paragraphs 115- 121 above, were not adequate or meaningful), it is clear from the SIA that communities and the majority of local people are opposed to the project and that seismic survey companies do not have a 'social license to operate'. The SIA indicates that *'[i]f TGS...wants to proceed with the project, they will need to engage in meaningful conversation with the communities and try to restore relationships. From a community and social risk perspective this is not negotiable'*.[169] The inclusion of mitigation measures in the EMPr (and by reference the EA) fails to adequately take into account the needs and values of the communities (and small scale fishers) who are opposed to the seismic survey.[170] Their voices in opposition to the seismic survey remain unheard in the final BAR and EA. Furthermore, it is submitted that the mitigation measure that TGS should (prior to the operation and on an ongoing basis) *'consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in the future'*[171] cannot be a substitute for meaningful consultation with communities and local people during the EIA process. It is submitted further that such an approach violates the principles of fair administrative decision-making and the right of interested and affected communities to be meaningfully consulted prior to a decision on authorisation being made, and is inconsistent with section 2(4)(f) of NEMA, which stipulates that the participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the		

[169] TGS SIA, p107.

[170] Section 2(4)(g) of NEMA requires that decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge.

[171] EMPr, section 13.7 item D.

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understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured. 157. The Appellants also note that the SIA states further that the seismic survey industry should reassess their position and social license to operate as an industry in the South African context and should conduct a strategic environmental assessment of the impact of the industry.[172] Notwithstanding this, the report makes a one-sided assumption that the discovery of commercially exploitable fossil oil or gas resources would be beneficial to the economic development of South Africa: *'Potential future benefits and the economic development of the country should the surveys find any significant resources are not disputed'.*[173] The Green Connection and Natural Justice submit that the SIA should have reflected the many negative socio-economic impacts that could or are likely to manifest should commercially exploitable reserves be found and developed through to production and use (including but not limited to the socio-economic costs of climate change[174]). 158. In light of the above, the Appellants submit that the public participation process, including the SIA conducted, did not constitute meaningful consultation with communities and local people (and in particular small-scale fishers), and that the mitigation measures requiring further consultation after the EIA has been conducted and a		

[172] Ibid p109.

[173] Ibid, p109.

[174] In 2021 an international team of scientists published their findings that economic damage from climate change could be six times higher by the end of this century than previously estimated. See:
https://www.ucl.ac.uk/news/2021/sep/economic-cost-climate-change-could-be-six-times-higher-previously-thought

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decision on authorisation made (but prior to the operation and ongoing thereafter) does not cure this flaw in the EIA process. As a consequence, it is submitted that the EA should be overturned on appeal.		
Ground 5. The FBAR does not contain a proper and objective assessment of the negative impacts of the project on people's human rights 159. Small-scale or subsistence fishers in coastal communities heavily rely on local fish populations for their livelihood and cultural practices. If seismic surveys lead to a reduction in fish stocks, it can have negative consequences for these fishers. They may experience reduced catch rates, economic losses, and disruptions to their traditional fishing practices. Furthermore, the cultural and heritage aspects tied to fishing may be undermined if fish populations decline significantly, as it can impact the intergenerational transmission of traditional knowledge and practices. 160. To better understand the correlation and potential impacts, comprehensive scientific studies and assessments are necessary. These studies would need to evaluate the specific local conditions, fish populations, and cultural contexts of the coastal communities in question. 161. Mitigation measures that are proposed within the EMPr, the specialist acoustic studies, socio-economic impact studies and	Section 9.3.3.1 of the BAR in dealing with the cultural heritage impacts, details the following: "The cultural heritage and living heritage related to the communities linked to fisheries and ocean subsistence and further identifying as indigenous communities can potentially be impacted by the proposed project. This impact is indirect and is in the community perceived to be primarily linked to their economic existence as a result in the loss of fishing yield." The Marine Ecological Assessment and the fisheries impact Assessment did not find that there would be a significant impact fishing activities as a result of the proposed seismic survey. As a result, the assumption by the Appellant that there would necessarily be an impact on the cultural practices, is questioned. It should further be noted that the specific local conditions, fish populations, and cultural contexts of the coastal communities in question were considered as part of the BAR as detailed in the Section 8 and 9 and Appendix 3 of the BAR. It is not disputed that the "small-scale or subsistence fishers in coastal communities often have deep cultural and heritage associations with fish and the marine environment. Their practices, traditions, and identity are intertwined with these resources." The impacts identified and the mitigation measures proposed in the Cultural Heritage Assessment and Social Impact Assessment, made it clear that the direct impact on fish populations was considered in detail and highlighted the cultural and heritage significance of fishing. Based on the findings of these studies and as detailed in the BAR, it was the	

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heritage impact studies such as adjusting survey timing and locations, implementing exclusion zones, and using sound mitigation technologies, can help reduce the potential negative impacts of seismic surveys on marine life. However, when it comes to the cultural and heritage associations of fish and the broader marine environment, proposing the above mentioned mitigation measures which solely focus on reducing direct impacts on fish populations, may fail to address the complex nuances and broader concerns.[175] 162. Small-scale or subsistence fishers in coastal communities often have deep cultural and heritage associations with fish and the marine environment. Their practices, traditions, and identity are intertwined with these resources. Simply mitigating the direct impact on fish populations may not adequately address the cultural and heritage significance of fishing. Preserving cultural practices, traditional knowledge, and the social fabric of coastal communities requires a more holistic approach that recognizes and respects their unique relationships with the marine environment. 163. Small-scale or subsistence fishers in coastal communities understand through their indigenous knowledge of fishing, that the marine ecosystem is capable of sensitivity to outside interferences. As fishers, they have observed that even the slightest interference with the sensitive marine ecosystem will have an impact on every fish in the ocean, and as a result their livelihoods. Plankton, for example, are the most sensitive to any interferences which indirectly have implications for the larger fish species that feed on plankton. Scientific experts have confirmed in their expert assessments that it is likely that the sound blasting in the ocean caused by seismic	opinion of the specialists and the EAP, that the there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the reconnaissance activities, the findings of the specialist studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team and the EAP that the significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures and the project should be authorised. Consequently, and with due consideration of the mitigation measures recommended by the Cultural Heritage and Social Impact Assessments, it was the opinion of the Applicant and the EAP that the proposed survey will not detrimentally affect cultural practices, traditional knowledge, and the social fabric of coastal communities. Specific mitigation measures that point to the robust consideration of the human rights aspects identified in the BAR include the following: • TGS should develop a community engagement protocol that is based on the San Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism. • TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as snoek respond to seismic surveying. • Consult with communities on potential ways in which to make a positive contribution to the communities.	

[175] Page 217-218 of the FBAR

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surveys will impact on the behaviour of plankton decreasing the number of plankton in the water.[176] Furthermore experts are of the opinion that seismic testing will have a significant adverse impact on numerous species of marine fauna, including endangered and vulnerable species located in the exploration area, and zooplankton.[177] 164. Mitigation measures that solely focus on addressing direct impacts on fish populations may not be appropriate for effectively addressing the indirect and cumulative effects on the broader ecosystem/ecocentric based cultural and heritage rights associated with fishing. Eco-centric based cultural and heritage rights are rights that can be defined as rights that acknowledge that ecosystems, species, and natural elements have their own rights and should be respected and preserved for their inherent worth, beyond their instrumental value to humans. Within this framework, cultural and heritage rights are understood in relation to the natural environment. Ensuring the protection of eco-centric based cultural and heritage rights involves recognizing and safeguarding the cultural practices, knowledge systems, traditions, and spiritual beliefs of indigenous and local small-scale or traditional fishing communities and other groups that have a close relationship with their surrounding ecosystems. These rights encompass the right to maintain and protect cultural landscapes, sacred sites, traditional	• A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with adjusting the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective. The above mitigation measures demonstrate that there is an onus on the applicant to further engage and develop a deeper understanding of the cultural and social aspects and practices within these communities. The nuances associated with potential disruption of fish behaviour, altered migration patterns, and changes to the ecological dynamics that are crucial to the cultural and heritage aspects tied to fishing, was assessed in detail in the Marine Ecological Assessment and included in Section 9 of the BAR for each of the organism groups. The impacts associated with each of these groups were found to be of LOW significance and fully reversable. It should further be noted that in terms of the fishing, the fisheries assessment was duly cognisant of the relationship between the small scale fishers and the application area, as well as the TEK, which some of the community member referred to during the public meetings, and was duly considered by the specialists. This is evidenced by the following extract from Section 8.5.3.10 of the BAR: *"Small-scale fishermen along the Northern Cape and Western Cape coastlines are*	

[176] McCauley et al, *Widely used marine seismic survey air gun operations negatively impact zooplankton* (2017), https://www.nature.com/articles/s41559-017-0195

[177] Fewtrell, J.L. and McCauley R.D., 2012. Impact of air gun noise on the behaviour of marine fish and squid. Marine Pollution Bulletin 64 (2012) 984–993; Harris JM, Olbers JM, and Wright K. 2022. "Report on Scientific basis for concerns of significant harm inflicted to marine wildlife by 2D and 3D Seismic Surveys on the South and West Coasts of South Africa."

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ecological knowledge, and sustainable resource management practices.[178] 165. The examples of proposed mitigation measures formulated by the EMPr inadequately acknowledge the substantial impact on ecosystem/ecocentric based cultural and heritage rights resulting from the broader indirect and cumulative consequences on fishing populations. 165.1. Implementing exclusion zones to minimize direct impacts on fish populations and sensitive habitats does not sufficiently address the broader ecosystem/ecosystem based cultural and heritage associations of fishing. While exclusion zones can help protect specific areas from immediate harm, they may not consider the holistic connections between fish populations, migration routes, and the cultural practices of coastal communities that extend beyond specific locations. 165.2. Using sound mitigation technologies, such as acoustic deterrent devices, can help reduce the direct impacts of seismic surveys on marine life. However, these measures may not fully address the indirect and cumulative effects on cultural and heritage rights. They primarily focus on	*unlikely to range beyond 20 km from the coastline; thus, inshore of the Reconnaissance Permit area (refer to Figure 83). This assessment is however cognisant of the ongoing issues related to the perceived areas fished and species targeted by SSF off the West Coast of South Africa e.g. that cultural practice of SSF may occur to 55 km offshore. While SSF regulations clearly specify that fishing is required to take place "nearshore" the actual differentiation between SSF and other fishing operations that might include SSF, such as the commercial "traditional linefish" and "pole and line" and the extent to which these commercial fisheries might include SSF, remains unclear. As such the offshore extent to which SSF may operate requires a precautionary approach in this assessment and consideration that the possibility exists (albeit a remote possibility that cannot be verified through the information made available on these fisheries), that SSF may have occurred historically and potentially in the future further offshore than suggested by the information made available for this assessment i.e. there is a remote possibility that some SSF may have targeted certain species (of which tuna and snoek are the main candidate species) further offshore than 20 km. The distance fished offshore by SSF and the associated risks determined in this assessment further necessarily considers practical aspects, notably that bottom fishing is impractical in waters deeper than 100 m and as such any bottom fishing, whether SSF or commercial, is highly unlikely beyond a precautionary depth being the 100 m depth contour. Further, in regard to migratory species, such as longfin tuna and snoek, economic and regulatory aspects relating to distances fished offshore is pertinent (i.e. such as the requirements of the South African Maritime Safety Authority [SAMSA]) in particular that most SSF are not likely to be "B" class certified (i.e. can operate up to 40 nm offshore and*	

[178] Akwasi-Achemfuour (2021) Balancing the interests of wildlife and humans resulting in sustainable ecotourism: the case of Boabeng-Fiema Monkeys' sanctuary, Ghana. In: McIntyre-Mills JJ, Corcoran Nantes Y (eds) From polarization to multispecies relationships: re-generation of the commons in the era of mass extinctions. Springer, New York, pp 519–536; McIntyre-Mills, J.J., Makululule, M., Lethole, P. et al. Ecocentric Living: A Way Forward Towards Zero Carbon: A Conversation about Indigenous Law and Leadership Based on Custodianship and Praxis. Syst Pract Action Res 36, 275–319 (2023). https://doi.org/10.1007/s11213-022-09604-0

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reducing noise levels and immediate physical harm, but do not consider the potential disruption of fish behavior, altered migration patterns, or changes to the ecological dynamics that are crucial to the cultural and heritage aspects tied to fishing. 165.3. Temporal restrictions, such as conducting seismic surveys during specific seasons or avoiding critical reproductive periods, may help reduce direct impacts on fish populations. However, these restrictions may not fully address the indirect and cumulative effects on the cultural and heritage rights associated with fishing. Cultural practices and traditional knowledge often extend beyond specific seasons and reproductive periods, and the long-term sustainability of fishing traditions and associated rights may depend on the availability of fish populations throughout the year. 165.4. Implementing measures specifically focused on protecting certain fish species or habitats may not comprehensively address the broader cultural and heritage rights tied to fishing. While protecting specific species or habitats is important for biodiversity conservation, cultural and heritage associations with fishing often encompass a diverse range of species, ecosystems, and traditional practices that go beyond the conservation of individual components.	*are longer than 9 m) are likely limited to "C" class being mainly vessels of <9 m21 permitted to only operate < 15 nm offshore."* It should be noted that the ecosystem level impact and interrelationships are described in section 4.3.8 of the Marine Ecological Assessment. The recommendation of the SIA is that, should the project be approved a representative from TGS must consult with leadership of the community to determine how the communities should be consulted with in future – that is, what is the way the community members prefer to be consulted with for provision of commencement notification and/or daily updates to advise on survey schedules, communication in respect of the proposed research outcomes, etc. The recommendation to include further consultation as part of the conditions of authorisation intends to ensure that the consultation process goes further than just the EIA process, but is continued throughout the entire process, regardless of the outcome. This will assist communities and people on the ground to make informed decisions about technical matters. The intention of the recommendation is not for this condition to be suspensive or determinant on the ultimate decision but rather to function as an additional management/ mitigation measure to be implemented post approval to reduce the significance of the identified impacts and further enhance the community engagements during implementation, should the project be implemented. The SIA specialist has made a reasoned opinion that the project can be approved on the basis of the outcomes of the consultations already undertaken. Communities are diverse and there are community members who are supportive of this type of development, as much as there are community members against the development. Communities were asked to suggest mitigation measures that the specialists should consider, and this influenced some of the recommendations made in	

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166. To effectively address the indirect and cumulative effects on ecosystem/ecocentric based cultural and heritage rights associated with fishing, mitigation measures should take a more holistic and inclusive approach that consider and incorporate the following aspects: 166.1. Incorporating the perspectives and insights of coastal communities into decision-making processes, ensuring their meaningful participation in the development and implementation of mitigation measures. 166.2. Recognizing and preserving cultural and heritage practices by considering the broader socio-cultural contexts, intergenerational knowledge transfer, and the long-term sustainability of traditional fishing practices. 166.3. Integrating traditional ecological knowledge with scientific research to inform mitigation strategies and ensure that they address the interconnectedness of fish populations, ecosystems, and cultural and heritage rights. 167. While the mitigation measures may focus on reducing direct impacts, there can be indirect and cumulative effects that are not fully addressed. Seismic surveys, even with mitigation, can still cause disturbances, alter fish behavior, or disrupt migration patterns, which may have cascading effects on the broader ecosystem. 168. Given the ecosystem impacts, seismic testing will likely result in a trophic cascade affecting all levels of the food chain and therefore indirectly impacting on small-scale fishing communities. The Fisheries Specialist failed to assess the potential impact of the seismic surveys on zooplankton in and around the survey area, as well as the knock-on effects that zooplankton die-off would have on the fish species on	the SIA. All perspectives were considered during the EIA process and the social impact analysis.	

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which small-scale and subsistence fishers rely for their sustenance and livelihood.[179] These indirect knock on and cascading effects on the dynamic and interconnected ecosystem could potentially affect not only food security for local small-scale fishing communities, but could also impact on the ecosystem/ecocentric based cultural and heritage rights associated with fishing. Counter to the requirements of NEMA and the NEM:ICMA, the BAR and the competent authority's decision does not consider impacts from an ecosystem perspective, and as a consequence, the "downstream" impacts have not been adequately assessed and presented to the DG. 169. Additionally, the cumulative impacts of multiple surveys or other anthropogenic activities in the area need to be weighed together. These indirect and cumulative impacts can have implications for cultural and heritage associations, as they may disrupt traditional practices and the functioning balance of the marine ecosystem. 170. Given the absence of a socio-economic impact assessment which adopts an ecocentric and ecosystem approach to the assessment of impacts, and which should have evaluated the cascading impacts on food webs, and how this will impact on the right to access of sufficient food as well as the associated connections of heritage and cultural rights to the practices of fishing, relevant information was not placed before the decision-maker. In the absence of that information, a precautionary approach should have been adopted. This omission is material – the right to food and culture and heritage are constitutionally enshrined – and consequently the authorisation should not have been granted.		

[179] Page 77 -82 of Fisheries Specialist Study

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171. Small-scale fishers often possess traditional ecological knowledge ("TEK"), which includes their understanding of fish behavior, spawning grounds, and the dynamics of the marine environment. This knowledge is often based on observations passed down through generations and is deeply connected to their cultural heritage. Proposing mitigation measures without considering and incorporating TEK may overlook valuable insights and alternative approaches that could better protect both the fish populations and the ecosystem/ecocentric based cultural and heritage rights of coastal fishing communities. 172. Given the above, it is submitted that the proposed and authorised mitigation measures are inadequate. The mitigation measures set out in the EMPr are designed to re-assess impacts post-project.[180] This is flawed for a number of reasons, including: 172.1. The proposed measures are aimed at providing "resources and support for communities to develop and undertake safeguarding measures or plans to enhance the mitigation capacity of their intangible cultural heritage by fostering dialogue, mutual understanding and reconciliation between and within communities" which in no way holds TGS accountable for any impacts caused by the 3D seismic surveys activities. 172.2. The proposed mitigation measures fail to comprehend and mitigate any of the economic or		

[180] Page 30 of the EMPr

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other harms to livelihoods, and cultural and heritage practices and identity. 173. The pre-mitigation significance given to the socio economic and cultural and heritage impacts are rated as Medium, and then Low post mitigation. If mitigation does not actually change the impacts, then it is implausible that the rating can change significantly as well. There is no rational connection between the results of the arbitrary, and somewhat absurd, mitigation measures and any change in significance with regards to the impacts caused by the reconnaissance activities on coastal communities. 174. The Social Impact Assessment (SIA) and Heritage Impact Assessment urges the need for dialogue and engagement with communities prior to the commencement of these activities as the Expert confirms that the oil and gas companies do not have a social license to continue currently.[181] However, there is evidence of any further dialogue with these communities with regards to addressing issues specifically relating to the indirect and cumulative effects on cultural and heritage rights associated with fishing. 175. Therefore, engaging and involving coastal communities in the decision-making process is crucial. Meaningful consultation and participation allow communities to express their concerns, share their knowledge, and contribute to the development of effective mitigation measures. Failure to include the perspectives and needs of these communities can result in measures that do not adequately		

[181] Page 109-110 of the SIA, and page 56, 58 of HIA.

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address their cultural and heritage associations and may lead to further marginalization. 176. Despite the apparent expert knowledge and the level of understanding expressed in the report recommendations regarding the potential effects of the seismic survey proceeding on the communities' identity, sense of place, and spiritual, cultural, and indigenous rights, and that decisions must consider the interests, needs, and values (our emphasis) of all interested and affected parties, including acknowledging all forms of knowledge, including traditional and ordinary knowledge,[182] it is clear that necessary deep conversations with coastal communities were not conducted. Consequently, insufficient information was placed before the decision-maker, and he/she neglected to afford sufficient weight to the indigenous and cultural rights of coastal communities.		
<u>Ground 6: *Failure to consider relevant coastal management considerations or to comply with the National Environmental Management: Integrated Coastal Management Act 24 of 2008*</u> 177. Section 63(1) of NEM:ICMA requires a competent authority to take account of specific factors when deciding whether or not to grant an environmental authorisation under NEMA for "coastal activities". By virtue of this section, the decision maker ought to have appreciated that in deciding whether to grant an environmental authorisation or not, he or she was required to consider additional	Section 4 of the BAR does list the Integrated Coastal Management Act (ICMA) and the Marine Living Resources Act. The decision-making authority was required to consider the principles and obligations of the ICMA in the decision making process. The marine fauna study assesses the potential impacts of the survey on the marine environment. The proposed survey activities to be undertaken by TGS are expected to result in impacts on marine invertebrate fauna in the Orange Basin, ranging from negligible to very low significance. Only in the case of potential impacts to turtles and marine mammals are impacts of low significance expected. If all	

[182] Section 2(4)(g) of NEMA.

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factors specified in section 63 of NEM:ICMA[183] and whether or not the proposed project "would be contrary to the interests of the whole community". This required an eco-centric consideration of the impacts of the proposed project in an area that must be afforded a particularly high standard of protection given the natural functioning of the dynamic coastal processes. 178. Section 12 and 21 set out the State's obligation in relation to the management of the coastal zone, which must be taken into account in taking a decision in respect of this zone. 179. The Director-General's decision makes no mention of section 63 of NEM:ICMA, and the ESIA contains no evidence that the factors set out in section 63 was considered or assessed. Whilst the BARidentifies that section 63 of NEM:ICMA is applicable, it does not assess each of the factors set out in section 63. 180. Read together, this means that there was no factual investigation as required by section 63 of the NEM:ICMA, including a determination of whether the coastal public property and the coastal protection zone would be impacted, and if so, to what extent the proposed activity is consistent with the goal of establishing or protecting those areas.[184]The management plans that are relevant in these areas, like the Coastal Management Programme for the	environmental guidelines, and appropriate mitigation measures recommended in this report are implemented, there is no reason why the proposed seismic survey programme should not proceed. With respect to the management and conservation of protected areas noted in the ICMA and MLRA, this is discussed in Section 8.6 of the BA Report. In terms of protected areas, Child's Bank and Tripp Seamount lie outside of the proposed 3D survey area, and any demersal species associated with these important fishing banks would receive the seismic noise within the far field range, and outside of distances at which physiological injury or avoidance would be expected. Despite the current lack of knowledge of the community structure and endemicity of South African macroinfauna off the edge of the continental shelf, the marine component of the 2018 National Biodiversity Assessment, rated the South Atlantic bathyal and abyssal unconsolidated habitat types that characterise depths beyond 500 m, as being of 'Least concern', with only those communities occurring along the shelf edge (-500 m) being considered 'Vulnerable'. This primarily reflects the great extent of these habitats in the EEZ. Numerous sanctuaries, marine protected area (MPA) exist offshore and along the coastline of the Western Cape, although none of them overlap with the Reconnaissance Permit Area. Seismic surveying is not only used for petroleum and natural gas exploration and development. In addition, the National Coastal and Marine Spatial Biodiversity Plan for the coast and ocean around the South African mainland states that petroleum production may be possible in CBAs using lateral drilling or other techniques that do not result in biodiversity impacts. According	

[183] S 63(1)(c), s 63(1)(h)(ii), s 63(1)(h)(iv) and s 63(1)(i) of NEM:ICMA.
[184] Section 63(1)(c) of NEM:ICMA.

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Western Cape Province,[185] have also not been taken into consideration. 181. The BAR does not, at any point, consider the interests of the affected human and non-human communities in any collective way. Consequently, the interests of the whole community[186] have not been presented to the decision-maker in the BAR, and without evidence of specific consideration of these interests in the Reasons for the Decision, the decision-maker has not evaluated these interests in their decision to grant environmental authorisation. 182. As set out elsewhere in this appeal, the impacts associated with seismic surveys could have significant impacts on marine life and coastal communities. Oceans play a critical role in regulating the climate and mitigating global warming by absorbing carbon dioxide. Seismic surveys pose a significant threat to functioning marine ecosystems, to living organisms in South Africa's coastal waters, and	to the plan if significant petroleum resources are identified in these areas the selection of the site as a CBA could be re-evaluated, although this would require alternative CBAs to be identified to meet biodiversity targets. No MPAs are located within the proposed survey area. Zero no-go areas within the proposed survey area have been identified in any of the specialist studies conducted. It should further be noted that the interests of the whole community (from and intra- and inter-generational perspective, as well as having regard to potential impacts on living organisms in South Africa's coastal waters) was indeed assessed in the assessing of the marine ecology, the impact on the fishing industry, the detailed social and cultural heritage assessments, and the public consultation undertaken. With regards to the requirements of Section 63 of the NEM:ICMA, the Competent Authority thus had sufficient information at their disposal in order to reach an informed decision regarding the proposed activity.	

[185] Western Cape Coastal Management Programme: 2016 available at https://cer.org.za/wp-content/uploads/2009/12/Western-Cape.pdf
Draft Western Cape Coastal management Programme 2022 – 2027 available at https://www.westerncape.gov.za/eadp/files/atoms/files/DRAFT%20Western%20Cape%20Provincial%20Coastal%20Management%20Programme%202022-2027.pdf.

[186] In terms of the National Environmental Management: Integrated Coastal Management Act 24 of 2008 (NEM:ICMA), the 'interests of the whole community' is defined as meaning the collective interests of the community determined by:

(a) prioritising the collective interests in coastal public property of all persons living in the Republic over the interests of a particular group or sector of society;

(b) adopting a long-term perspective that takes into account the interests of future generations in inheriting coastal public property and a coastal environment characterised by healthy and productive ecosystems and economic activities that are ecologically and socially sustainable; and

taking into account the interests of other living organisms that are dependent on the coastal environment.

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to communities that depend upon the oceans for their livelihoods. Small-scale fishers and fishing-dependent communities are particularly vulnerable to the negative impacts on fish stocks upon which they depend for their livelihoods. 183. The Appellants submit that it is not in the interests of the whole community (from and intra- and inter-generational perspective, as well as having regard to potential impacts on living organisms in South Africa's coastal waters] to expose our oceans and coasts to the increased risks associated with seismic surveys, or associated with further intended exploratory drilling and/or production activities.		
<u>Ground 7</u> *Failure to provide adequate reasons for the decision* 184. The reasons for the DG's decision, as described in Appendix 1 of the Environmental Authorisation ("the EA"), sets out that the following were 'key findings' that resulted in the decision to approve TGS's application for environmental authorisation: 185. The decision concludes as follows: *In view of the above, and having taken into consideration environmental management principles as set out in section 2 of NEMA, this Department is satisfied that the proposed activity will not be in conflict with the objectives of Integrated Environmental Management set out in Chapter 5*	It is the opinion of the Applicant that the Competent Authority thus had sufficient information at their disposal in order to reach an informed decision regarding the proposed activity.	

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of [NEMA] and will not result to any detrimental risks to the environment and public. The environmental authorisation is accordingly granted. 185. These reasons, and the conclusion arising from these reasons are generic and unsubstantiated. The reasons are almost verbatim the same reasons provided by the DG in other oil and gas related applications, such as those contained in the Environmental Authorisations for Searcher Geodata UK Limited and TotalEnergies EP South Africa Block 567 (Pty) Ltd . The EA itself further fails to deal substantively with any of the main issues raised by the Appellants and other I&APs. 187. On the reasons provided, it is impossible to conclude that the DG took all relevant considerations into account, including the submissions made by the Appellants and other interested and affected parties. To the contrary, it appears that the DG failed to consider all relevant information, for the reasons set out elsewhere in this appeal		
Ground 8. Decision to grant authorisation contravenes NEMA Principles, the Constitution and PAJA 190. Section 33 of the Constitution recognises that everyone has the right to administrative action that is lawful, reasonable and procedurally fair. PAJA seeks to give effect to this right.	It is the opinion of the Applicant that the Competent Authority thus had sufficient information at their disposal in order to reach an informed decision regarding the proposed activity.	

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191.From what is set out above, it is clear that the decision to grant authorisation to TGS runs contrary to at least the following NEMA principles: 191.1. Decision-makers must apply the precautionary principle when there is uncertainty or lack of scientific consensus regarding potential environmental harm. This principle requires taking preventive action to avoid serious or irreversible environmental damage, even in the absence of full scientific certainty. 191.2. Decision-making should promote equity and fairness in the distribution of environmental benefits and burdens. This principle recognizes the rights of all individuals, particularly disadvantaged and vulnerable groups, to a healthy environment and seeks to avoid disproportionately negative impacts on these groups. 191.3. Decision-makers must protect and conserve ecosystems, biodiversity, and ecological processes. This principle recognizes the intrinsic value of ecosystems and the critical role they play in supporting life and maintaining ecological balance. 192.It is further submitted that 192.1. Irrelevant considerations were taken into account or relevant considerations were not considered;		

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192.2. the action itself contravenes a law or is not authorised by an empowering provision; 192.3. the action itself is not rationally connected to the information before the administrator; and 192.4. the exercise of the power or the performance of the function authorised by the empowering provision, in pursuance of which administrative action was purportedly taken, is so unreasonable that no reasonable person could have so exercised the power or performed the function. 193.The decision is consequently reviewable under section 6(2) of PAJA. CONCLUSION 194.The Appellants have sent out in this appeal a number of grounds on which the decision to grant environmental authorisation to TGS was fatally flawed. The decision to authorise the project is consequently unlawful, in that it failed to comply with, inter alia, the Constitution and NEMA.		

ARR comments by Case Officer

Approved by Supervior

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Name & Surname:

Date:

Signature:

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Name & Surname:

Date:

Signature:

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pressures, and the inability of the prescribed mitigation measures preventing harm to individuals/populations. Furthermore, recent literature provides credible concern about ecosystem/food-chain impacts of seismic surveys, that may in turn have impact on fisheries, the severity and localisation of which will depend on coincidences with spawning and juvenile recruitment events. It is strongly recommended that further studies on these impacts, in the South African context, are carried out *in situ* before proceeding with further seismic surveys of this nature.

Summary of Findings

- Based on peer-reviewed scientific literature, it is clear that physical damage to marine animals, including soft tissue trauma damage, embolisms, damage to organs used in balance and orientation, concussions, haemorrhaging, decompression sickness and both temporary and permanent threshold shifts to hearing ability have been directly linked to the kind and level of sound emitted during this nature of seismic surveys.
- There is plausible evidence to suggest that seismic survey activity is likely to affect the conservation status and recovery of populations of vulnerable and threatened species including (IUCN Red list species such as humpback and southern right whales), because sound and the ability to hear and interpret sound is critical for many species to reproduce (both vocalisations on breeding grounds and communications across large distances for mate detection). Therefore, it must be assumed that interference in sound perception or utilisation for communication (temporarily or permanently) has the potential to impact a species at the population level.
- Some species have been shown and documented to display physiological stress responses and behavioural changes to seismic activities, such as moving away rapidly, diving or remaining still. These responses are likely to increase their energy consumption

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and energy costs, reduce their time to forage, and/or affect their vulnerability to predation, thus having negative impacts on the survival of individuals (especially young or compromised animals) as well as the overall population growth and survival of a species (especially for threatened species that are already at risk of extinction).

- The impacts of seismic activities are most well studied for marine mammals, and evidence suggests that there are distinct avoidance responses such as leaving the area or ceasing to undertake everyday activities such as feeding in preferred areas. This is likely to negatively impact the "fitness" of an affected animal.
- There is genuine conservation concern for beaked whales that are particularly sensitive to anthropogenic noise, including seismic surveys. It has been demonstrated that even minor, non-lethal disturbances, resulting in changes in behaviour such as displacement from preferred habitats, could impact a population.
- The only existing field study in South Africa (that we have been able to find) on the impacts of seismic activities in our waters is illuminating in this regard. It presents clear evidence that the endangered, endemic African penguin avoided preferred feeding sites when a seismic survey was active nearby. This is particularly of concern for a species which has had a 70% decrease in numbers over the past decade, is stressed by prey depletion creating a greater demand for them to forage further afield, and for which the prospect of extinction is significant.
- The phenomenon of energy-cost (from stress and avoidance behaviour) is of particular concern for some of the species expected to be encountered in the survey area in question, particularly the humpback whales and southern right whales who are at risk of the airgun noise affecting their behaviour or interfering with the communication between mother and calf. Any impact on their energy reserves could impact on their condition (weight-loss and physiological condition) and affect survival of the animals during a

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vulnerable time (especially for lactating mothers and their calves) on their long migration to feeding grounds in Antarctica.

- Recent research (2017) has shown significant mortality in zooplankton up to 1.2 km from a seismic survey array. Zooplankton forms the base of many important food webs in the marine environment. Depletion of zooplankton could thus have an impact on food for their predators (such as fish) as well as impact fish eggs and larvae (Ichthyoplankton) with potential local impacts on species important in fisheries. This damage to zooplankton over 1km away from the survey array raises concern that a 500m buffer for other animals that are unable to move away from the sound, is far too small to ensure that damage is not inflicted (even if they were able to evade it).
- The impact on fish assemblages is difficult to interpret, due to multiple factors at play including but not limited to the ability of a species to move from an area as well as the receiving habitat. A global review of the effect of seismic activities on fish and invertebrates acknowledged the limits of the current research due to experimental designs used or due to the focus on single species during investigations. A key concern is a lack of research focused on confounding effects and multiple stressors, therefore potential impacts of seismic surveys that have been previously identified may be reflective of underestimation or overestimation and would depend on the type of interaction (synergistic, additive, or antagonistic).
- In South Africa, since October 2021, thousands of dead and/or dying Cape fur seals (*Arctocephalus pusillus pusillus*), have washed ashore along the south and west coasts. The cause of these die-offs remains unknown but avian flu has been ruled out and malnourishment appears to be the most widely accepted reason. It is of concern that although the cape fur seal population within South Africa is relatively healthy, they too are

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under pressure from various anthropogenic pressures. Additional stress from seismic activity at this time is inadvisable.

- While "Soft starts" mitigation for seismic impacts are likely to reduce the impact for highly mobile large animals, this is unlikely to be adequate for the many species that are prevalent in the area over the austral summer months and are unable to avoid the array or leave the area due to their lower mobility, such as smaller turtles, penguins, invertebrates, some fish species and zooplankton.
- The finding of observer efficiency (from a scientific monitoring study conducted during the 2018/19 and 2019/2020 seasons on the humpback whales on the east coast) suggests that even with trained observers up to 44% of humpback whales in an area went undetected. This casts doubt on the effectiveness and success of Marine Mammal Observer (MMO) sightings of the largest species (humpbacks) as a mitigation measure, indicating that it is most likely that whales go undetected. Furthermore, the detection rate for smaller species, such as dolphins, seals, turtles and flightless birds (penguins), would be expected to be much lower, obviating the effectiveness of visual observations to prevent harm to these species.
- Also of concern, is that the efficacy of Marine Mammal Observers (MMO) is likely to be low due to the nature of the offshore marine environment in the survey area (frequent high swells and winds affecting surface visibility), putting species who are missed by MMO's and PAM operators at extreme risk, particularly at night or during adverse weather conditions.
- Furthermore, the reliance on Observers to do visual sightings to supplement the PAM monitoring during the day, as a mandated mitigation measure, necessitates that we question the acceptability of continuing with survey activities at night. If the visual observations are useful (perhaps sighting large animals around 65% of the time) in

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addition to PAM, then relying on PAM alone at night cannot be an effective mitigation measure. It is our opinion that surveys should not occur between sunset and sunrise each day if a genuine attempt of maximum avoidance of cetaceans is the objective of this mitigation measure.

- It is of our opinion that the proposed seismic survey activities are highly likely to both disturb and have an adverse effect on Marine Protected Areas (MPA), Critical Biodiversity Areas (CBA) and Ecologically or Biologically Significant Areas (EBSAs), and their associated fauna, situated adjacent to, within and surrounded by the reconnaissance permit area. The reconnaissance permit area occurs adjacent to six Marine Protected Areas and surrounds a seventh (Benguela Muds MPA). In the EMP, there is no reference or provision made regarding buffer areas around these protected areas or for areas identified with biological importance and significance. Therefore, it is assumed that the vessel can actively work within 1 km of the MPA boundaries, while ignoring EBSA's and CBA's altogether, thus giving no consideration to the biological importance of these areas or the likely impact at such close range. Although 2D surveys are proposed for these adjacent areas, the cumulative zone of impact for Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS) for physiological injury is between 500 - 5000m respectively.

Global context – Impacts of seismic surveys on marine wildlife

Despite seismic surveys having been undertaken for decades in South African waters, together with the knowledge that some impact to marine fauna does indeed occur[1], there remains very little scientific research on the effects of seismic surveys, and in addition there

[1] https://jnnc.gov.uk/our-work/marine-mammals-and-noise-mitigation: "to reduce the risk of deliberate injury to marine mammals".

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are no legislated guidelines for seismic surveys in South African waters (Purdon 2018). Globally, seismic surveys' environmental impacts and consequences are slightly better documented, although not uniform in results or widely accepted within all sectors. The primary mitigation measures for seismic surveys in South Africa include soft-starts, which is a gradual and systematic increase in power of the airgun array undertaken to warn and drive mobile marine species, such as cetaceans (whales and dolphins), seals, flightless birds and turtles away from the sound source before the full-power airgun blasts begin, thus attempting to minimise the negative effects of the airgun blasting activity. Various studies contest this assumption (McCauley et al. 2000; Weilgart 2013; Dunlop et al. 2016) and have revealed a growing concern for animals that are unable to avoid or out-swim the airgun arrays.

Animals use sound critical to their life cycles (Jasny et al. 2005) in three ways, by actively producing sound (Tyack 1981), by listening to sounds emitted by other living organisms (Clark et al. 2009; Van Opzeeland 2010), and taking cues from physical or non-living factors producing sounds, contributing to the ambient background noise, such as wind, waves, swell, bubbles, currents, turbulence, earthquakes, rainfall, ice cracking or breaking (Hildebrand 2005). Many marine animals produce sound for communication, reproduction, aggression, defence mechanisms, antagonistic interactions, courtship, group coordination, orientation, navigation, and prey identification (Hildebrand 2005). They rely on producing a sound that is heard while hearing a sound and interpreting the sound for their survival.

Various physical responses to acoustic disturbance have been documented, with physical responses including soft tissue damage (Balcom and Claridge 2001), embolisms (Dolman and Simmonds 2005), damage to organs used in balance (André et al. 2011), concussions in penguins (Cooper 1982), haemorrhaging (Evans et al. 2001) and decompression sickness

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(Fernández et al. 2005). Hearing impairment in the form of Temporary Threshold Shift (TTS) or Permanent Threshold Shift (PTS) has also been reported (Hildebrand 2005). Threshold shift refers to an increase in the minimum sound level required for an animal to hear a sound. A TTS is followed by successful recovery to normal hearing thresholds after a given period of time in the absence of that sound, while PTS is when the sensory hair cells in the inner ear are permanently damaged and lost making recovery impossible (Weilgart 2013).

Stress caused by disturbance is associated with a change in body chemistry (Jasny et al. 2005) and can be equally disruptive as physical damage. Stress has implications on sexual maturation, inhibits growth, reproduction and general survival ability (Pickering 1992; McCormick 1999; Consten et al. 2001). Perceptual effects can occur when there is an interference of sounds of interest to a specific animal but are being drowned out or masked by anthropogenic noise. The impact of this in the long term could have implications on breeding populations, thus on reproduction within a population (Erbe 2001). Many animals may have the ability to counteract this and make minor changes to their vocalisations and behaviour; however, these modifications may come at a cost in terms of energy expenditure (Tyack 2008) and are likely to reduce breeding productivity of the population. This is of particular concern for species that are threatened.

Behavioural responses to noise are dependent on various factors, such as age, sex, presence of offspring, location and an individual animals' previous encounter with a specific sound or noise. Behavioural responses may include modification of vocal behaviour, displacement from important habitats, and other subtle responses, including increased breathing rates, change in dive duration, time spent at the surface, rapid or erratic movements (Bowles et al. 1994; Lesage et al. 1999; Williams et al. 2002; Hastie et al. 2003; Ng and Leung 2003; Aguilar de

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Soto et al. 2006). These all with potentially high energetic costs (Williams et al. 2006; Koper and Plön 2012).

Most scientific research on the impacts of seismic surveys has been conducted on cetaceans, and as a result, most mitigation measures are to protect these animals. In South Africa, this is no different. However, it is becoming more and more evident that mitigation measures are not adequate (Weilgart 2013). In the Gulf of Mexico, it was recorded that ~250 male fin whales appeared to stop singing for several weeks to months during a seismic survey. These animals resumed singing within hours or days after the survey ended (IWC 2007). The assumption is that male fin whales use vocalisations for reproduction by finding and attracting mates (Croll et al. 2002); it can only be assumed that such an effect would be biologically significant (Weilgart 2013). In addition to this, a blue whale ceased calling in the presence of a seismic survey at 10 km away (Macdonald et al. 1995). Conversely, a different group of blue whales appeared to have the opposite reaction. They changed their vocalisations (De Lorio et al. 2010) by calling consistently more on days when the seismic surveys were actively ongoing, suggesting that seismic survey noise interfered with important signals used in their social interactions and feeding (De Lorio et al. 2010).

Other reactions to seismic airguns can be subtle or hard to detect (Weilgart 2013) and it has been found that Sperm whales in the Gulf of Mexico did not appear to avoid a seismic airgun survey area but reduced their swimming effort and their tendency to reduce foraging effort (Miller et al. 2009). It has also been documented that as a result of changes in behaviour, the result could be lower reproductive rates and have negative consequences for the population (Miller et al. 2009). In comparison, bowhead whales showed no avoidance or change in vocalisations in the area of seismic surveys; however, their dive duration was shorter

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(Richardson et al. 1986). In Brazil, a reduction in cetacean species diversity during 2000 and 2001 was noted with the increased occurrence of seismic surveys in the area being implicated in the possible cause of these animals vacating the area (Parente et al. 2007). In other areas, marine mammals have been recorded to avoid seismic noise by leaving an area (Castellote et al. 2012; Weir 2008; Stone and Tasker 2006). The long-term impacts of various changes in behaviour is largely unknown but potentially impact their ability to feed and/or reproduce as in some species, these life-history stages are site or habitat-specific.

South Africa's south and west coasts are hosts to eight species of beaked whales (Ziphiidae) (Best 2007), including a new species described in 2021 (*Mesoplodon eueu*; Carroll et al. 2021), which are globally recognised as being sensitive to anthropogenic noise, and having raised conservation concerns. New et al. (2013) found that adult female beaked whales could survive but not reproduce in times or areas of lower habitat quality. They may extend the duration of lactation in mediocre conditions to increase their chance of survival, while still reproducing. New et al. (2013) found that some beaked whale species require high-quality habitat to meet their requirements for reproduction and survival. They suggested that even minor, non-lethal disturbances, resulting in changes in behaviour such as displacement from preferred habitats, could impact a population.

McEwen and Wingfield (2003) suggested that all organisms must gather energy for growth and reproduction throughout their life cycle and that organisms must retain reserves for predictable changes such as seasons, and challenges that are less predictable such as disturbance, predation pressure, or social conflict. Often colloquially, this is referred to as the "fitness" of the animal. The accumulated cost in the balance between energy intake and demand is called the 'allostatic load', of physiological and behavioural mechanisms that enable

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allostasis or adaptation to these changes. McEwen and Wingfield (2003) use the word "allostasis" to signify mechanisms that allow an organism to regain equilibrium while dealing with external challenges; if energy demand is more than intake, then animals may activate a survival mode that may increase energy available, reduce energy demand, or both, to regain its energy balance. Implications on individuals and populations of this energy imbalance are unknown.

Several studies have reported negative impacts of acoustic signals from airguns on zooplankton (small, aquatic microorganisms living in the water column, including crustaceans, larvae, juvenile fish, juvenile invertebrates, eggs etc.) from more than 10m away (Kostyuchenko 1972; Kosheleva 1992; Parry *et al.* 2002) with some laboratory experiments on lobster larvae showing no impact at all (Day *et al.* 2016). However, Christian *et al.* (2003), showed retardation in some individuals in the development of snow crab eggs after being exposed to certain sound levels.

The effects of seismic noise on zooplankton were brought under the spotlight when McCauley *et al.* (2017) presented evidence from an *in-situ* study that suggested that seismic surveys cause significant mortality to zooplankton populations. Zooplankton, unlike vertebrates, do not have hearing structures (although they can sense pressure change) and their bodies are generally the same density as the surrounding water, so sudden pressure changes associated with seismic activities were presumed not to cause physical damage (Parry and Gason 2006). McCauley *et al.* (2017) disputed this and has shown zooplankton mortality at distances of up to 1.2km from the sound source.

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Similarly, inconsistent findings occur with fish assemblages. The impacts on fish assemblages are difficult to interpret, because of multiple factors at play including but not limited to the ability of a species to move from an area as well as the receiving habitat. We acknowledge the validity of the results presented by Meekan et al. (2021) which highlights that exposure to an experimental seismic source did not have an impact on the assemblage of tropical demersal fishes found along the northwest shelf of Western Australia. However, it must be noted that the findings have been stated to be applicable only to other habitats with similar physical environments, in particular similar water depths (50 – 70 m). The proposed reconnaissance permit area on the south and west coasts of South Africa differs significantly from those reported in the Meekan et al. (2021) research, thus highlighting the need for South African-specific and local research to be undertaken.

A global review of the effect of seismic activities on fish and invertebrates by Carroll et al. (2017) acknowledged the limits of the available research due to experimental design, or to the focus on single species which prevents extrapolation to other regions, other seismic surveys, species, or biological responses. In addition, they highlighted a serious concern, that there was a lack of research focused on confounding effects and multiple stressors, therefore potential impacts of seismic surveys which had previously been identified may be reflective of under-estimation or over-estimation and would depend on the type of interaction (i.e. synergistic, additive, or antagonistic).

Furthermore, the indirect effects of seismic activity on cetaceans is a concern. It is well known that the productivity and health of the oceans are under-pinned by marine plankton (Raymont 1983; Alcaraz & Calbet 2009). While forming the basis of the food webs, plankton has been implicated in links to climate change via their role in iron fertilisation and carbon sequestration

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through whales foraging on krill and subsequent defecation (Smetacek and Nicol 2005; Smetacek 2006; Nicol et al. 2010). In 2010, Pershing et al. suggested that over-fishing of large fish and commercial whaling had compromised the ocean's ability to store and sequester carbon, thus contributing to climate change. They indicated that populations of large baleen whales now store 9.1×106 tonnes less carbon than before commercial whaling and that protecting whales (and other large over-exploited species), would be a form of a carbon management scheme. The cascading and knock-on effects of seismic survey impacts between the upper (cetaceans) and lower reaches (plankton) of the food web, as each are being impacted are unknown. McCauley et al. (2017) noted that the ramifications of compromised larval recruitment could be massive for higher predators and for ocean health as a whole. While traditional feeding grounds for humpback whales are in Antarctic waters, Dey et al. (2021) has recently recorded regular feeding frenzies off the west coast in recent years (see super pods below).

South African Context

It is of concern that there are a number of 'unknowns' and 'warning bells' in terms of cetacean populations on the south and west coasts. Despite various species being recorded frequently on the coasts, the location of breeding grounds of Sei (*Balaenoptera borealis*) and Fin whales (*Balaenoptera physalus*) are unknown, the seasonality of pygmy (*Kogia breviceps*) and dwarf (*Kogia sima*) sperm whales are unknown and the abundance and occurrence of the offshore common dolphin (*Delphinus delphis*) is also unknown, highlighting that encounters with these animals cannot be predicted and the generic mitigation measures may be insufficient. Further to this, it is noted in the EMP submitted by Searcher that the two very well-studied and frequently observed species on the south and west coasts, the humpback and southern right whales, ***are expected to be regularly encountered and have a year-round occurrence***

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across the entire reconnaissance permit area. The period of humpback whales in this area is between July and February, with frequent feeding encounters during the months between December to February. Barendse et al. (2010), Best & Allison (2010), and Elwen et al. (2014) highlighted that there is no existing evidence of a clear 'corridor' of migration and humpback whales appear to be spread out widely across the shelf and into deeper pelagic waters, especially during the southward migration, in the Benguela ecosystem.

Further to this, the EMP itself highlights that, ***"It is highly likely that several hundreds of right whales can be expected to pass through the Reconnaissance Permit Area when migrating southwards from the feeding areas between April and June"*** (page 93). Apart from this going against the spirit of avoiding whale periods by the oil and gas industry, Vermeulen *et al.* (2020) warned that there is an observed decrease in southern right whale calving success of the South African population and a strong link between foraging success and reproduction. They suggest an investigation into possible decreases and/or spatial or temporal shifts in their prey availability at higher latitudes due to environmental variability. They also highlight a concern of the continued low numbers of unaccompanied adults along the South African coast which could potentially have serious consequences for cow-calf pairs in relation to the country's whale-watching industry in the future.

Since 2011, South Africa has witnessed 'super-pods' of up to 200 humpback whales feeding in south and west coast waters between October to January. Research by the National DFFE, in collaboration with various academic partners, has led to the discovery of these 'feeding grounds' away from their traditional feeding grounds in the Antarctic[2]. This phenomenon

[2] https://www.news24.com/news24/travel/watch-whale-super-pods-larger-than-usual-cause-stir-off-sas-west-coast-public-urged-to-keep-their-distance-20191216

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requires understanding the ecosystem-wide impacts and benefits, while potential human/whale conflicts remain unknown. According to Dey et al. (2021), the formation of super-groups in recent years suggests that there might be a change in oceanographic or ecological characteristics which provide the conditions for this novel feeding strategy in the Southern Benguela Upwelling System. Although the humpback whale population is increasing (Wilkinson, 2021), there is evidence to suggest that cetaceans in South African waters are being affected by changes in their ecosystem and it is not well understood yet what is driving these changes and what the long terme effects could potentially be to populations.

With other mammals, it was suggested by Thompson et al. (1998) that grey seals displayed strong avoidance behavior, altered foraging behavior and suggested an increased frequency of hauling out onto land to possibly escape the noise, while harbor seals had slower heart rates during controlled playback experiments. In contrast, during a study in shallow arctic waters, sighting rates of ringed seals (*Phoca hispida*) from a seismic vessel showed no difference when a different number of airguns were in use, did however suggest local avoidances based on distance from the sound source (Harris et al., 2001).

In South Africa, the Cape fur seals (*Arctocephalus pusillus pusillus*), is the only resident seal along the west coast, occurring at numerous breeding and non-breeding sites on South Africa's mainland and on nearshore islands and reefs. Other vagrant seals occurring along the south and west coast include the southern elephant seal (*Mirounga leonines*), subantarctic fur seal (*Arctocephalus tropicalis*), *Antarctica fur seal* (*Arctocephalus gazella*), crabeater (*Lobodon carcinophagus*) and leopard seals (*Hydrurga leptonyx*). Cape fur seals are highly

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mobile and have large foraging areas including on the continental shelf up to 120 nautical miles offshore (Shaughnessy 1979).

According to Kirkman et al. 2016, several morbillivirus epidemics have occurred in true seal (Phocid) populations in the northern hemisphere and, at the time it was agreed that no epidemic diseases were known to have infected Cape Fur Seals historically, but there was a considerable risk for disease transmission to the population through exposure to domestic or feral dogs and terrestrial carnivores, potentially resulting in mass mortality. Kirkman et al. (2016) cautioned that the health of individuals and their vulnerability to disease can be affected by feeding conditions, including the availability of prey, and that risk of disease may be exacerbated by anthropogenic pressures on the ecosystem.

In South Africa, since 10 September 2021, thousands of emaciated, dying and dead Cape fur seals (*Arctocephalus pusillus pusillus)*, have washed ashore along the south and west coasts. The cause of these die-offs remains unknown but avian flu has been ruled out and malnourishment appears to be the most widely accepted reason. It is of concern that although the cape fur seal population within South Africa are healthy, they too are under pressure from various anthropogenic pressures, and the EMP failed to mention this mass die-off event

In South Africa, only a single focused study on the impact of seismic surveys has been undertaken. This study, off Gqeberha, was within the foraging area of the endangered, endemic African Penguin (*Spheniscus demersus*). Pichegru et al. (2017) demonstrated that penguins avoided their preferred foraging areas during seismic surveys and foraged further from the survey vessel when in operation. Upon termination of seismic surveys, the penguins reverted to their normal behaviour (Pichegru et al. (2017), a behaviour which was also

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observed in Gray whales (*Eschrichtius robustus*) off Sakhalin Island in Russia (International Whaling Commission 2005). However, the long-term effects on populations of this temporary retreat of the area are unknown. Given the results of this study by Pichegru et al. (2017), strict management measures and decisions on seismic survey activities should have been established in South Africa. Furthermore, the cumulative effect of multiple, concurrent seismic surveys within the region may cause cumulative impacts.

Significant impacts on turtle species are a concern. Adult turtles may be less vulnerable to sound damage than cetaceans as the air spaces in their cochlear are smaller than those in cetaceans, making them less sensitive to sound shockwaves (Popper et al. 2014). However, while studies have shown that adult sea turtles have a moderate ability to move from an area being surveyed (Lenhardt 1994; O'Hara and Wilcox 1990), they are prone to TTS after exposure to sound within 1 km of a sound source, with signs of recovery only two weeks after injury (Lenhardt 1994). In a study undertaken on captive turtles, it was found that loggerhead turtles (*Caretta caretta*) responded to sound by swimming to the surface and remaining there or staying slightly submerged (Lenhardt 1994), as this area, regarded as a sound shadow, and is hypothesised as being where sound waves cancel each other out and the noise is at a minimum. Cummings et al. (2004) disputed this saying that although near the surface, could be a place where animals take refuge, they are not in a 'zone of silence'. With an increasing exposure of sound levels, the behaviour of caged green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles increased their swimming speed, potentially showing agitation to sound (McCauley et al. 2000). Turtle behaviour is difficult to interpret (DeRuiter and Doukara 2012), given that some studies have reported that turtles do not display any signs of distress (Pendoley 1997). Globally the Leatherback turtle (*Dermochelys coriacea*) is vulnerable, but critically endangered in the Southwestern Indian Ocean where this subpopulation is declining

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(Nel 2010, 2012; Nel et al. 2013). Loggerhead (*Caretta caretta*) populations are globally vulnerable but near threatened in the southwest Indian Ocean (Lombard & Kyle 2014).

The nesting grounds of the southern African loggerhead (*Caretta caretta*) and leatherback turtle (*Dermochelys coriacea*) populations are located on the east coast in iSimangaliso Wetland Park. In the Autumn months, adult turtles are moving towards their nesting beaches but stay inshore to avoid the north to south flowing Agulhas current. Once they have completed their laying of eggs, they leave the shore and into the current to be carried south once again, and by late March, they will be littered along the east and south coast in offshore waters. Both loggerhead and leatherbacks are known to occur within the reconnaissance permit area but known migration corridors of adult leatherbacks lie within the reconnaissance permit area. Harris et al. (2018) highlighted the migration path for leatherback turtles into the southeastern Atlantic (Agulhas-Benguela Corridor), through the reconnaissance permit area. Leatherback turtles inhabit deeper waters and are considered a pelagic species, traveling within the ocean currents. However, they have a moderate ability to avoid areas with an increase of noise in the water. According to Hays et al. (2004), these animals may dive to depths over 600 m and remain submerged for up to 54 minutes. Mitigation measures for turtles in seismic surveys include observers, although it is unclear how an observer would be able to observe these animals at such a distance (especially as large animals such as whales are only observed 44% of the time at best). A second mitigation measure, although only to be used if turtles are sighted by observers (EMP page 224), is to install 'turtle-guards' to prevent them from becoming entangled in the gear. These devices are accepted as being useful in terms of entrapment but not for sound in the water. Given the sighting probability of a turtle by an observer is minimal (as explained above) and that turtle guards are not a standard measure on the gear for this survey, these two mitigation measures are hardly justifiable.

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Effectiveness of Mitigation [Marine Mammal Observers (MMO) and Passive Acoustic Monitoring (PAM)]

During the 2018 and 2019 humpback whale (*Megaptera novaeangliae*) migration period along the east coast of South Africa, Wilkinson (2021) estimated the relative abundance of migrating humpback whales sighted by trainer observers from two towers located 22m apart (both observers viewing the same area), located at 70m above sea level on a dune with a horizontal vantage length of approximately 20 km. Over the observation periods during the peak of migration, it was estimated that observers from both towers missed between 41–44% of whale groups while distance offshore decreased the probability of sightings. Assuming that the best percentage sighting (56%) was achieved within 1-5km of the observers' vantage point, then more than 40% of whales were missed. Given that this survey was done during the northward migration when mostly larger animals are present, the sighting success may be less when small calves are present as well (as would be the case in December). This begs the question of the efficacy and reliability of the mitigation method of Marine Mammal Observers (MMO), while assuming that whales (and other cetaceans) are thus regularly missed by MMOs and could be harmed.

Despite various organisations who provide MMO's on vessels having a zero tolerance policy of intimidation it is not uncommon for an MMO to complain that he/she has been subjected to coercion, harassment and intimidation. The EMPr states that: "*The MMO has the authority to stop*

the survey activities (including seismic shooting) in response to certain circumstances related to marine mammal risk. However, due to the cost associated with terminating activities (e.g.

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an entire survey line may need to be repeated), it is recommended that the decision to terminate firing be made by the operator in consideration of the MMO's advice. The MMOs must provide full reporting of all termination decisions (including behaviour and distance of marine mammals) in a daily close out report (Part B, p.8)". This statement is highly problematic and reinforces the concern that "A risk-averse and cautious approach, which takes into account the limits of current knowledge about the consequences of decisions and actions", a principle of the National Environmental Management Act, 107 of 1998, will not be applied in full.

Furthermore, bearing in mind the examples above, i.e. blue and fin whales ceasing to sing, the use of Passive Acoustic Monitoring (PAM) technology to detect cetaceans is baseless if cetaceans do not vocalise. As per best practice, in an effort to improve mitigation, PAM technology is complemented by visual searching over an area of 500m around the vessel by qualified Marine Mammal Observers (MMO). This technique is, however, also fatally flawed because it cannot be used at night, during rain and in sea states more than three on the Beaufort Sea State Scale. Therefore, both PAM and MMO's are insufficient to detect, with certainty, cetaceans within the surrounding survey area and these types of mitigation will only be effective for all affected species if airgun firing ceases between sunset and sunrise, and adverse weather conditions that limit visibility.

The cumulative and long-term effects of seismic survey sound is not entirely understood (Jasny et al. 2005); however, it is accepted that ocean noise may have ecosystem-scale effects (Hildebrand, 2005) and the "knock-on" effects on animals, their prey and their predators will have consequences within the food chain (Koper and Plön 2012). It has been suggested that research and a critical review on mitigation measures (McCauley et al. (2017) as well as

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a better understanding of ecosystem-scale effects of sound (Koper and Plön 2012), especially at the lower trophic levels are imperative. Considering the ecosystem services provided by the Benguela Current Marine Ecosystem and its associated diversity and biomass, mitigation and understanding should be a conservation imperative in South African marine waters. Up to now, there has been no effort in increasing the knowledge of the impact of these seismic surveys by industry or South African environmental departments despite them being known to have impacts on marine animals and having been undertaken in South African waters for a number of decades.

Proximity to Marine Protected Areas and Critical Biodiversity Areas

The reconnaissance permit area occurs adjacent to six Marine Protected Areas (MPAs) including the Orange Shelf Edge MPA, Child's Bank MPA, Benguela Muds MPA, Cape Canyon MPA, Robben Island MPA and the Southeast Atlantic Seamounts MPA and completely surrounds the Benguela Muds MPA (See EMP: Figure 7-20). It is a significant concern that there is no reference or mention of buffers-areas around the MPAs in the EMP, which allows the vessel to come within 1 km of these protected areas. This is of particular concern, given that the EMP indicates *the cumulative zone of impact for the 3D survey extends to 800 m for permanent threshold shifts (PTS) and to 6 000 m for temporary threshold shift (TTS) for physiological injury, and the cumulative zones for PTS and TTS while the 2D survey is 500 m and 5 000m, respectively.* For example, the reconnaissance permit allows the survey vessel to be active ~800 m from the edge of the Orange Shelf Edge MPA, which is designated as a sanctuary zone, at depths of 250-1500m. Therefore, this would be within the zone of TTS and very near to that of PTS for 2D surveys.

It should be noted that, according to the National Environmental Management: Protected Areas Act 57 of 2003: section 48A reads:

"48A Restriction of activities in marine protected areas:
Despite any other legislation, no person may in a marine protected area-
....
(e) in any manner which results in an adverse effect on the marine environment, disturb, alter or destroy the natural environment of disturb of alter the water quality or abstract sea water;
(f) carry on any activity which may have an adverse effect on the ecosystem of the area;…."

While it is acknowledged that the EMP states that only 2D seismic activities will take place near any MPAs, it cannot be ignored that the proposed seismic activity will still have potential adverse effects on the ecosystem within the area and disturb the natural environment.

Further to this, large portions of the reconnaissance permit area comprise of Critical Biodiversity Areas (CBA) both 1 and 2 (See EMP; Figure 7-21). CBA 1 areas are irreplaceable or near-irreplaceable, while CBA 2 are sites that are the best option available for representing the features in a spatial prioritisation (Harris *et al.* 2020). The primary of objective, and national policy, is that both CBA 1 and 2 areas remain in natural or near-natural states for conservation management, while portions of these areas be ear-marked for future MPAs.

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Comments on Tosaco Energy Block 1 Exploration Right issued to

Tosaco Energy (Pty) Ltd (PASA Reference: 12/3/562)

Harris JM, Olbers JM, Wright K

6 April 2022

In preparing these comments, we have reviewed scientific literature on the physiological, behavioural and ecological impacts of seismic survey activities on marine wildlife. The body of peer-reviewed scientific literature on seismic surveys has grown over the last few decades in response to significant concerns about the impacts of these seismic surveys on the marine environment. Although scientists may debate the nature, magnitude and reach (distance away from the source of seismic blasts) of negative impacts of seismic surveys on marine fauna, the overwhelming majority of the multitude of peer-reviewed published scientific studies (over 536 studies on ocean noise, where the majority found negative effects on marine mammals, and/or adverse impacts on fish and invertebrates) demonstrate that harm is caused or is the most likely scenario. This is a tangible cause for concern and warrants a precautionary approach. The issue at hand is not whether harm will be caused but rather what the magnitude of that harm will be, and whether measures that would prevent or effectively mitigate this harm are in place and effective.

In this report we provide a summary as well as more detailed discussion of our findings from the available information and studies on the impacts of seismic activities on marine wildlife, both globally as well as specifically relevant to the survey area (the west coast of South Africa) and time of year (December to May) specified in the EIAR associated with the exploration right (including 2D/3D seismic survey) granted to Tosaco Ltd for Tosaco Energy Block 1. A list of relevant publications is provided at the end of this document for reference.

Having reviewed the available information we conclude that seismic surveys do cause harm to both species and ecosystems, and that significant direct harm to individual animals and harm to populations of endangered species is the most likely scenario in the case of this authorised seismic survey on the west coast of South Africa. Of specific concern is the impact on humpback whales and southern right whales which are still frequenting the west coast over this period, and the impact on critically endangered (leatherback) turtles (migration routes in the area), the critically endangered African Penguin (changes in foraging behaviour and impacts on fitness) and the Cape fur seal (and consideration of added stress in light of current mass die-offs). We conclude that this seismic survey is inadvisable due to the presence of these species in the area, the increasing anthropogenic pressures,

and the inability of the prescribed mitigation measures preventing harm to individuals/populations. We disagree with the findings of the Marine Specialist Report that impacts on all species both physiological and behavioural will be very low, because the mitigation mechanisms specified are not fully effective in preventing harm. Furthermore, recent literature provides credible concern about ecosystem/food-chain impacts of seismic surveys, which may, in turn, have impact on fisheries, the severity and localisation of which will depend on coincidences with spawning and juvenile recruitment events.

It is our opinion that the seismic survey should not have been authorised, and we recommend that further studies on the impacts of seismic activities in the South African context are carried out *in situ* before proceeding with further seismic surveys of this nature.

Summary of Findings

- Based on peer-reviewed scientific literature, it is clear that physical damage to marine animals, including soft tissue trauma damage, embolisms, damage to organs used in balance and orientation, concussions, haemorrhaging, decompression sickness and both temporary and permanent threshold shifts to hearing ability have been directly linked to the kind and level of sound emitted during this nature of seismic surveys.
- There is plausible evidence to suggest that seismic survey activity is likely to affect the conservation status and recovery of populations of vulnerable and threatened species including (IUCN Red listed species such as humpback and southern right whales), because sound and the ability to hear and interpret sound is critical for many species to reproduce (both vocalisations on breeding grounds and communications across large distances for mate detection). Therefore, it must be assumed that interference in sound perception or utilisation for communication (temporarily or permanently) has the potential to impact a species at the population level.
- Some species have been shown and documented to display physiological stress responses and behavioural changes to seismic activities, such as moving away rapidly, diving or remaining still. These responses are likely to increase their energy consumption and energy costs, reduce their time to forage, and/or affect their vulnerability to predation, thus having negative impacts on the survival of individuals (especially young or compromised animals) as well as the overall population growth and survival of a species (especially for threatened species that are already at risk of extinction).
- The impacts of seismic activities are most well studied for marine mammals, and evidence suggests that there are distinct avoidance responses such as leaving the area or ceasing to

undertake everyday activities such as feeding in preferred areas. This is likely to negatively impact the "fitness" of an affected animal.

- The only existing field study in South Africa (that we have been able to find) on the impacts of seismic activities in our waters is illuminating in this regard. It presents clear evidence that the endangered, endemic African penguins avoided preferred feeding sites when a seismic survey was active nearby. This is particularly of concern for a species that has had a 70% decrease in numbers over the past decade, is stressed by prey depletion creating a greater demand for them to forage further afield, and for which the prospect of extinction is significant.
- The phenomenon of energy-cost (from stress and avoidance behaviour) is of particular concern for some of the species expected to be encountered in the survey area in question, particularly the humpback whales and southern right whales who are at risk of the airgun noise affecting their behaviour or interfering with the communication between mother and calf. Any impact on their energy reserves could impact on their condition (weight-loss and physiological condition) and affect the survival of the animals during a vulnerable time (especially for lactating mothers and their calves) on their long migration to feeding grounds in Antarctica.
- Research has demonstrated significant mortality in zooplankton up to 1.2 km from a seismic survey array. Zooplankton forms the base of many important food webs in the marine environment. Depletion of zooplankton could thus have an impact on food for their predators (such as fish) as well as impact fish eggs and larvae (ichthyoplankton) with potential local impacts on species important in fisheries. This damage to zooplankton over 1km away from the survey array raises concern that a 500m buffer for other animals that are unable to move away from the sound, is far too small to ensure that damage is not inflicted (even if they were able to evade it).
- The impact on fish assemblages is difficult to interpret, due to multiple factors at play including but not limited to the ability of a species to move from an area as well as the receiving habitat. A global review of the effect of seismic activities on fish and invertebrates acknowledged the limits of the current research due to experimental designs used or due to the focus on single species during investigations. A key concern is a lack of research focused on confounding effects and multiple stressors, therefore potential impacts of seismic surveys that have been previously identified may be reflective of underestimation or overestimation and would depend on the type of interaction (synergistic, additive, or antagonistic).
- In South Africa, since October 2021, thousands of dead and/or dying Cape fur seals (*Arctocephalus pusillus pusillus*), have washed ashore along the south and west coasts. The cause of these die-offs remains unknown but avian flu has been ruled out and malnourishment appears to be the most widely accepted reason. It is of concern that although the cape fur seal population within

South Africa is relatively healthy, they too are under pressure from various anthropogenic pressures. Additional stress from seismic activity at this time is inadvisable.

- While "Soft starts" as mitigation for seismic impacts are likely to reduce the impact for highly mobile large animals, this is unlikely to be adequate for the many species that are prevalent in the area over the austral summer months and are unable to avoid the array or leave the area due to their lower mobility, such as smaller turtles, penguins, invertebrates, some fish species and zooplankton.
- The finding of observer efficiency (from a scientific monitoring study conducted during the 2018/19 and 2019/2020 seasons on the humpback whales on the east coast) suggests that even with trained observers up to 44% of humpback whales in an area went undetected. This casts doubt on the effectiveness and success of Marine Mammal Observer (MMO) sightings of the largest species (humpbacks) as a mitigation measure, indicating that it is most likely that whales go undetected. Furthermore, the detection rate for smaller species, such as dolphins, seals, turtles and flightless birds (penguins), would be expected to be much lower, obviating the effectiveness of visual observations to prevent harm to these species.
- Also of concern, is that the efficacy of Marine Mammal Observers (MMO) is likely to be low due to the nature of the offshore marine environment in the survey area (frequent high swells and winds affecting surface visibility), putting species that are missed by MMO's and PAM operators at extreme risk, particularly at night or during adverse weather conditions.
- Furthermore, the reliance on Observers to do visual sightings to supplement the PAM monitoring during the day, as a mandated mitigation measure, necessitates that we question the acceptability of continuing with survey activities at night. If the visual observations are useful (perhaps sighting large animals around 65% of the time) in addition to PAM, then it is unreasonable to rely on PAM alone at night. It is our opinion that surveys should not occur between sunset and sunrise each day if a real attempt for maximum avoidance of cetaceans is the objective of this mitigation measure.
- It is of our opinion that the proposed seismic survey activities are highly likely to both disturb and have an adverse effect on Marine Protected Areas (MPA) and Critical Biodiversity Areas (CBA). It should be noted that the MPA in question, the Orange Shelf MPA, provides key feeding grounds for the endangered Atlantic Yellow-nosed Albatross, the near-threatened Black-browed Albatross and the critically endangered Tristan Albatross.

Global context – impacts of seismic surveys on marine wildlife

Despite seismic surveys having been undertaken for decades in South African waters, together with the knowledge that some impact to marine fauna does indeed occur[1], there remains very little scientific research on the effects of seismic surveys, and in addition there are no legislated guidelines for seismic surveys in South African waters (Purdon 2018). Globally, seismic surveys' environmental impacts and consequences are slightly better documented, although not uniform in results or widely accepted within all sectors. The primary mitigation measures for seismic surveys in South Africa include soft-starts, which is a gradual and systematic increase in power of the airgun array undertaken to warn and drive mobile marine species, such as cetaceans (whales and dolphins), seals, flightless birds and turtles away from the sound source before the full-power airgun blasts begin, thus attempting to minimise the negative effects of the airgun blasting activity. Various studies contest this assumption (McCauley et al. 2000; Weilgart 2013; Dunlop et al. 2016) and have revealed a growing concern for animals that are unable to avoid or out-swim the airgun arrays.

Animals use sound critical to their life cycles (Jasny et al. 2005) in three ways, by actively producing sound (Tyack 1981), by listening to sounds emitted by other living organisms (Clark et al. 2009; Van Opzeeland 2010) and taking cues from physical or non-living factors producing sounds, contributing to the ambient background noise, such as wind, waves, swell, bubbles, currents, turbulence, earthquakes, rainfall, ice cracking or breaking (Hildebrand 2005). Many marine animals produce sound for communication, reproduction, aggression, defence mechanisms, antagonistic interactions, courtship, group coordination, orientation, navigation, and prey identification (Hildebrand 2005). They rely on producing a sound that is heard while hearing a sound and interpreting the sound for their survival.

Various physical responses to acoustic disturbance have been documented, with physical responses including soft tissue damage (Balcom and Claridge 2001), embolisms (Dolman and Simmonds 2005), damage to organs used in balance (André et al. 2011), concussions in penguins (Cooper 1982), haemorrhaging (Evans et al. 2001) and decompression sickness (Fernández et al. 2005). Hearing impairment in the form of Temporary Threshold Shift (TTS) or Permanent Threshold Shift (PTS) has also been reported (Hildebrand 2005). Threshold shift refers to an increase in the minimum sound level required for an animal to hear a sound. A TTS is followed by successful recovery to normal hearing thresholds after a given period of time in the absence of that sound, while PTS is when the sensory

[1] https://jncc.gov.uk/our-work/marine-mammals-and-noise-mitigation: "to reduce the risk of deliberate injury to marine mammals".

hair cells in the inner ear are permanently damaged and lost making recovery impossible (Weilgart 2013).

Stress caused by disturbance is associated with a change in body chemistry (Jasny et al. 2005) and can be equally disruptive as physical damage. Stress has implications on sexual maturation, inhibits growth, reproduction and general survival ability (Pickering 1992; McCormick 1999; Consten et al. 2001). Perceptual effects can occur when there is an interference of sounds of interest to a specific animal but are being drowned out or masked by anthropogenic noise. The impact of this in the long term could have implications on breeding populations, thus on reproduction within a population (Erbe 2001). Many animals may have the ability to counteract this and make minor changes to their vocalisations and behaviour; however, these modifications may come at a cost in terms of energy expenditure (Tyack 2008) and are likely to reduce breeding productivity of the population. This is of particular concern for species that are threatened.

Behavioural responses to noise are dependent on various factors, such as age, sex, presence of offspring, location and an individual animals' previous encounter with a specific sound or noise. Behavioural responses may include modification of vocal behaviour, displacement from important habitats, and other subtle responses, including increased breathing rates, change in dive duration, time spent at the surface, rapid or erratic movements (Bowles et al. 1994; Lesage et al. 1999; Williams et al. 2002; Hastie et al. 2003; Ng and Leung 2003; Aguilar de Soto et al. 2006). These all with potentially high energetic costs (Williams et al. 2006; Koper and Plön 2012).

Most scientific research on the impacts of seismic surveys has been conducted on cetaceans, and as a result, most mitigation measures are to protect these animals. In South Africa, this is no different. However, it is becoming more and more evident that mitigation measures are not adequate (Weilgart 2013). In the Gulf of Mexico, it was recorded that ~250 male fin whales appeared to stop singing for several weeks to months during a seismic survey. These animals resumed singing within hours or days after the survey ended (IWC 2007). The assumption is that male fin whales use vocalisations for reproduction by finding and attracting mates (Croll et al. 2002); it can only be assumed that such an effect would be biologically significant (Weilgart 2013). In addition to this, a blue whale ceased calling in the presence of a seismic survey at 10 km away (Macdonald et al. 1995). Conversely, a different group of blue whales appeared to have the opposite reaction. They changed their vocalisations (De Lorio et al. 2010) by calling consistently more on days when the seismic surveys were actively ongoing.

suggesting that seismic survey noise interfered with important signals used in their social interactions and feeding (De Lorio et al. 2010).

Other reactions to seismic airguns can be subtle or hard to detect (Weilgart 2013) and it has been found that Sperm whales in the Gulf of Mexico did not appear to avoid a seismic airgun survey area but reduced their swimming effort and their tendency to reduce foraging effort (Miller et al. 2009). It has also been documented that as a result of changes in behaviour, the result could be lower reproductive rates and have negative consequences for the population (Miller et al. 2009). In comparison, bowhead whales showed no avoidance or change in vocalisations in the area of seismic surveys; however, their dive duration was shorter (Richardson et al. 1986). In Brazil, a reduction in cetacean species diversity during 2000 and 2001 was noted with the increased occurrence of seismic surveys in the area being implicated in the possible cause of these animals vacating the area (Parente et al. 2007). In other areas, marine mammals have been recorded to avoid seismic noise by leaving an area (Castellote et al. 2012; Weir 2008; Stone and Tasker 2006). The long-term impacts of various changes in behaviour are largely unknown but potentially impact their ability to feed and/or reproduce as in some species, these life-history stages are site or habitat-specific.

South Africa's south and west coasts are host to eight species of beaked whales (Ziphiidae) (Best 2007), including a new species described in 2021 (*Mesoplodon eueu*; Carroll et al. 2021), which are globally recognised as being sensitive to anthropogenic noise, and having raised conservation concerns. New et al. (2013) found that adult female beaked whales could survive but not reproduce in times or areas of lower habitat quality. They may extend the duration of lactation in mediocre conditions to increase their chance of survival, while still reproducing. New et al. (2013) found that some beaked whale species require high-quality habitat to meet their requirements for reproduction and survival. They suggested that even minor, non-lethal disturbances, resulting in changes in behaviour such as displacement from preferred habitats, could impact a population.

McEwen and Wingfield (2003) suggested that all organisms must gather energy for growth and reproduction throughout their life cycle and that organisms must retain reserves for predictable changes such as seasons, and challenges that are less predictable such as disturbance, predation pressure, or social conflict. Often colloquially, this is referred to as the "fitness" of the animal. The accumulated cost in the balance between energy intake and demand is called the 'allostatic load', of physiological and behavioural mechanisms that enable allostasis or adaptation to these changes. McEwen and Wingfield (2003) use the word "allostasis" to signify mechanisms that allow an organism

to regain equilibrium while dealing with external challenges; if energy demand is more than intake, then animals may activate a survival mode that may increase energy available, reduce energy demand, or both, to regain its energy balance. Implications on individuals and populations of this energy imbalance are unknown.

Several studies have reported negative impacts of acoustic signals from airguns on zooplankton (small, aquatic microorganisms living in the water column, including crustaceans, larvae, juvenile fish, juvenile invertebrates, eggs etc.) from more than 10 m away (Kostyuchenko 1972; Kosheleva 1992; Parry *et al.* 2002) with some laboratory experiments on lobster larvae showing no impact at all (Day *et al.* 2016). However, Christian *et al.* (2003), showed retardation in some individuals in the development of snow crab eggs after being exposed to certain sound levels.

The effects of seismic noise on zooplankton were brought under the spotlight when McCauley *et al.* (2017) presented evidence from an *in-situ* study that suggested that seismic surveys cause significant mortality to zooplankton populations. Zooplankton, unlike vertebrates, do not have hearing structures (although they can sense pressure change) and their bodies are generally the same density as the surrounding water, so sudden pressure changes associated with seismic activities were presumed not to cause physical damage (Parry and Gason 2006). McCauley *et al.* (2017) disputed this and has shown zooplankton mortality at distances of up to 1.2 km from the sound source.

Similarly, inconsistent findings occur with fish assemblages. The impacts on fish assemblages are difficult to interpret, because of multiple factors at play including but not limited to the ability of a species to move from an area as well as the receiving habitat. We acknowledge the validity of the results presented by Meekan et al. (2021) which highlights that exposure to an experimental seismic source did not have an impact on the assemblage of tropical demersal fishes found along the northwest shelf of Western Australia. However, it must be noted that the findings have been stated to be applicable only to other habitats with similar physical environments, in particular similar water depths (50 – 70 m), highlighting the need for South African-specific and local research to be undertaken.

A global review of the effect of seismic activities on fish and invertebrates by Carroll et al. (2017) acknowledged the limits of the available research due to experimental design, or to the focus on single species which prevents extrapolation to other regions, other seismic surveys, species, or biological responses. In addition, they highlighted a serious concern, that there was a lack of research focused

on confounding effects and multiple stressors, therefore potential impacts of seismic surveys which had previously been identified may be reflective of under-estimation or over-estimation and would depend on the type of interaction (i.e., synergistic, additive, or antagonistic).

Furthermore, the indirect effects of seismic activity on cetaceans are a concern. It is well known that the productivity and health of the oceans are under-pinned by marine plankton (Raymont 1983; Alcaraz & Calbet 2009). While forming the basis of the food webs, plankton has been implicated in links to climate change via their role in iron fertilisation and carbon sequestration through whales foraging on krill and subsequent defecation (Smetacek and Nicol 2005; Smetacek 2008; Nicol et al. 2010). In 2010, Pershing et al. suggested that over-fishing of large fish and commercial whaling had compromised the ocean's ability to store and sequester carbon, thus contributing to climate change. They indicated that populations of large baleen whales now store 9.1×106 tonnes less carbon than before commercial whaling and that protecting whales (and other large over-exploited species), would be a form of a carbon management scheme. The cascading and knock-on effects of seismic survey impacts between the upper (cetaceans) and lower reaches (plankton) of the food web, as each are being impacted are unknown. McCauley et al. (2017) noted that the ramifications of compromised larval recruitment could be massive for higher predators and for ocean health as a whole. While traditional feeding grounds for humpback whales are in Antarctic waters, Dey et al. (2021) has recently recorded regular feeding frenzies off the west coast in recent years (see super pods below).

South African Context

It is of concern that no acoustic modelling was undertaken for the proposed seismic survey activity. Where the impact of sound was referred to in the EIAR, it appears that the most conservative estimates of impacts are used, with statements in the Marine Specialist Report (Pg. 9) including "Based on analogue sound sources, sound levels for the seismic survey can notionally be expected to attenuate below 160 dB less than 1,325 m from the source array." However, the author then goes on to sight multiple examples of behavioural responses of species outside of this range including but not limited to cephalopods (2-5km, pg. 81), fish (up to 5km, pg. 88), turtles (up to 3.5 km pg. 103), cetaceans (beyond 5 km, and potentially displaying avoidance responses at 24km, pg. 118). It thus becomes very difficult to accurately assess risk without this critical piece of information, however there are some key concerns.

It is of concern that there are a number of 'unknowns' and 'warning bells' in terms of presence of and impacts on cetacean populations on the west coast. Despite various species being recorded frequently on the coast, the location of breeding grounds of Sei (*Balaenoptera borealis*) and Fin whales (*Balaenoptera physalus*) are unknown, the seasonality of pygmy (*Kogia breviceps*) and dwarf (*Kogia sima*) sperm whales are unknown and the abundance and occurrence of the offshore common dolphin (*Delphinus delphis*) is also unknown, highlighting that encounters with these animals cannot be predicted and the generic mitigation measures may be insufficient. Further to this, it is noted in the EIAR for the Tosaco exploration right that the two very well-studied and frequently observed species on the south and west coasts, the humpback and southern right whales, are expected to be regularly encountered and have a year-round occurrence in the seismic survey area. The period of humpback whales in this area is between July and February, with frequent feeding encounters during the months between December to February. Barendse et al. (2010), Best & Allison (2010), and Elwen et al. (2014) highlighted that there is no existing evidence of a clear 'corridor' of migration and humpback whales appear to be spread out widely across the shelf and into deeper pelagic waters, especially during the southward migration, in the Benguela ecosystem. Apart from this going against the spirit of avoiding whale periods by the oil and gas industry, Vermeulen *et al.* (2020) warned of an observed decrease in southern right whale calving success of the South African population and a strong link between foraging success and reproduction. They suggest an investigation into possible decreases and/or spatial or temporal shifts in their prey availability at higher latitudes due to environmental variability. They also highlight a concern of the continued low numbers of unaccompanied adults along the South African coast which could potentially have serious consequences for cow-calf pairs in relation to the country's whale-watching industry in the future.

Since 2011, South Africa has witnessed 'super-pods' of up to 200 humpback whales feeding in south and west coast waters between October to January. Research by the National DFFE, in collaboration with various academic partners, has led to the discovery of these 'feeding grounds' away from their traditional feeding grounds in the Antarctic[2]. This phenomenon requires understanding the ecosystem-wide impacts and benefits, while potential human/whale conflicts remain unknown. According to Dey et al. (2021), the formation of super-groups in recent years suggests that there might be a change in oceanographic or ecological characteristics which provide the conditions for this novel

[2] https://www.news24.com/news24/travel/whale-whale-super-pods-larger-than-usual-count-sit-off-sas-west-coast-public-urged-to-keep-their-distance-20191218

feeding strategy in the Southern Benguela Upwelling System. Although the humpback whale population is increasing (Wilkinson, 2021), there is evidence to suggest that cetaceans in South African waters are being affected by changes in their ecosystem and it is not well understood yet what is driving these changes and what the long terms effects could potentially be to populations.

With other mammals, it was suggested by Thompson et al. (1998) that gray seals displayed strong avoidance behavior, altered foraging behavior and suggested an increased frequency of hauling out onto land to possibly escape the noise, while harbor seals had slower heart rates during controlled playback experiments. In contrast, during a study in shallow arctic waters, sighting rates of ringed seals (*Phoca hispida*) from a seismic vessel showed no difference when a different number of airguns were in use, did however suggest local avoidances based on distance from the sound source (Harris et al., 2001).

In South Africa, the Cape fur seals (*Arctocephalus pusillus pusillus*), is the only resident seal along the west coast, occurring at numerous breeding and non-breeding sites on South Africa's mainland and on nearshore islands and reefs. Other vagrant seals occurring along the south and west coast include the southern elephant seal (*Mirounga leonina*), subantarctic fur seal (*Arctocephalus tropicalis*), *Antarctica fur seal* (*Arctocephalus gazella*), crabeater (*Lobodon carcinophagus*) and leopard seals (*Hydrurga leptonyx*). Cape fur seals are highly mobile and have large foraging areas including on the continental shelf up to 120 nautical miles offshore (Shaughnessy 1979).

According to Kirkman et al. 2016, several morbillivirus epidemics have occurred in true seal (Phocid) populations in the northern hemisphere and, at the time it was agreed that no epidemic diseases were known to have infected Cape Fur Seals historically, but there was a considerable risk for disease transmission to the population through exposure to domestic or feral dogs and terrestrial carnivores, potentially resulting in mass mortality. Kirkman et al. (2016) cautioned that the health of individuals and their vulnerability to disease can be affected by feeding conditions, including the availability of prey, and that risk of disease may be exacerbated by anthropogenic pressures on the ecosystem.

In South Africa, since 10 September 2021, thousands of emaciated, dying and dead Cape fur seals (*Arctocephalus pusillus pusillus*), have washed ashore along the south and west coasts. The cause of these die-offs remains unknown but avian flu has been ruled out and malnourishment appears to be the most widely accepted reason. It is of concern that although the cape fur seal population within

South Africa are healthy, they too are under pressure from various anthropogenic pressures and the seismic survey is likely to add stress to the population.

In South Africa, only a single focused field study on the impact of seismic surveys has been undertaken. This study, off Gqeberha, was within the foraging area of the endangered, endemic African Penguin (*Spheniscus demersus*). Pichegru et al. (2017) demonstrated that penguins avoided their preferred foraging areas during seismic surveys and foraged further from the survey vessel when in operation. Upon termination of seismic surveys, the penguins reverted to their normal behaviour (Pichegru et al. 2017), a behaviour which was also observed in Gray whales (*Eschrichtius robustus*) off Sakhalin Island in Russia (International Whaling Commission 2005). However, the long-term effects on populations of this temporary retreat of the area are unknown. Given the results of this study by Pichegru et al. (2017), strict management measures and decisions on seismic survey activities should have been established in South Africa. Furthermore, the cumulative effect of multiple, concurrent seismic surveys within the region may cause cumulative impacts.

Significant impacts on turtle species are a concern. Adult turtles may be less vulnerable to sound damage than cetaceans as the air spaces in their cochlear are smaller than those in cetaceans, making them less sensitive to sound shockwaves (Popper et al. 2014). However, while studies have shown that adult sea turtles have a moderate ability to move from an area being surveyed (Lenhardt 1994; O'Hara and Wilcox 1990), they are prone to TTS after exposure to sound within 1 km of a sound source, with signs of recovery only two weeks after injury (Lenhardt 1994). In a study undertaken on captive turtles, it was found that loggerhead turtles (*Caretta caretta*) responded to sound by swimming to the surface and remaining there or staying slightly submerged (Lenhardt 1994), as this area, regarded as a sound shadow, and is hypothesised as being where sound waves cancel each other out and the noise is at a minimum. Cummings et al. (2004) disputed this saying that although near the surface, could be a place where animals take refuge, they are not in a 'zone of silence'. With an increasing exposure of sound levels, the behaviour of caged green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles increased their swimming speed, potentially showing agitation to sound (McCauley et al. 2000). Turtle behaviour is difficult to interpret (DeRuiter and Doukara 2012), given that some studies have reported that turtles do not display any signs of distress (Pendoley 1997). Globally the Leatherback turtle (*Dermochelys coriacea*) is vulnerable, but critically endangered in the Southwestern Indian Ocean where this subpopulation is declining (Nel 2010, 2012; Nel et al. 2013). Loggerhead (*Caretta caretta*) populations are globally vulnerable but near threatened in the southwest Indian Ocean (Lombard & Kyle 2014).

Both loggerhead and leatherbacks are known to occur within the Tosaco 2D/3D seismic survey area but known migration corridors of adult leatherbacks lie just offshore of the survey area. Harris et al. (2018) highlighted the migration path for leatherback turtles into the south-eastern Atlantic (Agulhas-Benguela Corridor), adjacent to the survey area. Leatherback turtles inhabit deeper waters and are considered a pelagic species, traveling within the ocean currents. However, they have a moderate ability to avoid areas with an increase of noise in the water. According to Hays et al. (2004), these animals may dive to depths over 600 m and remain submerged for up to 54 minutes. Mitigation measures for turtles in seismic surveys include observers, although it is unclear how an observer would be able to observe these animals at such a distance (especially as large animals such as whales are only observed 44% of the time at best). A second mitigation measure, is to install 'turtle-guards' to prevent them from becoming entangled in the gear. These devices are accepted as being useful in terms of entrapment but not for sound in the water. Given the sighting probability of a turtle by an observer is minimal (as explained above) and that turtle guards are recommended gear, not compulsory for this survey, these two mitigation measures do not instil confidence that impacts on turtles are effectively mitigated.

Effectiveness of Mitigation (Marine Mammal Observers (MMO) and Passive Acoustic Monitoring (PAM))

During the 2018 and 2019 humpback whale (*Megaptera novaeangliae*) migration period along the east coast of South Africa, Wilkinson (2021) estimated the relative abundance of migrating humpback whales sighted by trainer observers from two towers located 22m apart (both observers viewing the same area), located at 70m above sea level on a dune with a horizontal vantage length of approximately 20 km. Over the observation periods during the peak of migration, it was estimated that observers from both towers missed between 41-44% of whale groups while distance offshore decreased the probability of sightings. Assuming that the best percentage sighting (56%) was achieved within 1-5km of the observers' vantage point, then more than 40% of whales were missed. Given that this survey was done during the northward migration when mostly larger animals are present, the sighting success may be less when small calves are present as well (as would be the case in December). This begs the question of the efficacy and reliability of the mitigation method of Marine Mammal Observers (MMO), while assuming that whales (and other cetaceans) are thus regularly missed by MMOs and could be harmed.

Furthermore, bearing in mind the examples above, i.e., blue and fin whales ceasing to sing, the use of Passive Acoustic Monitoring (PAM) technology to detect cetaceans is baseless if cetaceans do not vocalise. As per best practice, in an effort to improve mitigation, PAM technology is complemented by visual searching over an area of 500m around the vessel by qualified Marine Mammal Observers (MMO). However, this technique is also fatally flawed because it cannot be used at night, during rain, and effectively in sea states more than three on the Beaufort Sea State Scale. Therefore, both PAM and MMO's are insufficient to detect, with certainty, cetaceans within the surrounding survey area and these types of mitigation will only be effective for all affected species if airgun firing ceases between sunset and sunrise, and adverse weather conditions that limit visibility.

The cumulative and long-term effects of seismic survey sound are not entirely understood (Jasny et al. 2005); however, it is accepted that ocean noise may have ecosystem-scale effects (Hildebrand, 2005) and the "knock-on" effects on animals, their prey and their predators will have consequences within the food chain (Koper and Plön 2012). It has been suggested that research and a critical review on mitigation measures (McCauley et al. (2017) as well as a better understanding of ecosystem-scale effects of sound (Koper and Plön 2012), especially at the lower trophic levels are imperative. Considering the ecosystem services provided by the Benguela Current Marine Ecosystem and its associated diversity and biomass, mitigation and understanding should be a conservation imperative in South African marine waters. Up to now, there has been no effort in increasing the knowledge of the impact of these seismic surveys by industry or South African environmental departments despite them being known to have impacts on marine animals and having been undertaken in South African waters for a number of decades.

Proximity to Marine Protected Areas and Critical Biodiversity Areas

The authorised Tosaco Block 1 exploration right area encompasses a proportion the Orange Shelf Edge MPA, and completely surrounds the Namaqua Fossil Forest MPA (See EIAR Figure 14 pg. 41). While it is noted that a 5 km buffer has been included around these MPAs in relation to the associated 2D/3D seismic survey, there is still cause for concern as the impact of noise from the array can influence the behaviour of some species at distances of over 5 km. The marine specialist report continually identifies the impact on marine species to be no more than 1.5 km, with impacts on fisheries of up to 5 km from the sound source. However, a report on seismic operations from a proposed vessel in the same area (Searcher), using the same technology indicated *"the cumulative zone of impact for the 3D survey extends to 800 m for permanent threshold shifts (PTS) and to 8 000 m for temporary threshold shift (TTS) for physiological injury, and the cumulative zones for PTS and TTS while the 2D survey is 500 m*

and 5 000m, respectively". The Orange Shelf MPA forms key feeding grounds for the endangered Atlantic Yellow-nosed Albatross, the near-threatened Black-browed Albatross and the critically endangered Tristan Albatross (Birdlife International unpublished data) and it provides an important foraging and aggregating area for cetaceans and large fish species. A significant concern should seismic activities occur nearby. Furthermore, the 2D/3D survey area abuts the Namaqua Fossil Forest MPA, meaning that the vessel will be active for an extended period, up to four months, in very close proximity to the MPA.

It should be noted that, according to the National Environmental Management: Protected Areas Act 57 of 2003: section 48A reads:

"48A Restriction of activities in marine protected areas:

Despite any other legislation, no person may in a marine protected area-

....

(e) in any manner which results in an adverse effect on the marine environment, disturb, alter or destroy the natural environment of disturb of alter the water quality or abstract sea water;

(f) carry on any activity which may have an adverse effect on the ecosystem of the area;...."

It cannot be ignored that the proposed seismic activity will still have potential adverse effects on the ecosystem within the area and disturb the natural environment.

Further to this, large portions of the Tosaco exploration right area comprise Critical Biodiversity Areas (CBA) both 1 and 2, with a significant proportion of the 3D area comprising CBA 1 and 2. CBA 1 areas are irreplaceable or near-irreplaceable, while CBA 2 are sites that are the best option available for representing the features in a spatial prioritisation (Harris *et al.* 2020). The primary of objective, and national policy is that both CBA 1 and 2 areas remain in natural or near-natural states for conservation management, while portions of these areas be ear-marked for future MPAs.

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Curriculum Vitae

JEAN MARY HARRIS

PERSONAL DETAILS

Name	:	Jean Mary Harris
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ID Number	:	6212280006086
Place of birth	:	Johannesburg
Nationality	:	South African
Race	:	White
Gender	:	Female
Address	:	49 Netford, Bluff, Durban, 4052, KZN South Africa
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EDUCATION

1993 PhD (Zoology), University of Cape Town. Focus: Trophic ecology in estuarine and intertidal systems.
1984 B.Sc. Hons. (Marine Biology), University of Cape Town, First Class
1982 B.Sc. (Zoology), University of Cape Town
1979 Matriculated, A-grade, Clarendon Girls High School, East London

AWARDS:

- PEW Fellowship in Marine Conservation, 2000
- Purcell Memorial Prize for best Zoology PhD thesis, 1993
- FRD Special Merit Doctoral Award, 1990

SELECTION OF PROFESSIONAL OFFICES HELD

Pew Fellow in Marine Conservation, Pew Fellows Program in Marine Conservation, 2000 - present
Trustee: South African Association for Marine Biological Research, 2016- July 2017
Member: Programme Steering Committee for the Marine Science for Management Association (MASMA), Western Indian Ocean Marine Science Association (WIOMSA) 2004-2015.
Chair: Subsistence Fisheries Task Group 1999-2000.
Chair: SA Network for Coastal and Oceanographic Research (SANCOR) National Steering Committee 1997-2001.
Member: IUCN Species Survival Commission – Marine Conservation Committee, 2018-present
Member: IUCN SSC Red List Committee, 2018-2021
Executive Trustee: Wetlands Conservation Trust, 2015- April 2017
Member: Scientific Authority 2014-2017. Advises the SA Minister of Environment on biodiversity matters
Chair: Symposium of Contemporary Conservation Practice (SCCP) 2012- July 2017.
Member: East African Marine EcoRegion Programme Committee (EAME) 2004-2010

EMPLOYMENT RECORD

Executive Director WILDOCEANS, Wildlands Conservation Trust, August 2017 - current
Research Associate, Institute for Coastal and Marine Research, Nelson Mandela University, 2016-present
Senior General Manager: Scientific Services, Ezemvelo KZN Wildlife, October 2006 – July 2017
Ecological Advice Co-ordinator, Coast Region, Ezemvelo KZN Wildlife, 2002- September 2006
Regional Ecologist Marine/Scientist, Scientific Services, KZN Nature Conservation Service, 1995 – 2002
Senior Scientific Officer, Terrestrial Antarctic Biology Research Programme, Ornithology, UCT, 1991-1994

SELECTION OF RESEARCH AND MANAGEMENT EXPERIENCE

Project Leader Blue Action Fund "Oceans Alive" iSimangaliso MPA Project (2019-current): This project has 3 main objectives 1) Build knowledge of the biodiversity and socio-economics of the MPA and its communities, 2) Support effective management of the iSimangaliso MPA, and 3) Ensure benefits and improved livelihoods for rural communities living alongside the iSimangaliso MPA.

Directs the following WILDOCEANS projects for the Wildlands Conservation Trust (2017-current): Ocean Stewards, WhaleTime, MPA Expansion Project, Shark and Ray Conservation Project, Comoros Fish and Benthic Biodiversity Project, iSimangaliso Oceans Alive (MPA expansion, effective management and benefits to communities) Project, Blue Crew project in the Durban bay estuarine environment (plastic pollution action).

Principle Investigator and Co-ordinator for NRF-funded African Coelacanth Ecosystem Programme research projects: Biodiversity Surrogacy (2014-2017), Spatial Solutions (2016-2018) and Canyon Connections (2018-2020). Offshore biodiversity survey and sampling to test validity of modelled biozones, to refine conservation planning, and to support marine protected area expansion and the National Biodiversity Assessment (CBD).

Project leader for WWF-SA, NRF and ACEP funded project: SeaPLAN – development of a systematic conservation plan for the east coast of South Africa (2004-2012). Integrates shoreline biodiversity mapping, reef biodiversity surveys and key species and processes.

Project leader Wildlands Trust funded project: Rare and Endangered Species of the Greater St Lucia Wetland Park (2002-2005). This project aims to update the records of these species in the park and provide a management handbook. It is focussed on terrestrial and freshwater wetland species and employs a full-time researcher. This project has become entrenched and is ongoing.

Project leader for NRF funded project: KwaZulu-Natal and Transkei Indigenous knowledge of subsistence harvesters (2002-2006): Aims to document traditional knowledge and management systems of rural subsistence harvesters, compare regional differences, and integrate into current management practices.

Chairperson of Subsistence Fisheries Task Team, on behalf of Marine and Coastal Management (DEAT), managed a national programme for coast-wise identification of and consultation with subsistence fishers (1999-2000). Acted as Program manager and supervisor of 8 Regional Fieldworkers (Northern Cape, West Cape (x2), South coast, Eastern Cape (x2), KwaZulu-Natal (x2), and a National Co-ordinator and project researcher. – Project leader and finance vote-holder (ca R1 mill)

Project executant (co-ordinator & researcher, and supervisor of 2 project staff) for 5-year project funded by The Green Trust, WWF-SA: The development of sustainable utilization of roussels by artisanal and subsistence gatherers along the northern KwaZulu-Natal coast – Sokhulu community alongside iSimangaliso 1995-2000.

POST-GRADUATE STUDENT SUPERVISION:

6 MSc and 2 PhD students

PUBLICATION SUMMARY:

Papers in refereed journals:	37
Book/ book chapter	8
Reports and Popular articles	10

PUBLICATIONS AND REPORTS

Grorud-Colvert K, Sullivan-Stack J, Roberts C, Constant V, Horta e Costa B, Pike E, Kingston N, Laffoley D, Sala E, Claudet J, Friedlander A, Gill D, Lester S, Day J, Gonçalves E, Ahmadia G, Rand M, VillagoA, Ban N, Gurney G, Spalding A, Bennett N, Briggs J, Morgan L, Moffitt R, Deguignet M, Pikitch E, Darling E, Jessen S, Hameed S, Di Carlo G, Guidetti P, Harris J, Torre J, Kizilkaya Z, Agardy T, Cury P, Shah N, Sack K, LingCao, Fernandez M, Lubchenco J (2021) The MPA Guide: A Framework to Achieve Global Goals for the Ocean. Science. Submitted and accepted.

Obura DO, Katererе Y, Mayet M, Kaelo D, Msweli S, Mather M, Harris JM, Louis M, Kramer R, Teferi T, Samollys M, Lewis L, Bennie A, Kumah F, Isaacs M, Nantongo P (2021) Shared earth/shared ocean – a framework to link biodiversity and people. Science. Submitted and accepted.

O'Leary BC, Ban NC, Fernandez, M, Friedlander, Garcia-Borboroglu P, Golbuu Y, Guidetti P, Harris J, Hawkins JP, Langlois T, McCauley DJ, Pikitch EK, Richmond RH, Roberts CM (2018) Addressing Criticisms of Large-Scale Marine Protected Areas. BioScience.

Harris JM & AT Lombard 2017. SOCIO-ECOLOGICAL RESILIENCE IN SOUTH AFRICA'S BLUE ECONOMY: THE ROLE OF MARINE PROTECTED AREAS http://www.saiia.org.za/policy-briefings/socio-ecological-resilience-in-south-africa-s-blue-economy-the-role-of-marine-protected-areas.

Harris JM, Lombard AT 2017. Why we need more protected areas – tossing red herrings off the table. Maritime Review Africa. Mar/April edition.

Livingstone T, Harris JM, Lombard AT, Smit AJ, Schoeman DS (2018) Classification of marine bioregions on the east coast of South Africa. SAJMS.

Lagabrielle E, Lombard At, Harris JM, and T Livingstone (2018) Multi-scale marine spatial planning: from theory to policy - the SeaPlan project in South Africa. PLOS ONE.

Roberson L, Lagabrielle E, Lombard A, Sink K, Harris J, Grantham H, Livingstone T (2017) Pelagic bioregionalisation using open-access remote-sensing data to inform marine protected area planning in South Africa's Exclusive Economic Zone. Ocean & Coastal Management 148:214-230

Haupt P, Lombard AT, Goodman PS, Harris JM (2017) Accounting for spatiotemporal dynamics in conservation planning for coastal fish in KwaZulu-Natal, South Africa. Biological Conservation. 209:289-303

Mills M, Weeks R, Pressey B, Gleason M, Eisma-Osorio R, Lombard M, Harris JM, Killmer AB, White W, Morrison TH. (2015) Real-world progress in overcoming the challenges of adaptive spatial planning in marine protected areas. Biological Conservation 181 54–63

Vincent A and JM Harris (2014) Boundless no more - Ending illegal, unregulated and unreported fishing would bring hope to ocean wildlife. Science 346:420-421

Harris J.M., Livingstone T, Lombard AT, Lagabrille E, Sink K (2011) SeaPLAN: Marine biodiversity assessment and identification of priority areas for conservation action. Technical Report. Ezemvelo KZN Wildlife. (www.kznwildlife.com)

Reaugh-Flower KE, Branch GM, Harris, JM, McQuaid, CD, Currie B, Dye A, Robertson B (2011) Scale-dependent patterns and processes of intertidal mussel recruitment around southern Africa. Marine Ecology Progress Series. 434: 101-119

Sink KJ, Harris JM and Branch GM (submitted) A rocky shore biotope classification system and its application in conservation planning on the east coast of South Africa. *Conservation Biology*

Reaugh KE, Harris JM, Branch GM (2007) Further refutation of the primary-secondary settlement hypothesis for the brown mussel Perna Perna. African Journal of Marine Science. 29(3): 545-549

Napier, V.R., G.M. Branch and J.M. Harris, 2005. Evaluating conditions for successful co-management of subsistence fisheries in KwaZulu-Natal, South Africa. *Environmental Conservation* 32: 165-177.

Sink KJ, Branch GM and Harris JM (2005) Biogeographic patterns on rocky shores in KwaZulu-Natal, south Africa: implications for conservation of biodiversity. *African Journal of Marine Science* 27(1): 76-96

Harris JM, TA Livingstone, Phadima L, Sink KA, Fasheun, T, Boyd A, Mfeka X 2015 Phakisa Initiative : fast-tracking establishment of an effective and representative network of Marine Protected Areas for South Africa. Oral presentation WIOMSA Symposium 2015

McKean S, Phadima L, Jewitt D, Mander M, Harris J.M. Assessment of the value of the ecosystem services provided by biodiversity in the province of KwaZulu-Natal. Technical report. Ezemvelo KZN Wildlife (www.kznwildlife.com)

Driver, A., K. Maze, M. Rouget, A.T. Lombard, J. Nel, J.K. Turpie, R.M. Cowling, P. Desmet, P. Goodman, J. Harris, Z. Jonas, B. Reyers, K. Sink and T Strauss 2005. *National Spatial Biodiversity Assessment 2004: priorities for biodiversity conservation in South Africa. Strelitzia 17.* South African National Biodiversity Institute, Pretoria. (www.sanbi.org)

Harris *et al.* 2005. SeaPLAN: a marine biodiversity conservation plan. August 2005: Brochure.

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Harris, J.M., Branch, G.M., Clark B.M., Cockcroft, A.C., Coetzee, C., Dye, A.H., Hauck, M., Johnson, A., Kati-Kati, L., Maseko, Z., Salo, K., Sauer, W.H.H., Siqwana-Ndulo, N. and M. Sowman. 2002a. Recommendations for the management of subsistence fisheries in South Africa. *South African Journal of marine Science* 24: 503-523.

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on Coastal and Fisheries Co-Management. Unpublished Report: 15 pp

Cox M, Harris JM, Balfour DA, Steele WK (1999) Ornithogenic influences of bird nests to nutrient status and nitrogen transformations in soils on inland nunataks in Antarctica. *Polar Biol*

Hanekom N, Harris JM, Branch GMB (1999) Microbial infection, mass mortalities and recolonization by the redbait Pyura stolonifera along the south coast of South Africa. *S Afr J Zool*

Harris, J.M., Branch, G.M., Elliott, B.L., Currie, B., Dye, A.H., McQuaid, C.D., Tomalin ,B.J. & C. Velasquez. 1998. Spatial and temporal variability in recruitment of intertidal mussels around the coast of southern Africa. SA Afr. J. Zool. 33(1):1-11

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Harris JM, Tibbles BJ 1997 Factors affecting bacterial production in soils on isolated inland nunataks of continental Antarctica. Microb Ecol 33:106-123

Swart A, Harris JM 1996 *Panagrolaimus magnivalvatus* Bostrom 1995 in nest material, algae and soils from inland nunataks in western Dronning Maud Land, Antarctica. S Afr J Zool 31(1):15-22

Tibbles BJ, Harris JM 1996 The use of 3H-thymidine and leucine in the measurement of bacterial production in continental Antarctic soils. Appl. Environ. Microbiol.

Dastych H, Harris JM 1995 A new species of the genus *Macrobiotus* from inland nunataks in western Dronning Maud Land, continental Antarctica (Tardigrada) Entomol Mitt Zool Mus Hamburg Bd

Van den Berg E, Harris JM 1995 The occurrence of the plant-parasitic nematode *Rotylenchus* capensis Van den Berg & Heyns, 1974 in soils of isolated nunataks in western Dronning Maud Land, Antarctica

Steele WK, Balfour DA, Harris JM, Dastych H, Heyns J 1994 Biological survey of Vesleskarvet nunatak, the new South African base site in northern Ahlmannryggen, western Dronning Maud Land, Antarctica. Polar Biol

Dastych H, Harris JM 1994 A new species of the genus Hebesuncus from the Antarctic nunataks, Dronning Maud Land (Tardigrada). Entmol Mitt Zool Mus Hamburg Bd 11(150):139-145

Harris JM 1993 Widespread occurrence of extensive epimural rod bacteria in the hindguts of marine Thalassinid and Brachyura (Crustacea: Decapoda) Mar Biol 116:615-629

Harris JM 1993 The presence, nature and role of gut microflora in aquatic invertebrates: a synthesis. Microb Ecol 25:195-231

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Selected Conference Presentations

Harris JM (2017) Contribution of MPAs to building ecological and social resilience. In Session: The role of MPAs in Achieving Ocean Health and Sustainable Blue Economies, 4th International Protected Areas Conference, Chile. September 2017. Invited oral presentation.

Harris JM, Lombard AT (2017) Why we need more Marine Protected Areas – tossing red-herrings off the table. South African Marine Science Symposium. July 2017. Port Elizabeth. Oral presentation.

Harris JM (2017) Marine Protected Area Expansion in South Africa. 10x20 Symposium. Ocean Conference New York, USA. June 2017. Invited oral presentation.

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SKILLS

- Class IV Commercial Diver (2004).
- SAMSA Skipper - Category C [Surf Launch] (2017)
- SAMSA Short Range VHF Radio Operators Certificate (2017)
- IMO* STCW* Basic (in progress; awaiting the end of lockdown)
- First aid - Level 3 (in-date).
- Quantum GIS (2015)

Profile

A marine scientist with a keen interest in marine biodiversity. I have a proven knowledge of essential scientific skills and technical experience, including data collection, data analysis, as well as worthy presentation and report writing skills. This resume validates my excellent work ethic and personal attributes, including sound organizing and planning skills, together with the ability to work both independently or in a team.

Education

PhD (Zoology) - 2016
University of Cape Town, South Africa.
Taxonomy, biodiversity and biogeography of the brittle stars (Echinodermata: Ophiuroidea) of South Africa.

MSc (Biological Sciences) - 2006
University of KwaZulu-Natal, Oceanographic Research Institute.
Zonation of the benthic communities on Aliwal Shoal, KZN, South Africa.

BSc Hons (Marine Ecology) - 2003
University of Natal, Durban.
Age, growth and stock assessment of Otolithes ruber from KwaZulu-Natal, South Africa.

BSc degree (Natural and Environmental Sciences) - 2002
Rand Afrikaans University.

Higher Certificate in Environmental Law and Liabilities for the Regulated Community - 2019
University of South Africa.

Employment History

Wildlands Conservation Trust - Marine Conservation Scientist - August 2020 - Present
Provide scientific oversight on the WILDOCEANS Shark and Ray Protection Project, funded by the Shark Conservation Fund.

Ezemvelo KZN Wildlife - Marine Ecologist - 2007 - 2020.
Provide ecological advice and decision support to conservation managers on priority biodiversity information needs in KZN. Develop and implement biological monitoring programmes for several marine ecosystems and resources. Contribute to policy development, guidelines and legislation tackling marine biodiversity conservation concerns. Provide training to field staff on aspects of marine protected areas, threatened and protected species and marine resources. Liaise with external organisations on issues relating to marine research and the marine environment.

* IMO (International Maritime Organisation)
* Standards of Training, Certification and Watchkeeping

Oceanographic Research Institute - Research Assistant - 2006.
Sort, process and identify benthic samples, including data capture and maintain a benthic reference collection database.

Oceanographic Research Institute - MSc Fellowship - 2004 - 2005.
In addition to completing an MSc, maintain the ORI research aquarium, capture data for the east coast reef survey project and assist with oyster, crayfish and mud prawn surveys.

IUCN Shark Specialist Group - Workshop assistant
Batoid Workshop - September 2003.
Sub-Equatorial Africa Workshop - September 2004.
General and administrative assistance for the duration of the workshop, and aid in documenting elasmobranches for IUCN red data list criteria.

Publications

2020 Dames, V., Bernard, A., Floros, C., Mann, B., Speed, C., Magga, J., Laing, S., Meekan, M., **Olbers, J.M.** 2020. Zonation and reef size significantly influence fish population structure in an established marine protected area, iSimangaliso Wetland Park, South Africa. *Ocean and Coastal Management*, 185: 105040

2019 **Olbers, J.M.**, Griffiths, C.L., O'Hara, T.D. & Samyn, Y. 2019. Field guide to the brittle and basket stars (Echinodermata: Ophiuroidea) of South Africa. *Abc Taxa* 19: 1-346.

2018 Atkinson L.J, Mah C., Filander Z., **Olbers J.** and Thandar A. 2018. Phylum Echinodermata In: Atkinson L.J. and Sink K.J. (eds) *Field Guide to the Offshore Marine Invertebrates of South Africa*, Malachite Marketing and Media, Pretoria, pp. 393-476. DOI: 10.15493/SAEON.

2015 **Olbers, J.M.**, Samyn, Y. and Griffiths, C.L. 2015. New or notable records of brittle stars (Ophiuroidea: Echinodermata) from South Africa. *African Natural History* 11:83-116.

2014 **Olbers, J.M.**, Rowe, F.W.E., Griffiths, C.L. and Samyn, Y. 2014. The rediscovery of a collection of echinoderms including two holotypes in the Durban Natural Science Museum, South Africa. *Novitates*: 36: 1-13.

2013 Smit, A.J., Roberts, M., Anderson, R.J., Du Fois, F., Dudley, S.F.J., Bornman, T.G., **Olbers, J.M.** and Bolton, J.J. 2013. A coastal Seawater Temperature dataset for biogeographical studies: Large biases between in-situ and remotely-sensed datasets around the coast of South Africa. *PLoS ONE*, 8(12): e81944. Doi: 10.1371/journal.pone.0081944.

2013 Okanishi, M, **Olbers, J.M.** and Fujita, T. 2013. A taxonomic review of the genus *Asteromorpha* Lütken (Echinodermata: Ophiuroidea: Euryalidae). *The Raffles Bulletin* 61(2): 461-480.

2012 **Olbers, J.M.** and Samyn, Y. 2012. The *Ophiocoma* species (Ophiurida: Ophiocomidae) of South Africa. *Western Indian Ocean Journal of Marine Science*, 10(2): 137-154.

2009 **Olbers, J.M.**, Celliers, L. and Schleyer, M.H. 2009. Zonation of benthic communities on the subtropical Aliwal Shoal, Durban, KwaZulu-Natal, South Africa. *African Zoology* 44(1): 8-23.

2007 **Olbers, J.M.** and Fennessy, S.T. 2007. A retrospective assessment of the stock status of *Otolithes ruber* (Pisces: Sciaenidae) as bycatch on prawn trawlers from KwaZulu-Natal, South Africa. *African Journal of Marine Science*, 29(2): 247-252.

2005 **Brash, J.M.** and Fennessy, S.T. 2005. Age and growth of *Otolithes ruber* of KwaZulu-Natal, South Africa. *Western Indian Ocean Journal of Marine Science*. 4(1): 21-28.

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KENDYL ANDREA WRIGHT

SYNOPSIS

Kendyl is a well-rounded scientist with experience in both the academic and applied fields. She completed her master's in environmental consultancy at the University of Plymouth in 2011, before returning to South Africa. With 10 years of professional work experience including the commercial, academic, governmental, and scientific sectors, she specialises in both estuarine and offshore macrobenthic research on the KwaZulu-Natal coastline. Kendyl has managed several different environmental projects including environmental authorizations, environmental management programme development, ecological assessments and undertaking stakeholder engagement. She has completed a PhD in macrobenthic research at the University of KwaZulu-Natal, undertaking a thesis to identify the connections between coral reefs and the adjacent sandy benthos. A competent passionate ocean enthusiast, she has experience diving (rescue diver), power boating (category C <10m), sailing and surfing.

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Education

PhD Marine Biology	University of KwaZulu-Natal	2020
MSc Environmental Consultancy	University of Plymouth United Kingdom	2011
BSc (Honours) Marine Biology	University of KwaZulu-Natal	2009
BSc Marine Biology and Geography	University of KwaZulu-Natal	2008

Employment

WildOceans	2021 - current	Marine Protected Area Scientist
Oceanographic Research Institute	2018 - 2021	Assistant Scientist
University of KwaZulu-Natal, Westville	2016 – 2017	Contractual lecturer
Anchor Environmental	2014 - 2015	Contractual Consultant
GCS Water and Environmental Consultants	2014 - 2015	Contractual Consultant
WSP Environment and Energy	2014 - 2015	Contractual Consultant
WSP Environment and Energy	2012 - 2014	Consultant
Oceanographic Research Institute	2011	Laboratory Assistant

KENDYL ANDREA WRIGHT

Selected Project Related Experience

Marine

2014-2019: Identification of macrozoobenthic zonation and ecosystem linkages in the iSimangaliso Wetland Park

Kendyl spent a year sampling the nearshore macrobenthos inshore of 2-Mile Reef in Sodwana Bay, KwaZulu-Natal. An area that is not well studied, she hoped to provide improved insight into biodiversity in the region. She is currently compiling two scientific papers for publication from her doctoral thesis, allowing for improved management in the region.

2016: KwaZulu-Natal Environmental Outlook Report – Marine Specialist Component

In order to align with government legislation, a specialist report assessing the current state and pressures experienced by the KZN coastal environment was compiled. Indicators to assess the impact of these pressures were outlined for monitoring purposes. The specialist report provided improved decision-making capabilities at all levels of government.

2013-2014: Richards Bay Oil Spill and Subsequent Mangrove Monitoring, Contractual Consultant

Following a crude oil spill within Richards Bay harbour, assistance and advice were sought for the implementation of a clean-up strategy and a monitoring plan. Kendyl spent time in the field, assisting in the management of staff tasked with the clean-up. She also undertook the post-clean-up monitoring of the mangroves.

2015: Mhlanga Estuarine Assessment, KwaZulu-Natal, Contractual Consultant Anchor Environmental:

An estuarine assessment was undertaken for a Water Use License Application to permit discharge from a Waste Water Treatment Facility. Kendyl undertook the identification of the invertebrates and compiled the specialist report.

Basic Assessment

2013 – 2014: Ecocycle Waste Solutions (Pty) Ltd, Facility Expansion, KwaZulu-Natal, Consultant:

Basic Assessment for the expansion of the current Ecocycle Health Care Risk Waste Facility including stakeholder engagement, environmental assessment and report development.

2013 – 2014: Lanxess Isithebe Decommissioning, Consultant:

Waste management license and basic assessment process application to facilitate the decommissioning and decontamination of the Lanxess, Isithebe inorganic chemical manufacturing facility.

2013 - 2014: eThekwini Municipality, Mtunzi Reservoir Inlet Pipeline, Consultant:

Basic Assessment for the installation of 3 km of pipeline and associated reservoir inlet pipeline.

2012 – 2013: Transnet National Ports Authority Waste Compaction Facility, KwaZulu-Natal, Consultant:

Basic assessment and waste management license for the construction of a hazardous galley waste handling and compaction facility within the Port of Durban.

KENDYL ANDREA WRIGHT

2011 - eThekwini Water & Sanitation, Veary Road Sewer Extension, Kingsburgh, KwaZulu-Natal, South Africa, Assistant Consultant:

Basic assessment for the proposed sewer extension in Kingsburgh, Durban. Assisting in the stakeholder engagement, environmental assessment and report development.

2011 - On-going: L. Tovl & Associates CC, Dukuduku Bulk Water Supply, Mtubatuba, KwaZulu-Natal, South Africa, Assistant Consultant:

Basic Assessment for the proposed construction of a water reservoir and bulk water supply pipeline in the area of Mtubatuba, KwaZulu-Natal. Assistant consultant in preparing the amended EMPr for submission to the Department of Environmental Affairs.

Environmental Impact Assessment

2013 – 2014: Proposed Pemba Port and Logistics Base, Assistant Consultant:

Scoping and EIA for the development and construction of a new Port based in Pemba, northern Mozambique.

2013 – 2014: BrightSource Kathari Solar Energy Power Project, Assistant Consultant:

Scoping and Environmental Impact Assessment for the installation of a Solar Power Plant in Upington, Northern Cape.

2012 - 2014: Illovo Sugar South Africa (Pty) ltd, Proposed Green Boiler Project, Assistant Consultant:

Scoping and environmental impact assessment for the construction of boilers at Eston and Noodsberg to convert bagasse to energy for export to the national grid. Assistant consultant in stakeholder engagement and report writing.

Rehabilitation Plans

2013 - 2013: Stefanutti Stocks (Pty) Ltd, Umbilo Canal Rehabilitation Plan, Cato Manor, Durban, KwaZulu-Natal, South Africa, Environmental Consultant Officer:

Rehabilitation Plan for the Umbilo Canal, adjacent to the Golden Gate School in Cato Manor, Durban. Compilation of the addendum to the rehabilitation plan including the need for Dwarf Chameleon monitoring and management as well as undertaking the roe of Environmental Control Officer.

Environmental Screenings

2012 – Africa Sun Oil, Environmental Screening of a Proposed Shopping Centre, Reservoir Hills, Consultant:

Environmental Screening of the proposed new Reservoir Hills Shopping Centre based on virgin land, including the identification of potential impacts or areas of concern.

KENDYL ANDREA WRIGHT

References: *additional references on request

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GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMIRE/PASA
accepted reason. Activities associated with the Project could further pressure this species by physically harming individual seals, and by disrupting the seals' food supply. 84. The Pisces Report states that Cape fur seals are unlikely to be found in the project area, citing map that shows generalized foraging areas that extend nearly exactly to the edge of the reconnaissance area.[90] However, the report also states, "[s]eals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles (~220 km) offshore,"[91] meaning a large part of the reconnaissance area is well within the foraging range of Cape fur seals. Moreover, the Based on the questionable assumption that Cape fur seals are unlikely to occur within the reconnaissance area, the Pisces Report authors deemed their sensitivity to the proposed seismic operations to be "LOW," in spite of the finding that "The potential impact of physiological injury to seals as a result of seismic noise is deemed to be of HIGH intensity."[92] **Whales and dolphins** 85. There is genuine conservation concern for beaked whales that are particularly sensitive to anthropogenic noise, including seismic surveys. It has been demonstrated that even minor, non-lethal disturbances, resulting in changes in behaviour such as displacement from preferred habitats, could impact a population.[93] 86. The phenomenon of energy-cost (from stress and avoidance behaviour) is of particular concern for some of the species expected to be encountered in the survey area in question, particularly the humpback whales and southern right whales who are at risk of the	were more associated with operational dynamics of the Namibian fleets and their licensing conditions that had reduced their effort (as South African vessels were not permitted to fish in Namibian waters). Cumulative impacts are assessed in Section 9 of the BA report. For both technical and commercial reasons, it is unlikely that concurrent seismic surveys will be undertaken in the same area during the same survey window. However, the cumulative impacts associated with multiple surveys was assessed and detailed in Section 9.3.5 of the BAR. Section 9.3.5 of the BA Report states that "three seismic surveys of regional extent, undertaken simultaneously, could be expected to result in an impact of medium negative significance on the large pelagic longline sector, both with and without the application of mitigation measures. This relates to the large pelagic long-line sector only, and only in the event that all three surveys are undertaken simultaneously. It should be noted that the seismic industry typically avoids simultaneous surveys occurring in close proximity to each other as this has the potential to degrade the quality of the recorded survey data. Other cumulative impacts are all expected to be low after mitigation is applied – therefore overall cumulative impacts are considered low post-mitigation. It should also be noted that of the three potential surveys cited by the Appellants, the GX Technologies survey should be disregarded as the company went into liquidation in 2022. The appellants' contention that up to 30% of the revenue generated by the impacted fisheries would be lost during the 70 day period is unsubstantiated and vague for the following reasons:	

[90] Pisces Report at 69 (Fig. 37)

[91] Id. at 111.

[92] Id.

[93] Harris Report

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GROUNDS OF APPEAL	RESPONDING STATEMENT BY THE APPLICANT	COMMENTS BY THE DMRE/PASA
airgun noise affecting their behaviour or interfering with the communication between mother and calf. Any impact on their energy reserves could impact on their condition (weight-loss and physiological condition) and affect survival of the animals during a vulnerable time (especially for lactating mothers and their calves) on their long migration to feeding grounds in Antarctica.[94] Fish 87. The BAR downplays the impacts of seismic surveys on fish and the fisheries they support, particularly in the case of the large pelagic longline fishery and the tuna pole-line fishery. While the BAR assesses the exclusion of fishing vessels due to temporary safety zones during seismic surveys, it fails to adequately assess the actual impacts of seismic activities on the target fish species themselves, both in the short and long-term. During the seismic survey, fishing vessels would be required to maintain a safe operational distance from the survey vessel and streamer array, which may extend up to 6 nautical miles. The FBAR assessed the impact of potential exclusion for each commercial sector based on the affected area of fishing ground and the amount of catch reported within the Reconnaissance Permit area. Given the location of the Reconnaissance Permit application area, two high-value fisheries are directly impacted: the large pelagic longline fishery (targeting tuna, swordfish and shark) and the tuna pole-line fishery. 88. The FBAR concluded that the Project's activities will result in exclusion to fishing grounds for at least the large pelagic longline fishery. The FBAR states that "[t]here is a high probability that the large pelagic longline sector (targeting tuna, swordfish and shark) will experience loss of access to fishing ground over the duration of the	• The four-month window is proposed to coincide with the period of lowest activities for the fisheries that operate in the potentially affected sectors, • It should further be noted that the survey will not be undertaken over the entire tuna fisheries area or the whole application area at the same time and will thus not lead to a complete shutdown of the fishing activities in the pelagic longline sector during the 70 day period of the survey; and • The mitigation measures included in Section 9.3.2 of the BAR provide for avoidance of the peak fishing periods and, furthermore, for the establishment of clear communication channels to be established with the other users of the survey area and to ensure that the disturbance within this sector is reduced to the absolute minimum. The impact on the affected fishing sectors was assessed to be of low significance and short duration and it could thus not be stated that "The FBAR fails to consider the long-term behavioural or migration impacts that seismic activity could have on the pelagic longline fishery, which include several species of tuna." Impacts of cumulative sound exposure on marine mammals are evaluated using disturbance and injury threshold, defined as temporary threshold shifts (TTS) and permanent threshold shifts (PTS) (Southall et al. 2019). The audibility of a noise pertains only to the perception or detection of a sound above background levels of ambient noise. The thresholds established by Southall et al. (2019) are internationally regarded as standard references for environmental impact assessment of underwater noise. Although the modeling report doesn't specifically reference the CBA areas, the purpose of the modelling was to model the likely sound transmission and contours. The outputs of the model were then	

[94] Harris Report

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MARINE ACOUSTIC ECOLOGY EXPERT COMMENTS ON "ENVIRONMENTAL BASIC ASSESSMENT REPORT: PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT"

Michelle Fournet, M.S., PhD

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1 OVERVIEW

This document provides commentary and expert opinion on the scientific soundness of activities related to a planned seismic campaign in the Orange Basin region off the west coast of South Africa. Specifically, it examines whether Appendix 3.5 – "TGS: SOUTH AFRICA ORANGE BASIN 3D SEISMIC SURVEY SOUND TRANSMISSION LOSS MODELLING" (hereafter referred to as the "Acoustics Specialist Report") and Appendix 3.1 –"PROPOSED 3D SEISMIC SURVEY IN THE ORANGE BASIN OFF THE WEST COAST OF SOUTH AFRICA: BIODIVERSITY AND ECOSYSTEM SERVICES ASSESSMENT" (hereafter referred to as the "Marine Ecology Report")—both in support of the document "ENVIRONMENTAL BASIC ASSESSMENT REPORT: PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT, PASA REFERENCE: 12/1/040" (BAR)—adequately assess the environmental impact of anthropogenic noise associated with seismic operations and related maritime activities. This document includes commentary on the appropriateness of the content in the Acoustic Specialist Report and the Marine Ecology Report for developing mitigation strategies outlined in Section 9 ("Environmental Impacts Assessment," EIA) within the BAR, and the suitability of the proposed mitigation strategies in addressing potential harms related to sound produced by the proposed seismic operations.

1.1 PROJECT DESCRIPTION

TGS Geophysical Company (UK) Ltd is planning a seismic campaign in the Orange Basin off of the west coast of South Africa, pending the approval of the Reconnaissance Permit and vessel availability (the "project"). The Reconnaissance Permit Area spans approximately 57,400 km², located about 120 km offshore from St Helena Bay, extending to around 230 km offshore from Hondeklip Bay across several petroleum license blocks.

The survey will utilize a single 100 m seismic ship equipped with seismic sources and streamers, supported by up to two escort vessels of unknown size, and is expected to last around 70 days. The towed hydrophone streamers would be 8,000 meters in length and 2,000 meters, approximately the area of 3,000 football fields. The seismic pulse would be discharged every 2-6 seconds continuously during exploration operations at source levels (loudness at the source) between 200-255 dB re 1 µPa; for reference this is among the loudest produced anthropogenic sounds on the planet and is in the range of military weapons or explosions.

1.2 SUMMARY OF OPINION

The Acoustics Specialist Report and the associated Marine Ecology Report solicited by TGS fail to adequately demonstrate that anthropogenic noise generated by the proposed seismic campaign will not have significant ecological consequences for marine organisms and habitats at the permit location. This is primarily due to (1) the failure to recognize the anthropogenic noise from the project as chronic, (2) the failure to consider the full spatial extent of the noise generated by the project, (3) the omission of an assessment of underwater ambient sound conditions at the site prior to the proposed activities, (4) the failure to evaluate potential impacts on the broader marine community, including population-level effects, and (5) the failure to incorporate the most up-to-date and relevant scientific recommendations for assessing industrial noise impacts on marine ecosystems.

Consequently, the mitigation actions proposed in the associated Environmental Impact Assessment (EIA) are based on an inaccurate assessment of noise impacts and fail to meaningfully address the potential or likely impacts of anthropogenic noise on the marine environment related to the seismic exploration. Moreover, the mitigation actions proposed in the EIA fail to address the full range information contained in the specialist reports and reiterated within the text of the EIA, this willful omission results in even less comprehensive or appropriate mitigation measures.

1.3 PRIMARY FAILURES OF THE BAR and ASSOCIATED SPECIALIST REPORTS

1. Inadequate Premise and Limited Scope of Impact
   The Acoustics Specialist Report is founded on a flawed temporal premise and exhibits a narrow scope that fails to comprehensively address the complexities of anthropogenic noise impacts on the environment. As the primary resource used to assess mitigation needs associated with anthropogenic sound, the report is severely lacking. The fault of this should be attributed to TGS- who commissioned the report and determined the scope assigned to the contracting agency.

2. Appropriateness of Inference in Marine Ecology Report
The Marine Ecology Report uses the outputs of the Acoustics Specialists Report in concert with data from a desk study to assess acoustic impacts on the marine environment; as such it contains the same flaws as the Acoustics Specialist Report and additionally underestimates the severity of seismic survey noise impacts. The report suggests insufficient mitigation strategies that fail to consider population-level impacts, soundscape level impacts, or chronic impacts associated seismic operations.

3. Insufficient Mitigation Measures within the EIA
The proposed mitigation measures do not adequately address the potential acoustic impacts of the proposed project on the marine ecosystem, leaving significant risks unmitigated. The best available science was not considered when assessing the impact of the project, the scope of the available information was overly narrow, and the EIA selectively omits information included in the specialist reports and the broader literature.

2 GENERAL INTRODUCTION TO ANTHROPOGENIC NOISE IN THE MARINE ENVIRONMENT

Anthropogenic noise refers to sound generated by human activities, including infrasonic (below the range of human hearing) and ultrasonic vibrations (above the range of human hearing), as well as sounds within the human audible range. Anthropogenic noise poses a significant threat to organisms that rely on sound for vital life functions such as foraging, breeding, migration, and social interaction. Its effects are particularly severe in marine ecosystems, where sound travels vast distances with minimal energy loss. Most marine species have evolved to depend on sound as their primary sensory modality.

Social cetaceans and seabirds, including whales, dolphins, and penguins, rely on acoustic signals for communication, foraging, and social cohesion. Bottom-dwelling animals, fish, and invertebrates also respond to environmental sounds; for example, larval stages of various species use sound cues to time their transition from open water to benthic habitats. Alterations to the marine soundscape impact how marine animals interact with their environment, have the potential for both short term individual harm, and may result in shifts in long-term population dynamics.

Anthropogenic noise impacts ecosystems by disrupting communication, displacing species from critical habitats, altering foraging and predator-prey behaviors, increasing physiological stress, causing physical harm (including hearing loss), and even leading to mortality. Assessing these effects requires an interdisciplinary approach, combining ecology, resource management, acoustics, and statistics. Research on marine responses to noise has documented behavioral changes, auditory impairments, increased mortality, and reduced reproductive success. As such, any activity that generates noise may have significant ecological consequences, underscoring the need for comprehensive environmental impact assessments.

2.1 RELEVANT DEFINITIONS AND EXPLANATIONS

Characterizing Sounds

When determining the impacts of noise on an organism or an ecosystem, the sound must first be characterized. Sound is broadly characterized according to the following:

1. Duration: how long each signal lasts
2. Frequency (or pitch): how high, low, or broadband (simultaneously high and low) a sound is
3. Pulsivity: whether a sound is impulsive (like a series of bangs from fireworks) or continuous (like traffic noise)
4. Chronic versus discrete: Does the noise occur in a single short time period (like a jackhammer outside of an apartment window for a morning) or does it persist over long time periods (like an apartment which abuts a train track with trains passing by every day for many years).

Inappropriately characterizing noise has severe implications on individuals or organisms, and improper characterization can hide ecological impacts that may be significant. For example:

1. Duration: It would be misleading to characterizing the duration of a fireworks display that took place from 7pm until 11pm as having an average duration of 1.4 seconds (the length of time of a single firework).
2. Frequency: It would be misleading to say that simultaneously blowing 10,000 dog whistles (which are too high pitched for humans hear) would not impact a mother dog and her pups that were feeding 1 meter from the whistle blowers, simply because it doesn't substantially contribute to overall low frequency sound levels.
3. Pulsivity: It would be misleading to say that animals were capable of adjusting the timing of their calls to vocalize in between sound signals, if the sounds were continuous and there was no break between sounds.
4. Chronic vs. discrete: It would be misleading to say that the sound of a jackhammer outside of a bedroom window would have negligible effects on the apartment residents because it only occurred for three hours, when in reality the sound of the jackhammer occurred for three hours every day at 3am for 20 years.

Determining Ecological Baselines

To assess whether elevated noise levels associated planned human activities will impact an ecosystem, it is crucial to understand the environment's sound profile prior to the proposed human interference. This process is referred to as "determining the baseline soundscape," defined as the acoustic condition of a site before anthropogenic disturbance.

Components of a Baseline Soundscape Assessment: A baseline soundscape assessment should provide a thorough analysis of the sonic environment prior to proposed anthropogenic activities, focusing on spatial and temporal variations in sound levels and frequencies. Key components include:

1. **Identification and Characterization of Natural Sound Sources:** This includes biophony (sounds from living organisms), geophony (natural environmental sounds), and anthrophony (human-generated sounds).

2. **Data Collection Across Habitats and Seasons**: The assessment should capture sound data across different habitats and seasonal variations within a proposed site, enabling the detection of changes in sonic diversity and diel sound patterns associated with alteration.
3. **Evaluation of Sound Pressure Levels**: This includes assessing sound levels across ecologically relevant frequency ranges and identifying key signals, correlating these findings with ecological functions.
4. **Establishment of Reference Points for Ambient Noise Levels**: Identifying pre-project sound levels and sources is essential for future impact assessments and for effective project management and harm prevention. In the absence of pre-project sound levels, contributions of the project to the soundscape cannot be assessed, and preventative mitigation cannot be employed.

Mischaracterization or omission of baseline soundscape elements can significantly impact ecological interpretation, leading to negative ecological consequences across several scales. For example:

1. **Erroneously Assigning Acoustic Baselines**: An urban task force tasked with determining whether traffic noise affects the foraging habitat of a rare bird compares ambient noise levels during moderate traffic and a period with a single tractor-trailer truck. They conclude noise has no impact based on equivalent noise levels. However, a second task force compares recordings from a traffic-free Sunday morning and a Monday rush hour, revealing a 300% increase in ambient noise due to traffic—an important change that would be overlooked with a mischaracterized baseline.
2. **Omitting Frequency Analysis**: The same task force examines whether new power lines interfere with bat echolocation (ultrasonic frequencies >20 kHz). They report a small increase in average sound levels between 1 kHz and 30 kHz, concluding the noise increase is not ecologically significant. However, noise levels in the bats' communication range exceed 400% when power lines are active, indicating that their findings could lead to hearing loss in bats.
3. **Omitting Temporal Patterns of Sound Sources**: A contractor records baseline sounds for only 10 seconds each hour over a single autumn day, outside the typical mating and migration seasons. Consequently, the report lacks data on these critical signals and inaccurately concludes that elevated noise levels won't impact them. In reality, migrating and mating animals acoustically present for several months each year were simply not recorded.

3 SPECIFIC COMMENT AND CRITIQUE OF SPECIALIST REPORTS

3.1 INADEQUATE PREMISE AND LIMITED SCOPE OF ACOUSTICS SPECIALIST REPORT

3.1.1 Appendix 3.5 – "TGS: South Africa Orange Basin 3D Seismic Survey Sound Transmission Loss Modelling" (Acoustics Specialist Report), prepared by Environmental Impact Management Services Inc. (EIMS), presents a Sound Transmission Loss

Modeling (STLM) study to assess the spatial extent of noise impact on marine fauna within the proposed survey area off the West and South-West Coast of South Africa. This report was commissioned by TGS and used as the basis for risk assessment and mitigation planning associated with the proposed project.

3.1.2 The science contained within the report appears to be thorough. Due to fundamental flaws in its initial assumptions and the project scope requested by TGS, however, the Acoustics Specialist Report fails to accurately represent the real-world impacts of 3D seismic exploration on the marine soundscape and marine organisms within and beyond the proposed permit area. The report is based on incorrect premises regarding both the temporal and acoustic characteristics of the noise. EIMS' study focuses on the impact of discrete, 24-hour, pulsive noise on low-frequency sound levels in an otherwise pristine marine environment. Specifically, EIMS was tasked with identifying zones of impact from single airgun pulses and the cumulative effects of multiple airgun pulses over a 24-hour period (Acoustics Specialist Report, p. i).

3.1.3 In reality, the proposed project involves chronic pulsive noise coupled with continuous vessel noise over several months (70 days), significantly raising ambient sound levels in the low and mid-frequency ranges that affect marine mammals, fish, and invertebrates, both within and beyond the proposed project area. If the project were limited to 24 hours and only involved airguns, the study's assumptions might be valid. However, the cumulative effects of sustained high-intensity noise from multiple sources over 70 days are far more impactful than the short-term effects modeled in the report.

3.1.4 The Acoustics Specialist Report's failure to consider the added impacts of multiple sound sources on both direct (injury) and indirect (behavioral) effects on animals significantly undermines the assessment and its use for determining robust mitigation plans. The study exclusively considers the threats posed by airguns, primarily modeling the temporary threshold shifts (temporary deafness, TTS) and permanent threshold shifts (permanent deafness, PTS) associated with their use, with moderate to minimal consideration for behavioral impacts. However, additional sound sources—including two support vessels, a seismic ship measuring 100 meters in length, and generator noise on the ship—are also critical sources of noise associated with the proposed project. Recent research investigating marine mammal response to noise associated with seismic operations indicates that the behavioral response to seismic vessels is at the same magnitude as the airguns themselves[1] Notably, while airgun noise is generally considered low-frequency (<200 Hz), the frequency range produced by vessels is broader (also including mid-high frequency components), which were not included in the noise impact assessment. Noise from these additional omitted sources contributes to the overall ambient sound levels, collectively affecting the acoustic environment that marine organisms rely on for survival.

3.1.5 No baseline soundscape assessments were made for the proposed permit region within the Acoustics Specialist Report nor the BAR. No effort was made to quantify the naturally occurring sound levels for this region, the sources of naturally occurring sounds, or the seasonal and temporal cycles in ambient sound levels that may serve as

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ecologically important cues. Given that marine organisms use sound for navigation, prey detection, predator avoidance, and foraging, alterations to the natural soundscape within and beyond the permitted region may have severe ecological consequences. In the absence of known natural ambient noise levels, it is not possible to assess how much the proposed activities will increase ambient noise levels in the soundscape—and therefore also not possible to assess underwater noise impacts.

3.1.6 The contribution of this project to the ambient soundscape is particularly relevant given that airguns produce some of the loudest known underwater sounds on the planet[2,3] and in some cases, can be detected 4,000 kilometers from the source[4]. The Acoustics Specialist Report failed to quantify how many total square meters would be ensonified as a result of the proposed project (see Wood 2010 for an example)[4]. However, based on the modeling reported, the detection of airguns is certain to expand beyond the permitted area and into the Critical Biodiversity Areas (CBA) and Marine Protected Areas (MPA) within and beyond the permitted area (Acoustics Specialist Report, Figure 17; Marine Ecology Report, Figure 42). Additionally, seismic and support vessels will operate beyond the limits of the proposed permit region, transiting through both CBAs and MPAs. The contributions of these sound sources to sensitive habitats were not modeled or addressed. Soundscape impacts and ensonification ranges were not solicited by TGS, and would have indicated a much broader spatial impact of the project than is currently reported.

3.1.7 Noise produced from industrial activities cannot be physically contained underwater and may inundate critical biodiversity locations proximate to proposed operations and associated vessel activities. This requires careful consideration given the known impact of noise on marine mammals (stress, behavioral responses, reduction in foraging[5]), fish (behavioral responses, physiological responses, antipredator responses, death[7,8]), larval invertebrates (reduction in settlement, larval deformation [9–11]), and pelagic zooplankton (death[12]). Anthropogenic noise within CBAs and MPAs may harm, alter, or lead to death or population decline across a wide range of organisms and life stages that make up both ends of the trophic web. Because noise cannot be contained to the project site due, the impacts of noise are further reaching than the directing region of interest and must include coastal and adjacent pelagic areas as well.

3.1.8 An adequate baseline assessment of the acoustic properties of the soundscape—including biological sources of ambient sound, environmental sources, and ambient sound levels—is needed to complete an assessment of underwater noise impacts. Broader-scale sound propagation modeling, including the total range of ensonification associated with airguns and general project operations (seismic ship returning to port, support vessels, aircraft), throughout both pelagic and coastal habitats – inclusing seismic ship travel routes – is essential for adequately assessing project impact, risk, and mitigation strategies. This is particularly relevant for the Child's Bank, the Tripp Seamount, Cape Canyon and Cape Valley, which will likely experience changes in ambient soundscape conditions associated with the project. The report models ensonification up to 200 km, and notably the project is associated with high noise values up to that range (e.g., Acoustics Specialist Report, Figure 17).

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3.1.9 The Acoustics Specialist Report overlooks the broader ecosystem-scale consequences of injuries caused by anthropogenic noise. The report focuses primarily on direct physical injuries to marine organisms, such as hearing damage from airgun blasts. This is not a comprehensive assessment. Temporary or permanent hearing loss, stress, and direct or indirect death in fishes and invertebrates are all physical consequences of anthropogenic noise exposure. However, the repercussions of such injuries extend beyond individual organisms and can affect entire ecosystems. When marine mammals or fish experience hearing loss, their ability to communicate, navigate, and locate predators or prey is compromised. This impacts their survival and can also disrupt predator-prey dynamics within the ecosystem, leading to population imbalances. Additionally, both injuries and anthropogenic noise in isolation can lead to stress responses in affected species, potentially resulting in altered reproductive success and decreased population resilience. The failure to adequately assess these ecosystem-level consequences limits the understanding of how noise pollution can disrupt ecological interactions and degrade marine biodiversity.

3.1.10 In addition to the direct impacts on individual animals, the report fails to consider the population-level consequences of behavioral changes induced by noise exposure. Noise from airgun activities can lead to significant shifts in the behavior of marine species. Responses of fishes to anthropogenic noise include reduction of anti-predator response, which leave individuals at higher risk of being eaten, acoustic masking of breeding sounds which may impact species at the population level, and reduced breeding success [6,13,14].Marine mammals may alter their vocalization patterns, leading to reduced communication effectiveness. Fish may also exhibit changes in schooling behavior or abandon critical habitats due to increased noise levels. Such behavioral changes can affect reproduction rates, survival, and population dynamics over time. Furthermore, if key species alter their foraging behaviors or habitats, the repercussions can cascade through the food web, impacting other species reliant on them. The Acoustics Specialist Report's neglect of the consequences of behavioral shifts and their population-level impacts undermines the comprehensive assessment needed to understand the full ramifications of the proposed project on marine ecosystems.

3.1.11 The report also fails to quantify the number of marine animals likely to be acoustically impacted by airgun and other anthropogenic noise sources, missing an opportunity to address critical factors such as sex and behavioral state that influence vulnerability to noise exposure. Research indicates that certain demographics, such as nursing females, may be more sensitive to noise due to their specific behavioral contexts [15]. To fully understand the implications of noise exposure, it is essential to estimate the proportion of populations that could be affected by the proposed activities, particularly for vulnerable species. Furthermore, long-term consequences for impacted individuals can include decreased reproductive success and altered migration patterns[16,17], which can lead to population declines over time. A robust assessment would not only quantify the number of individuals affected but also evaluate the potential implications for population viability, particularly in the context of ongoing anthropogenic pressures[18]. This level of analysis is critical for informing appropriate mitigation strategies and ensuring the long-term sustainability of marine populations.

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3.1.12 Since the release of the Acoustics Specialist Report, more recent scientific studies have emerged that challenge the premise of using blanket sound exposure level (SEL) or sound pressure level (SPL) thresholds to assess the impacts of anthropogenic sound on marine animals (Southall 2024). The Acoustics Specialist Report heavily relies on Southall (2019) to justify using these thresholds to determine varying levels of risk, while omitting the caveats included in the 2019 publication. Southall 2019 states that "***The approaches [in Southall (2019)] are not applicable to evaluating potential auditory effects of chronic noise exposure over periods of weeks, months, or years.***" [19]

3.1.13 In the updated guidelines, Southall (2024) again explicitly states that "simplistic received level-only step-function 'thresholds' indicating a binary lack or presence of response for any sound type are outdated and inconsistent with the best scientific information available"[18]. The Acoustics Specialist Report relies on exactly these binary thresholds, despite strong scientific evidence that this method is flawed[18,19]. Moreover, Southall (2024) highlights the issue of appropriately assessing the temporal scale (chronic impacts versus acute impacts) as a major flaw in the method used in the Acoustics Specialist Report. According to Southall (2024), "Where the acute exposure-response severity scale-based assessment approach really falls short is in the evaluation of repeated or sustained exposures for aggregations and/or local populations of animals on broader spatial and temporal scales." Given the multiple months of sound exposure to this ecosystem (70 days), this should be considered a chronic rather than acute sound source.

3.1.14 Beyond the 2024 publication, which the agency responsible for the Acoustics Specialist Report may not have had access to, Southall (2021) offers clear recommendations on acoustic exposure and the types and severity of behavioral responses, focusing on vital rates during acute events. Notably, Southall (2021) was not cited in the Acoustics Specialist Report, despite the report's goal of determining zones of impact for behavioral responses Acoustics Specialist Report, p. i). Given the Acoustics Specialist Report's reliance on Southall (2019), it should be assumed that the work of Southall—internationally regarded as industry standard and best practice—is considered reliable by BIMS. The omission of the most recent work is yet another indication that the Acoustics Specialist Report fails to reach the necessary depth to be used for reliable environmental impact assessment. These flaws can be predominantly associated with the scope of the project as requested by TGS.

Summary of Comments on Acoustic Specialist Report:

1. **Inaccurate Assumptions in Acoustic Specialist Report:** The report is based on incorrect assumptions, primarily focusing on short-term impacts from 24-hour airgun pulses. However, the actual project will involve 70 days of chronic, high-intensity noise, including both airguns and continuous vessel noise, leading to significantly higher impacts than modeled.
2. **Underestimated Noise Sources:** The study overlooks the noise contributions from multiple sources, including support vessels and generator noise, which affect both low and mid-frequency ranges critical to marine fauna and elicit behavioral responses. These omitted noise sources exacerbate the overall impact of seismic operations on the marine soundscape.

3. **Lack of Baseline Soundscape Assessment:** No baseline data on natural ambient noise levels or soundscape characteristics in the project area were collected, making it impossible to accurately assess how much the proposed activities would increase ambient noise levels.
4. **Broader Spatial Impact Unaccounted For:** The report fails to quantify how far noise will travel beyond the project area, particularly into Critical Biodiversity Areas (CBAs) and Marine Protected Areas (MPAs), where noise could have far-reaching ecological consequences.
5. **Insufficient Consideration of Ecosystem-Level Consequences:** The report focuses primarily on direct physical injuries (such as hearing loss) but does not adequately address the indirect effects on behavior, communication, and predator-prey dynamics, which could disrupt entire ecosystems.
6. **Failure to Address Behavioral and Population-Level Impacts:** Noise-induced behavioral changes, such as altered communication or abandonment of critical habitats, are not properly assessed. These changes could lead to population-level consequences, affecting reproduction, survival, and overall ecosystem stability.
7. **Outdated Noise Thresholds and Methodologies:** The report relies on outdated sound exposure thresholds that fail to account for the chronic nature of the project's noise impacts. More recent scientific guidelines suggest that this approach is insufficient for assessing long-term impacts on marine animals.
8. **Missing Quantification of Impacted Marine Animals:** The report does not estimate the number of marine animals likely to be affected by the noise, nor does it consider the heightened vulnerability of specific demographics, such as breeding males or nursing females, to noise exposure.
9. **Need for Scaled Sound Propagation Modeling:** The report requires a broader-scale sound propagation model and an assessment of the full spatial and temporal extent ensonification.

3.2 COMMENTS ON APPROPRIATENESS OF INFERENCE IN MARINE ECOLOGY REPORT

3.2.1 Appendix 3.1 – " PROPOSED 3D SEISMIC SURVEY IN THE ORANGE BASIN OFF THE WEST COAST OF SOUTH AFRICA: Biodiversity and Ecosystem Services Assessment " (Marine Ecology Report), builds on the information provided in the Acoustics Specialist Report. As such, it shares same shortcomings, as well as additional issues with scope, depth, and inappropriate inference of acoustic information and application to mitigation strategies.

3.2.2 The Marine Ecology Report mirrors the shortcomings of the Acoustics Specialist Report by considering TTS an acceptable impact after mitigation, despite significant unknowns regarding the consequences of temporary hearing loss for affected populations and species. The Marine Ecology Report fails to account for the potential impacts of repeated noise exposure over multiple days, which could have more serious long-term effects that those assumed in the report. Established methodologies, such as those from Wood (2010) and Southall (2024), provide

guidance on assessing environmental impacts based on sex and behavioral states. However, the Marine Ecology Report neglects to incorporate these variables or critically to estimate the total proportion of marine populations of any species likely to be affected by the 70-day project. This omission occurs, despite the acknowledgement that portions of the proposed permit area are ecologically valuable for critical species and are in some cases considered vulnerable to human activities (Marine Ecology Report, "3.4.2 Conservation Areas and Marine Protected Areas"). Instead, the report applies the same simplistic binary threshold approach as the Acoustics Specialist Report, without considering chronic impacts or population level consequences.

3.2.3 In the case of marine mammals, prolonged exposure to noise is associated with chronic stress, internal and external injuries, displacement from breeding and foraging areas, altered migratory patterns, and permanent hearing loss [17,20–23]. Despite the vulnerability of local cetacean species such as humpback whales, sperm whales, Bryde's whales, and beaked whales found in the proposed permit area (Marine Ecology Report, Table 7) neither the Marine Ecology Report nor the Acoustics Specialist Report adequately addresses the risks associated with chronic noise exposure for these animals at the individual or population level. The assumption was made that animals would likely leave the area, but there was no quantitative estimation of the number of individuals impacted, the probability of habitat abandonment, the change in probability associated with age, sex, or behavior state (e.g. cows and calves versus adult males). This is particularly critical for data deficient species (fish, invertebrates, benthic organisms in abyssal regions) and deep diving odontocetes expected to use much of proposed region.

3.2.4 The Marine Ecology Report and associated EIA recommendations (BAR Section 9: Environmental Impact Assessment) fail to adequately suggest mitigation measures that will address the acute risks of seismic operations to the marine environment. The proposed measures, including a 500 m buffer around sensitive areas, a 500 m mitigation zone, Marine Mammal Observers (MMO), Passive Acoustic Monitoring (PAM), and operational responses based on animal proximity, are inadequate. For example, the report acknowledges that certain species, including beaked whales, are at risk of fatal acoustically induced decompression sickness —a behavioral response with an acute outcome (Marine Ecology Report, p. 67). Very high frequency cetaceans, which includes most odontocetes and beaked whales and will be impacted at ranges of 650 m (injury) and 3.8 km (behavioral responses), yet the mitigation zone is only 500 m. This is a clear misalignment between the proposed mitigation strategies and the data driven spatial extent of impact to marine species. Per the information included in the Marine Ecology Report, this misalignment may result in odontocete fatality.

3.2.5 Similarly, the Marine Ecology Report downplays the impact of noise on invertebrates and prey species, and the report suggests ineffective mitigation strategies to minimize the impact of seismic operations. While the report acknowledges the physiological and behavioral responses of squid (Marine Ecology Report, "4.3.6 Impacts of Seismic Noise

on Marine Invertebrates")— a primary prey source for marine mammals, including beaked whales, in Southeast African waters [24,25]—it incorrectly downplays squid mortality as having a LOW impact due to temporal and spatial scale. The report claims the impact on squid would be REGIONAL and IMMEDIATE- 1.5 months, but mortality is permanent and behavioral responses of surviving squid will likely occur beyond the permitted region, as the acoustic influence zone (2–5 km) extends beyond the survey area during operations (EIA, p. 215, area (Acoustics Specialist Report, Figure 17; Marine Ecology Report, Figure 42). The loss of squid would significantly affect trophic interactions, especially in a system already low in food sources. The report's claim that the removal of squid (a scarce resource) is low impact, is akin to draining a desert oasis and labeling the impact low because water is rare there anyway.

3.2.6 Additionally, the proposed mitigation measure intended to minimize harm to cephalopods —"Terminate seismic shooting upon observing any obvious mass squid mortalities estimated by the MMO as a direct result of the survey"—is ecologically unsound. Squid, which are found at depth, are neutrally or negatively buoyant and will not float to the surface for meaningful observation [26]. Even if they did float to the surface, they are highly camouflaged and ship movement would scatter them, making detection by the MMO virtually impossible. This suggestion that MMO's would be capable of reporting squid mortality is unrealistic, and the consequences of squid mortality are ecologically meaningful.

3.2.7 Impacts to Plankton and Ichthyoplankton were considered MEDIUM before mitigation, and LOW after mitigation. However, the proposed mitigation measures – for example no seismic operation within 5 km of important ecological areas – directly minimize the duration or extent of high source level sounds inundating the marine soundscape (see Figure 45a, Marine Ecology Report for a visualization of spatial scale, see also Madsen et al 2006)[17]. Noise associated with seismic operations will extend well beyond 5km, and vessel noise within ecologically vulnerable areas may have meaningful impacts that were omitted from this assessment. Fishes exposed to anthropogenic noise experience reduced anti-predator responses, leaving them more vulnerable to predation, acoustic masking of breeding sounds, reduced breeding success, temporary or permanent hearing loss, stress, and death[17,28,29]. Many larval invertebrates and fishes, such as corals, shellfish, and crustaceans, rely on sound to locate suitable habitat for settlement—the transition from their pelagic phase to a permanent location.[30–37] Acoustic masking of environmental cues within MPAs CBAs or other vulnerable habitats exposed to both seismic and vessel sounds may disrupt this process for key structure-building organisms.

3.2.8 Importantly, like the Acoustics Specialist Report, the Marine Ecology Report fails to consider population-level consequences for any species of interest. It makes no effort to quantify the number of individuals affected by the proposed activities or to assess the potential short- and long-term impacts on population dynamics. These omissions minimize the overall consequences of the proposed seismic activities. Understanding population-level impacts is critical, as disruptions to even a small number of individuals can have cascading effects on the species' reproductive success, genetic diversity, and

long-term survival, or may have meaningful trophic implication as prey species (like squid) grow scarce.

3.2.9 Lastly, the Marine Ecology Report fails to quantify soundscape properties in relation to other oceanographic features, such as bathymetry and currents. Since sound is the primary way marine organisms interact with their environment, the omission of a basic soundscape description and the potential impacts of the proposed project on it is a significant oversight.

Summary of Comments on Marine Ecology Report

1. **Inadequate Consideration of Temporary Threshold Shifts (TTS):** Based on mitigation suggestions the Marine Ecology Report TTS an acceptable post-mitigation outcome and fails to address the long-term consequences of temporary hearing loss to individuals of specific species or populations. There is also no consideration for the cumulative effects of multiple days of noise exposure. It overlooks more detailed approaches, such as assessing impacts based on species' sex and behavioral states, and neglects to estimate how much of the marine population will be affected by the 70-day project.
2. **Chronic Noise Exposure Risks:** The report downplays the significant risks of prolonged noise exposure for vulnerable cetacean species (e.g., humpback whales, sperm whales, beaked whales). It fails to assess how chronic noise might cause stress, injuries, altered migration patterns, and permanent hearing loss. There is also no quantitative estimation of how habitat alteration might affect these species.
3. **Insufficient Mitigation for Acute Noise Impacts:** The mitigation strategies proposed, including a 500 m buffer zone, are insufficient to minimize acoustic impacts to marine species (e.g, beaked whales and cephalopods). This highlights a failure to align mitigation efforts with the real world risks.
4. **Failure to Address Population-Level Impacts:** The report does not estimate how many individuals will be affected or assess the broader population-level consequences of direct or indirect harm, which downplays the long-term impacts of seismic exploration to this marine ecosystem.
5. **Omission of Soundscape Analysis:** The report neglects to assess the soundscape in relation to key oceanographic features (e.g., bathymetry, currents), despite sound being critical for marine organisms' interactions with their environment.

Overall, the report underestimates the severity of both acute and chronic noise impacts on marine life and offers inadequate mitigation strategies without accounting for population-level or soundscape effects.

3.3 INSUFFICIENT MITIGATION MEASURES PROPOSED WITHIN BAR SECTION 9 "ENVIRONMENTAL IMPACT ASSESSMENT" (EIA)

Throughout, the EIA fails to effectively propose mitigation measures that will address the acoustic impacts of seismic operations on the marine environment. Broad criticisms of the BAR's approach to mitigating acoustic impacts as well as specific criticisms on mitigation measures are below.

Broad Criticisms Associated with BAR Section 9, Environmental Impact Assessment (hereafter "EIA")

3.3.1 **Failure to Address Habitat Variability:** The BAR fails to adequately account for the variability in habitat sensitivity within the proposed permit region. The region in question displays significant bathymetric variability (BAR, p. 46), with habitat use and biodiversity differing greatly throughout the area (Marine Ecology Report, p. 19). For example, the Marine Ecology Report highlights the continental slope region (200–2000 meters in depth) as likely to support cetaceans and endangered fishes (Marine Ecology Report, Table 1 & p. 50), yet, the EIA (BAR, Section 9 "Environmental Impact Assessment") does not propose targeted mitigation measures for activities on the continental slope. Environmental mitigation measures should consider different operational behaviors based on habitats expected to harbor higher biodiversity or be home to species of concern.

Different marine habitats support distinct species assemblages, each with its own sensitivities to human-induced disturbances. The lack of appropriate mitigation in certain regions could result in physical damage to sessile organisms that inhabit specific habitats but lack the ability to abandon an environment when seismic operations commence. Alternatively, mobile organisms like cetaceans are more likely to congregate along continental slopes where nutrient upwelling attracts prey (Marine Ecology Report p. 50). Ignoring habitat-specific sensitivities increases the risk of disrupting critical ecological processes.

3.3.2 **Inconsistencies within the BAR:** The BAR and associated EIA contain inconsistencies. For example, the BAR proposes a long-term soundscape analysis for acoustics mitigation (BAR, p. 259) but fails to specifically include this measure in mitigation plans or to indicate spatial and temporal extent as part of the preventive strategies. The BAR also specifically acknowledges the need to minimize ambient sound levels associated with seismic operations (BAR, p. 245), yet requires no concrete mitigation measures regarding implementing technological or operational adjustments.

The EIA makes broad recommendations without considering the specific environmental conditions or the species most at risk at any given location or time of year. For example, seismic operations are proposed for January–May to minimize impact to baleen whales and commercially important fisheries – yet the BAR states that "it should also be kept in mind that some of the migratory species are now present year round off the West Coast, and that certain baleen and toothed whales are resident and/or show seasonality opposite to the majority of the baleen whales" (BAR, p 244). Despite this acknowledgment, these data were not meaningfully incorporated into planning or mitigation.

Effective EIAs should provide consistent, integrated, and transparent evaluations of all potential risks. A fragmented approach can result in a gross underestimation of cumulative or synergistic effects, where multiple stressors interact to amplify the harm caused.[38]

3.3.3 **Overly Optimistic Reliance on MMOs and PAM** The EIA fails to provide a clear scientifically driven, adaptive plan for real-time responses based on monitoring during the seismic survey. The existing plan incorporating real-time monitoring data (e.g., Passive Acoustic Monitoring (PAM) or Marine Mammal Observers (MMOs) is touted as a catch all to mitigate nearly every acoustic impact. MMOs, however, are limited in the scope and scale of their observations and PAM only captures loudly vocalizing animals (essentially omitting invertebrates and fish). Research indicates that the visual extent of MMOs from large ships is limited to 1 km, [5,18] yet per the Acoustics Specialist Report and the Marine Ecology Report acoustic impacts to marine mammals occur well beyond this range. MMOs are tasked with documenting mammals, fish, turtles, seabirds, fishes and invertebrates. This is both unrealistic and unreasonable. Many species of concern (e.g., odontocetes like sperm whales or beaked whales) have dive times in excess of one hour and surface intervals of less than a minute[39,40], making them hard to sight. Invertebrates, like squid, are negatively or neutrally buoyant[41] and aren't likely to be at the water's surface. Similarly, most fish species can't be reliably cited from a ship observation platform. Thus, while MMOs and PAM operators are crucial for reducing seismic operation impacts, they are not a panacea to address all potential risks.

3.3.4 **Incorrect Temporal Scale** The EIA focuses on short-term acoustic impacts (seconds to hours), despite the project involving approximately 70 days of seismic operation. This narrow focus disregards the long-term implications of chronic noise exposure. Prolonged anthropogenic[20,42,43] noise can lead to cumulative effects such as chronic stress, hearing damage, and altered behavioral patterns in marine species.[17] These chronic impacts, especially over the course of two months, are more likely to disrupt population dynamics, such as habitat avoidance or disrupted breeding patterns, which were overlooked in the assessment. Noise from the seismic survey is both chronic and spatially far-reaching, making the EIA's temporal scope inaccurate (See Commentary on Acoustics Specialist Report).

3.3.5 **Unknowns Are Disregarded** The EIA does not sufficiently account for unknown variables, including species-specific responses, role of behavioral states, lack of biodiversity data and ecosystem sensitivities. Uncertainty is inherent in ecological impact assessments, particularly when dealing with complex, dynamic marine ecosystems. It is essential to adopt the precautionary principle in such cases, ensuring that mitigation measures err on the side of caution to protect ecosystems from unforeseen consequences [18,44]. By failing to address these unknowns, the EIA underestimates in the scoring system and in its overall assessment the potential impacts of the seismic activity on species and habitats. The failure to collect baseline data significantly increases uncertainty; despite this, the EIA does not recommend commissioning ecological studies to address biological unknowns.

3.3.6 **Disregard for Far-Field Sound** The EIA does not adequately consider the effects of far-field sound, which can propagate over long distances and affect distant marine life. On page 58 of the BAR states that for areas that "receive the sound in the far field only, no detrimental effects to the communities or to individual benthic species are expected" (BAR, p. 58). However, seismic noise can travel thousands of kilometers [4], disrupting long-range communication among marine species such as cetaceans.[45] Far-field sound from seismic airguns will extend well beyond the immediate operational area, including into Critical Biodiversity Areas (CBAs) and Marine Protected Areas (MPAs) (see commentary on Acoustics Specialist Report and Marine Ecology Report), yet the EIA does not quantify the extent or ecological consequences or far field sound, nor does the EIA recommend broader scale acoustic modeling.

3.3.7 **Generalized Masking Effects** The EIA, acknowledges the importance of acoustic masking to marine organisms (BAR, p. 198) but overgeneralizes the effects of noise masking, failing to account for species-specific auditory ranges and behavioral needs. Different marine species rely on unique frequency ranges for communication, predator detection, and prey location [35,42,46–49]. A generalized approach that does not differentiate between species' auditory sensitivities can result in inadequate mitigation. For instance, what may be a moderate disturbance for one species could be catastrophic for another. Masking effects should be assessed separately for each species, given their varying hearing thresholds and reliance on the sonic environment.

3.3.8 **Disregard for Chronic Impacts** The EIA does not sufficiently consider the long-term effects of temporary injuries, such as hearing loss, resulting from seismic exposure. Temporary hearing loss can have severe long-term consequences if it impairs an animal's ability to communicate, forage, or avoid predators. Chronic exposure to noise may also lead to habitat abandonment or reduced reproductive success, ultimately affecting population resilience.[17,42,50] Seismic operations, particularly over 70 days, will result in chronic, not just temporary, impacts, leading to long-term harm to individuals and populations that depend on the proposed permit region.

3.3.9 **Disregard for Cumulative Impacts of Project Stressors** The EIA does not adequately consider the cumulative impacts of multiple noise sources, such as airguns, vessels, and ambient noise, over the duration of the 70-day seismic survey. Despite including a discussion on Cumulative Impacts (e.g., BAR section 9.2) generally, the BAR adopts a siloed approach in assessing risks. Per the EIA impact assessment protocol, the criteria required to score a "High" Cumulative Impacts is stated as: "Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change" (BAR, Table 39). Yet there is no transparent measure assessing the interactive impact of each potential threat. Instead, the TGS appeared to assess risks in isolation rather than integrating them. For instance, there is no apparent analysis concerning the impact to species that

experience temporary hearing loss (TTS) alongside habitat displacement- and although this would change the temporal and spatial scale of impact that is not reflected in the mitigation assessment. Similarly, the combined effects of anti-predator behaviors triggered by vessel noise and physiological stress associated with seismic noise may change reproductive output in fishes, which would alter the temporal scale of impact – but this scientific probability did not appear to change the risk assessment rating. This piecemeal approach – or at the very least the lack of transparency pertaining to how cumulative impact criteria were scored – significantly underestimates the true impact of the proposed activities.

3.3.10 **Disregard for Cumulative Impacts of Possible Multiple Projects** The EIA fails to propose adequate mitigation to prevent the impact of multiple exposures to marine organisms in association with other proposed survey projects in the region (e.g., Searcher and Gx Technologies). This scenario – multiple projects occurring simultaneously – was not quantitatively modeled within the Acoustics Specialist Report, addressed in the Marine Ecology Report, and therefore adequately assessed in the EIA. The EIA within the BAR considers the impact of the proposed exploration project isolation, with one brief mention of isolated impacts of multiple project (BAR, p. 211). This is a gross oversight that requires comprehensive consideration and mitigation strategies based in realistic data to remedy.

Each additional project in or near the proposed survey region is associated with a set of risks that compound when they occur in close spatial or temporal proximity. Most mitigation measures proposed to address the impact of anthropogenic noise in the EIA would be minimized or completely invalidated by the presence of additional exploration. Part of the EIA mitigation plan hinges on there being a 'safe place' for marine organisms to retreat to avoid the impacts of extremely high amplitude sound, or by minimizing the spatial and temporal scale of sound exposure associated with the project. These assumptions are untrue if multiple project occur simultaneously. The scale of sound propagation greatly exceeds the proposed 40 km mitigation zone proposed to account for the occurrence of simultaneous projects (BAR, p. 211). Moreover, depending on the temporal scale of the other project, this would extend the overall high noise exposure to the environment, rendering the modeled SEL in the Acoustics Report incorrect, increasing the probability for both PTS and TTS for marine organisms, and increasing the probability for elevated stress levels in marine organisms at a regional level. Noting that the sound of seismic exploration, vessels, and other anthropogenic noise sources can travel for hundreds or even thousands of miles, the 40km buffer between ships would have minimal mitigation impact. No additional mitigation measures were proposed (e.g. adjusting the timing of operations, altering seasonality, stopping in the presence of other operations, etc.).

3.3.11 **Flawed Scoring System** The EIA employs a scoring system that does not allow for population-level impacts or the meaningful incorporation of uncertainty. In data-deficient situations, this scoring system biases the assessment toward assuming minimal impact, leading to underestimation of real risks. There is a need to factor in

uncertainty and variability in population responses to ensure a precautionary approach is taken.

3.3.12 **Inadequate Mitigation Zone** The EIA's reliance on a 500 m mitigation zone is insufficient to protect marine life from the harmful impacts of seismic noise. The Acoustics Specialist Report explicitly indicates that behavioral impacts are expected for marine mammals at distances up to 3.8 km from the array source and for fish at 1.3 km. Similarly, a zone of 2-5 km is necessary to avoid significant impacts on squid and other cephalopods (BAR, p. 215). A 500 m zone does not adequately mitigate the risk of injury or behavioral disruptions, especially given the repetitive use of airguns over 70 days. The BAR and associated specialist reports failed to incorporate the best available statistical methods to model habitat abandonment or avoidance, which would provide a more accurate assessment of indirect impacts[16,19,51,52]

3.3.13 **Failure to Use Best Science** The EIA fails to incorporate the best available scientific practices in its mitigation strategies. For example, in the absence of comprehensive biological surveys, best practice recommends assuming the presence of sensitive species and applying conservative mitigation measures to avoid harm. The reliance on outdated scientific recommendations from the Acoustics Specialist Report results in insufficient mitigation strategies. The Specialist Report critiques this failure to integrate the latest scientific guidelines, such as those from Southall et al. (2021), which provide more accurate frameworks for assessing long-term noise impacts (Specialist Report, p. 57).

Selected section specific comments associated with proposed mitigation within the EIA

9.3.1.1 ACOUSTIC IMPACTS OF SEISMIC SURVEYS ON MARINE FAUNA

This section outlines the importance of sound in the marine environment and the broad impacts of the noise associated with seismic operations to the marine environment and fauna. The following specific points are made (p. 128, statistics per the BAR):

1. **Shipping noise** is a significant and persistent source of anthropogenic sound, particularly at low frequencies, and can propagate over large distances, affecting vast marine areas.
2. **The Application Area** for the proposed project lies within busy shipping routes, where ambient noise is expected to be high (90-130 dB) due to shipping traffic.
3. **Seismic surveys** use intense sound sources, which can also propagate over great distances, with sound transmission being influenced by factors like water depth, distance, and ocean conditions. Sound pulses change in character due to reflective boundaries (sea surface, seafloor, etc.).
4. **In shallow waters**, seismic sound can travel up to 75 km, while in **deep water**, detection ranges can exceed 1,000 km under ideal conditions.
5. **Marine animals' auditory masking** occurs when background noise interferes with their ability to detect important environmental sounds. The duration and repetition of seismic impulses can affect animals' hearing thresholds

Despite the BAR's identification of these threats, most of these concerns are not adequately addressed by the proposed mitigation measures. Below is a point-by-point consideration of these omissions.

1. ***Shipping noise:*** *is a significant and persistent source of anthropogenic sound, particularly at low frequencies.* Despite this, the BAR neither commissioned the modeling of noise associated with the seismic ship and vessel operations, nor conducted a baseline soundscape analysis to measure the potential changes associated with seismic operations. Mitigation measures did not include vessel speed limits or daily maximum hours a day of use, both which would minimize vessel noise associated with shipping operations. The EIA within the BAR determined pre-mitigation impact of vessel noise on marine fauna to be "LOW" however, there is no empirical data to support this.

2. *The Application Area for the proposed project lies within busy shipping routes, where ambient noise is expected to be high (90-130 dB) due to shipping traffic.* TGS failed to measure the *in situ* contributions of vessel noise to the proposed permit area or the adjacent areas likely to be ensonified by seismic operations. It is not possible to test this claim, or to assess how the proposed operations will alter baseline soundscapes. In the absence of *a priori* measurements and comprehensive modeling. While vessels within an environment are loud, seismic operations including vessel operation and have been demonstrated to elevate ambient noise conditions in all known cases, and in broader frequency ranges than anticipated.[4,53–58] Per the Acoustics Specialist Report, ambient sound values will well exceed the 90-130 dB range within and beyond the permitted area in association with seismic operations (Acoustics Specialist Report, Table 11).

3. ***Seismic surveys use intense sound sources, which can also propagate over great distances, with sound transmission being influenced by factors like water depth, distance, and ocean conditions. Sound pulses change in character due to reflective boundaries (sea surface, seafloor, etc.).*** In keeping with this point, the Acoustic Specialist Report indicated that "the directivity of received noise is dominated by the directionality of the source array." Simply put, the direction the sound is produced in, dominates the direction the sound impacts. Despite this, no mitigation measures were suggested to restrict directionality of sound sources to minimize impact to biologically sensitive areas within and beyond the proposed permit zone.

4. ***In shallow waters, seismic sound can travel up to 75 km, while in deep water, detection ranges can exceed 1,000 km under ideal conditions.*** While this statistic is an underrepresentation (seismic has in certain context been detected for up to 4,000 km [4]), the BAR is correct that seismic sound can be very far reaching. Despite this acknowledgment, and the demonstration in the Acoustic Specialist Report that loud persistent sound sources associated with the proposed project are up to at least 200 km (maximum modeled distance), there were no concrete mitigation measures suggested that would minimize the acoustic energy input into the ocean throughout the project or to assess impact at a broader spatial extent.

5. ***Marine animals' auditory masking*** *occurs when background noise interferes with their ability to detect important environmental sounds. The duration and repetition of seismic impulses can affect animals' hearing thresholds.* It is true that the sound associated with seismic operations can mask critical sounds; behavioral responses also include altering the timing of calling – which may also interfere with important information transfer. Additionally (though unaccounted for in the Acoustics Specialist Report) the seismic ship and support vessels will also mask sounds. Moreover, animals experiencing temporary hearing shifts, will have altered decreased hearing sensitivities, thus increasing the likelihood and impact of masking. Despite these realities, mitigation measures do not adequately prevent the elevation of ambient sound that will lead to masking at broad scales or at altered thresholds, or indeed measure changes in the soundscape from baseline levels. Further, while the zones of behavioral response were modeled in the Acoustics Specialist Report, zones of masking were not solicited by TGS for the report.

9.3.1.1.1 NOISE IMPACT ON WHALES AND DOLPHINS

The overall assessment of seismic noise impact on cetaceans was calculated based on the impact to the individual, rather than the population, thus downplaying the potential impact to cetaceans over broader temporal scales. The proposed mitigation zone falls well below the zone of acoustic response expected for physiological, behavioral, or masking impacts. The Acoustics Specialist Report indicates that behavioral impacts are expected in cetaceans at 3.8 km from the array source. The maximum zones of temporary threshold shifts (TTS, temporary deafness) for very-high-frequency cetaceans are within 650 m of the source (Acoustics Specialist Report, p. i). Under normal operations, TTS zones for low-frequency cetaceans extend up to 5 km from the survey lines. Based on the research available and integrated into the BAR, a 500 m zone is insufficient to prevent injury to animals, especially given the repetitive use of airguns over 70 days. This strategy does not minimize harm. Similarly, because it is currently unknown how the seismic operations will elevate ambient sound (no baseline soundscape analysis was conducted) or how far the sound is expected to travel (lack of total onsonificaiton range) it is not possible to calculate the potential range over which cetaceans will experience acoustic masking. Lastly, while MMOs and PAM operators are extremely useful in mitigating negative impacts on marine mammals, many species (e.g., deep diving odontocetes) surface after long (>60 minute) dives and are extremely difficult to identify at distances greater than 1 km, thus minimizing the effectives of MMOs for long range impacts.

9.3.1.1.6 NOISE IMPACTS ON MARINE INVERTEBRATES

Despite the information contained in the Marine Ecology Report indicating the potential impact of seismic operations on marine invertebrates, and squid specifically (death, injury, displacement), and the acknowledgment that the zone of acoustic impact of for cephalopods is broad (2-5 km, BARp. 204) the BAR and its associated reports erroneously claim that impact of seismic on invertebrates is LOW (see specific comments on the Marine Ecology Report on squid). The proposed mitigation, that MMO would watch for mass squid mortality is functionally meaningless. Squid are neutrally buoyant and therefore would not float to the surface; even if squid did float, given the size of the ship, the water current associated with vessel transit, and the camouflage of the animals, mass mortalities of squid wouldn't be visible from the seismic ship.

9.3.1.1.7 NOISE IMPACT ON PLANKTON

The EIA indicates that pre-mitigation impacts on planktonic communities (the base of the marine food web) would be MEDIUM pre-mitigation. Indicating, by the TGS' admission a potentially biologically meaningful impact. Despite this the BAR states that the "Application Area is located far offshore, it is not deemed necessary to implement mitigation measures to avoid the key spring spawning periods thereby mitigating potential impacts on plankton to some degree." (BAR, p. 204). Put plainly, the mitigation plan is to do nothing; yet according to the EIA this will reduce the threat from MEDIUM to LOW. This is unreasonable, and not based in science.

9.3.1.2.1 IMPACTS OF NON-SEISMIC NOISE (VESSEL AND HELICOPTER NOISE)

The significance of non-seismic noise is said to be "low" before and after mitigation. This cannot be assessed according to the BAR's own criteria in the absence of a baseline soundscape analysis. Vessel noise, particularly as it reaches CBAs, MPAs, and regions of ecological importance (seamounts and caverns containing deep water corals), will alter the soundscape in potentially meaningful ways. This could impact larval recruitment, predator-prey dynamics, and beyond. The EIA, and the reports it relied on for assessment, failed to quantify, model, or predict, elevated ambient noise associated with vessel or aircraft within or beyond the proposed permit area. The assumption that this noise does not meaningfully impact the environment cannot be assessed. No mitigation was suggested, this course of action is not based on scientific information.

4 SUGGESTIONS FOR REASSESSMENT OF NOISE IMPACTS

NOTE This is a **minimal selection** of suggested assessment and mitigation measures pertaining to acoustics impacts associated with the proposed seismic operations. These measures alone will not be sufficient to minimize the acoustic impact to the marine environment within and beyond the proposed permit region. These suggestions are needed in order to assess if or how to develop mitigation plans to minimize acoustic impacts. .

1. **Comprehensive Soundscape Analysis (1-Year Minimum) Prior to Project Implementation**
   Objective: Conduct a thorough baseline analysis of the soundscape within the habitat over a minimum of one year before project activities begin. This will help establish a baseline understanding of natural noise levels and seasonal variations, providing critical context for assessing the potential impact of the project's noise on the ecosystem.

2. **Model Full Spatial and Temporal Range of Ensonification for All Sound Sources**
   Objective: Model the full spatial and temporal extent to which anthropogenic sounds associated with the proposed project will inundate marine soundscapes, including the ensonification range for airgun operations within the proposed permit area, as well as the ensonification associated with seismic ship and support vessel transit within and beyond the proposed permit area.

3. **Inclusion and Consideration Population Level Impacts and Associated Uncertainty**
   Objective: Acknowledge the necessity of modeling population level impacts (including estimated proportion impacted) and incorporate uncertainty in population density

estimates for the relevant species (e.g., marine mammals, fish, etc.) by developing multiple density scenarios. This includes:

a. Assessing the risk to species under a range of plausible population densities, especially considering variability in population numbers.
b. Where available, use population abundance data and apply variability factors to estimate the proportion of the population that could be exposed to noise during the project's operational period (e.g., 70 days).

4. **Separate Mitigation for Direct (Injury) and Indirect (Behavioral) Impacts of Noise**
Objective: Differentiate between the direct impacts (e.g., physical injury) and indirect impacts (e.g., behavioral disturbances) of noise exposure on species and propose mitigation for each
   a. For **direct impacts**, model potential injury thresholds based on noise exposure.
   b. For **indirect impacts**, consider the latest version of the **probabilistic disturbance approach**, which incorporates various behavioral states (e.g., feeding, resting, migrating) and estimates the time spent in each state. This method will help refine understanding of how noise affects species' daily activities.
   c. Develop mitigation relevant to spatial and temporal ranges of each.

5. **Exposure and Risk Assessment Based on Behavioral States**
Objective: Rather than adopting a blanket seasonal approach, model exposure levels and risks based on species' behavioral states (e.g., breeding, feeding, migration) and proportion of the population engaged in each activity. This will allow for the development of an **operation schedule** that minimizes noise during critical behavioral periods, thus reducing potential disruptions.
   a. The model should take into account how noise influences different states, adjusting operations to align with periods when species are least sensitive to noise.

6. **Integration of Southall et al. (2024) Recommendations**
Objective: Implement the recommendations outlined by Southall et al. (2024) on managing anthropogenic noise. The study critiques current regulatory approaches adopted in the BAR which rely on simple thresholds for noise exposure criterion. Southall et al (2024) calls for more nuanced criteria that consider species-specific and context-dependent responses, including behavioral responses.

7. **Required Evaluation of Proposed Mitigation Measures**
Objective: Evaluate the effectiveness of proposed mitigation strategies for both direct and indirect impacts that include uncertainty. This should involve a **comparative analysis** of different mitigation approaches, such as noise reduction technologies, spatial or temporal restrictions, and habitat protection measures. The evaluation should include:
   a. Quantitative and qualitative assessments of the potential success of each measure.
   b. A comparison of the potential impacts before and after the implementation of mitigation measures.

c. Consideration of adaptive management approaches based on scientifically based zones of impact to allow for adjustments if initial mitigation measures prove inadequate.

8. **Incorporation of Real-World Detection Probabilities of Marine Mammal Observers into Risk Assessment and Mitigation Strategies**
Objective: Integrate **real-world detection probabilities** of Marine Mammal Observers (MMOs) into the risk assessment process and the development of mitigation strategies. These detection probabilities can vary significantly based on factors such as:
   a. **Species size** (larger species are easier to detect)
   b. **Group size** (larger groups are more noticeable)
   c. **Time of day** (e.g., detection can be lower during low light conditions such as dawn, dusk, or night)
   d. **Observer experience** (more experienced observers are likely to have higher detection success)
   e. **Animal behavior state** (for example, animals in more active states may be easier to spot than those resting or submerged)
   f. This incorporation will help **refine risk assessments** by accounting for the inherent variability in detection rates and potential missed detections, especially during times of high operational noise or challenging environmental conditions. Additionally, it ensures that mitigation measures (such as shutdowns or noise reduction) are based on more realistic expectations of detection success, thereby improving overall protection for marine mammals.

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57. Wiggins, S. M., Hall, J. M., Thayre, B. J. & Hildebrand, J. A. Gulf of Mexico low-frequency ocean soundscape impacted by airguns. *J Acoust Soc Am* **140**, 176–183 (2016).
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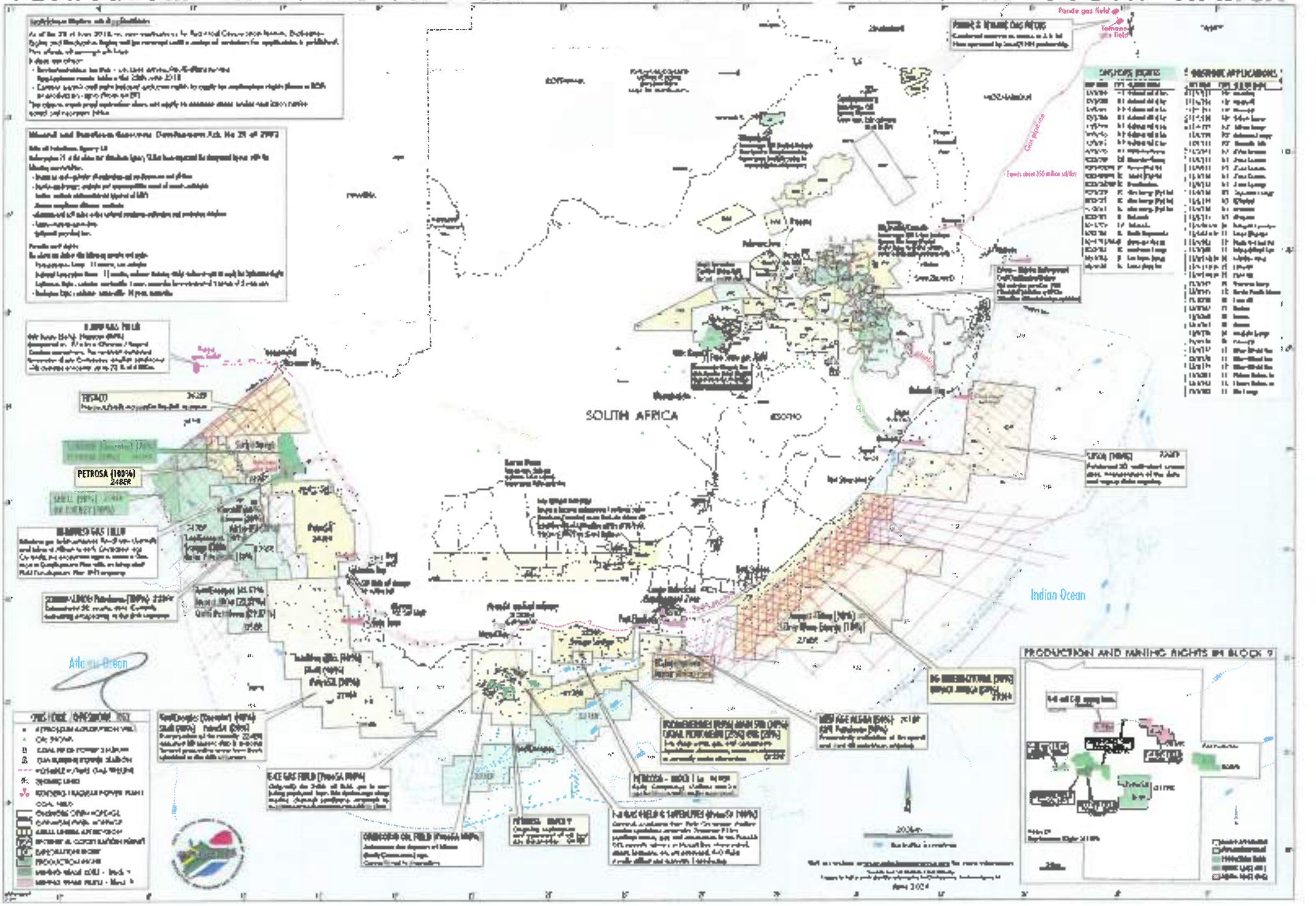
PETROLEUM EXPLORATION AND PRODUCTION ACTIVITIES IN SOUTH AFRICA



REPUBLIC OF SOUTH AFRICA

OPERATION PHAKISA

Unlocking the Economic Potential of South Africa's Oceans

Offshore Oil and Gas Exploration
Final Lab Report

15 August, 2014

2217
"A15"

Abstract

Context

- Although South Africa's oil and gas sector is in the early development phase, it has the potential to create large value to the country in the long run
- Developing an oil and gas industry takes decades; in Nigeria, it took 15-20 years from the moment of licensing until first production
- South Africa has possible resources of ~9 bn barrels oil and 11 bn barrels of oil equivalent of gas, but uncertainty is large
- Oil and gas exploration requires significant investments, particularly in South Africa's deep-water offshore environment where a single exploration well can cost over USD 150 mn. To achieve 30 exploration wells in the next 10 years, investments in the range of USD 3-5 bn are needed. Given that exploration success rates are below 15%, investors see these opportunities as risky

Vision – what success could look like

- In order to get a view of actual prospectivity, exploration activity must increase; the lab has set an aspiration to achieve 30 exploration wells in the next 10 years
- Assuming South Africa could achieve production levels of 370,000 barrels of oil and gas per day (of which the likelihood is hard to assess at this stage), this would mean up to 130,000 jobs are created with an annual uplift to GDP of USD 2.2 bn, while reducing the dependence on expensive oil and gas imports

What do you need to get there

- **Infrastructure** – although the infrastructure is currently not a constraint to exploration, particularly for gas, further coordination with other stakeholders may be helpful to incorporate the potential implications of offshore production into infrastructure plans
- **Environment** – to address concerns about a potential negative impact of offshore oil and gas exploration and production (E&P) several initiatives have been proposed, of which joint emergency response drills, and operationalisation of the international oil pollution fund are 2 examples of "quick wins"
- **Capability development** – a collaborative skills strategy roadmap and sub-surface research capability should be developed
- **Supply chain (local content)** – although still in the exploration phase, limited opportunities arise to develop local content (potential for local seismic work is assessed); a mechanism should be developed for the production phase based on global best practices
- **Institutional arrangements:** to maximise value for the country, adequate institutional governance is critical to ensure efficient and effective reservoir management, licensing, planning, data management and auditing
- **Legislative:** to affirm investor confidence, clarity and stability must be provided on the full legislative, regulatory and contractual package

2218

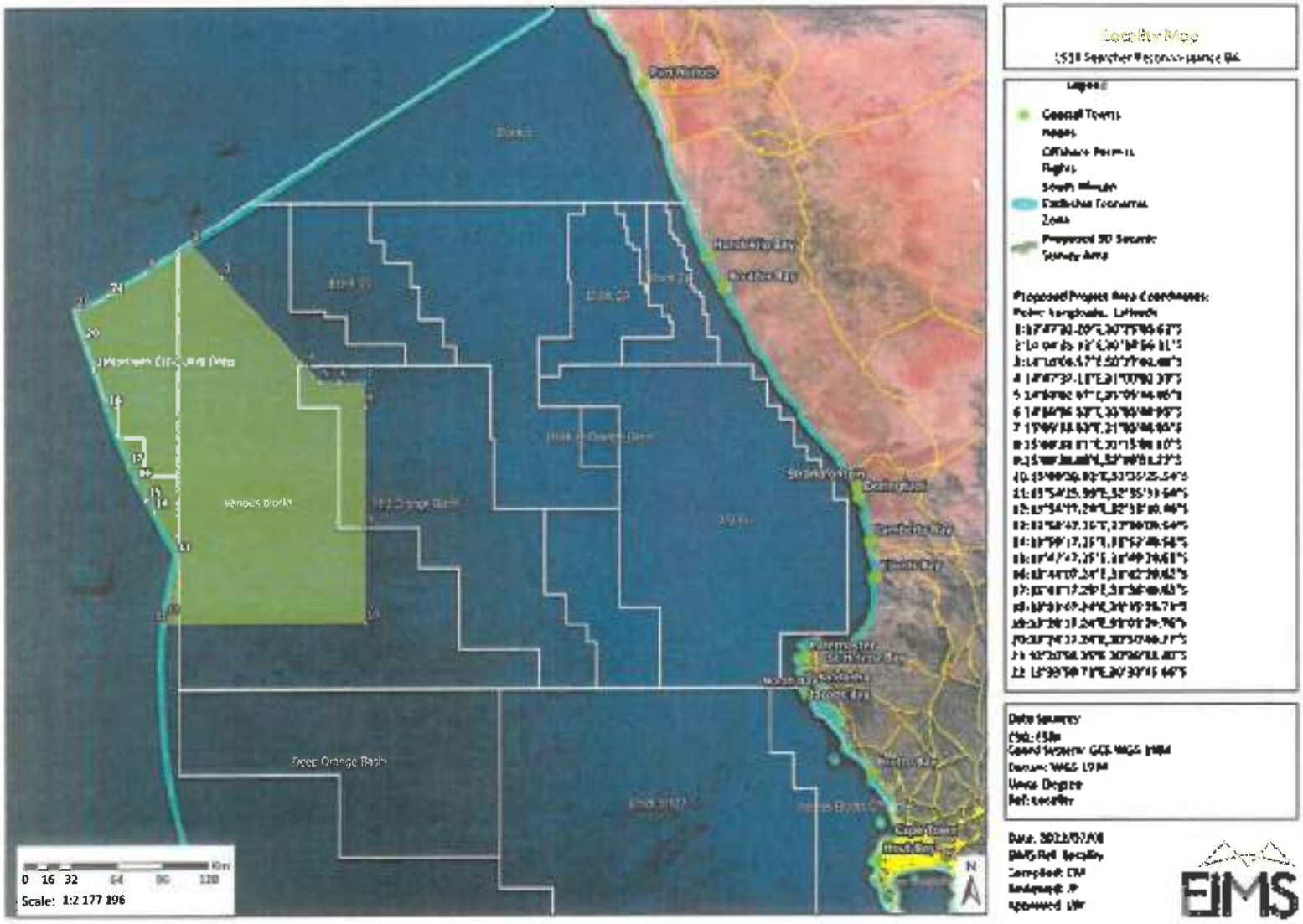


Figure 1: Locality map.

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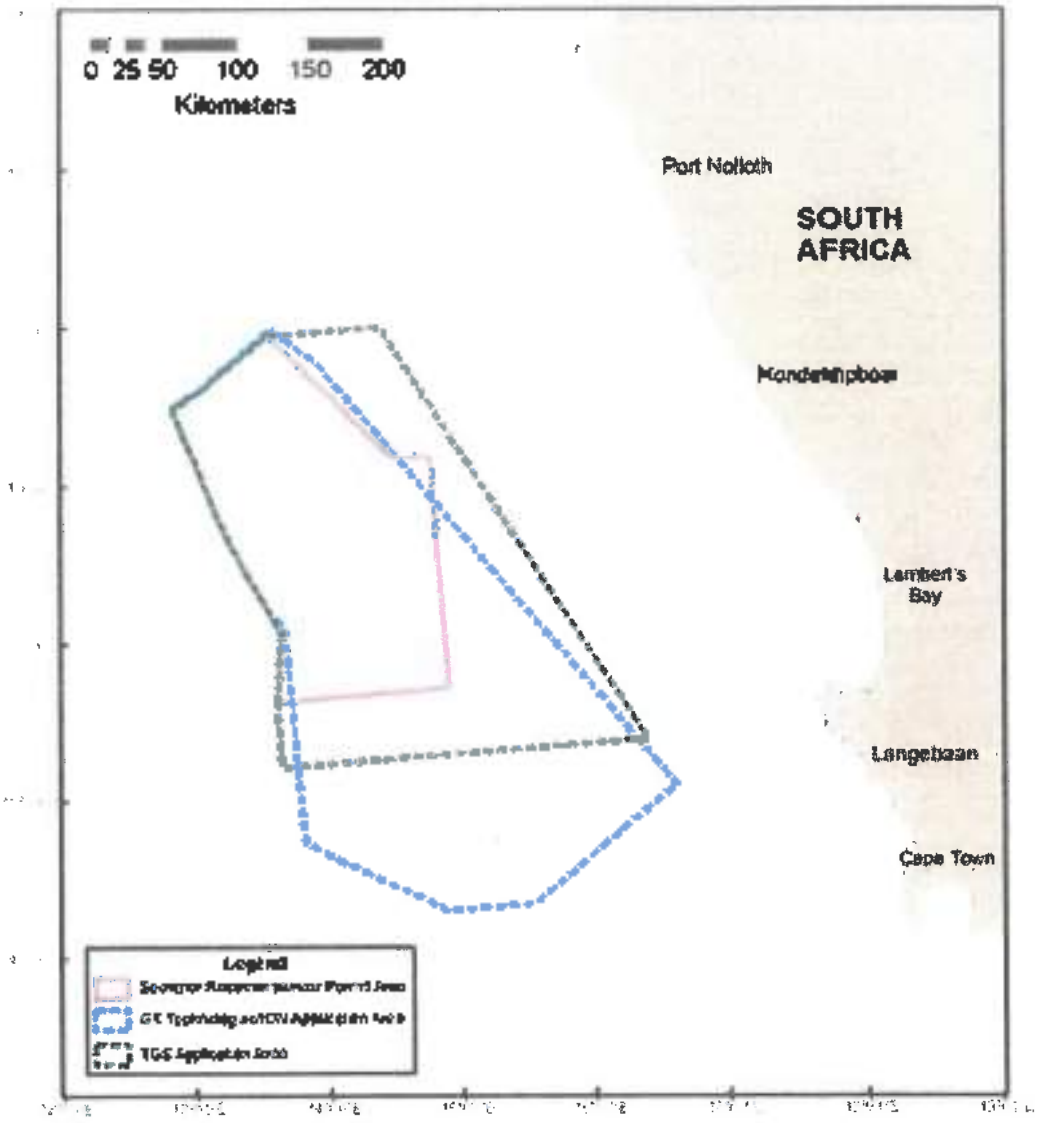
2219



Source: TGS draft BAR, p235.

"A19"

mineral resources & energy

Department:
Mineral Resources and Energy
REPUBLIC OF SOUTH AFRICA

Enquiries: Mr. BP Mohasoa EAP Reg No.: 2022/4684 Email Address: Peter.Mohasoa@dmre.gov.za
Ref: 12/1/043

BY E-MAIL

The Director
Searcher Geodata UK Limited
Unit 6 Albion House
High Street
Working
United Kingdom
GU21 6BG

Attention : Ms Debbie Sewell
Cell : +44 780 028 2966
Tel : +44 148 391 7339
Email : d.sewell@searcherseismic.com

ENVIRONMENTAL AUTHORISATION IN TERMS OF SECTION 24 OF NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998) AS AMENDED, READ WITH REGULATION 19 OF THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS, 2014 AS AMENDED, FOR 3D SEISMIC SURVEY ACTIVITIES LOCATED BETWEEN APPROXIMATELY 25KM OFFSHORE OF ST HELENA BAY EXTENDING NORTH ALONG THE WESTERN COASTLINE TO APPROXIMATELY 220KM OFFSHORE OF HONDEKLIP BAY, ADJACENT TO THE NAMAKWALAND AND WEST COAST MUNICIPALITIES: WESTERN CAPE REGION.

I, Mr. Jacob Mbele, in terms of the powers delegated to me, have in terms of regulation 24 of the National Environmental Management Act, 1998 (Act 107 of 1998): Environmental Impact Assessment Regulations, 2014 (hereafter referred to as 'EIA Regulations') decided to grant an environmental authorisation (hereafter referred to as the authorisation) in respect of the application lodged to us on 06 September 2022. Herewith attached is the copy of the authorisation and reasons for the decision to grant.

You are instructed in terms of regulation 4(2) of the EIA Regulations to notify all registered interested and affected parties (I&APs), in writing and within fourteen (14) days of the date of the decision, of the outcomes of your application. You are also required to inform registered I&APs of the procedure to submit appeals against the decision as contained in the National

2023

Environmental Management Act, 1998 (Act 107 of 1998): National Appeals Regulations, 2014 (hereafter referred to as 'Appeals Regulations').

Should you wish to appeal the decision or any aspect thereof, you must submit an appeal in the prescribed form and in accordance with Chapter 2 of the Appeals Regulation, within twenty (20) days from the date of notification of the decision. The said must be submitted to the Minister of Forestry, Fisheries and the Environment, and copies sent to the Department of Mineral Resources and Energy (Head Office) and the Petroleum Agency SA by one of the following means:

1) Department of Forestry, Fisheries, and the Environment

Appeals and Legal Review Directorate	
Attention:	Director: Appeals and Legal Review
Email:	appeals@dffe.gov.za
Post:	Private Bag x 447, Pretoria, 0001
By Hand:	Environmental House, Corner Steve Biko and Soutpansberg Street, Arcadia, Pretoria, 0083

2) Copy(s) of the lodged appeal(s) to the Petroleum Agency SA

Attention:	The Chief Executive Officer
Email:	EAappeals@petroleumagencysa.com
Post:	Private Bag x 5111, Tygervalley, 7536
By Hand:	Tygerpoort Building, 7 Mispel Road, Bellville, 7530

3) Copy(s) of the lodged appeal(s) to the Department of Mineral Resources and Energy

Legal Services Directorate	
Attention:	Director: Legal Services
Email:	Pieter.Alberts@dmre.gov.za
Facsimile:	086 710 0677
Post:	Private Bag x 59, Arcadia, 0007
By Hand:	Trevenna Campus, Building 2C, c/o Meintjes and Francis Baard Street, Sunnyside, 0007

The authorised activities shall not commence within twenty (20) days from the date of notification of the decision. Please also note that should the Minister of Forestry, Fisheries and the Environment receive appeals against this authorisation or conditions thereof, this authorisation will be suspended in accordance with section 43(7) of National Environmental Management Act, 1998 (NEMA) pending the decision on such appeals.

Yours sincerely,

MR JACOB MBELE

DIRECTOR-GENERAL

DATE: 20/12/2022

mineral resources & energy

Department:
Mineral Resources and Energy
REPUBLIC OF SOUTH AFRICA

Enquiries: Mr. BP Mohasoa EAP Reg No.: 2022/4684 Email Address: Peter.Mohasoa@dmre.gov.za
Ref: 12/1/043

ENVIRONMENTAL AUTHORISATION IN TERMS OF
THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998) AS AMENDED ("NEMA")
AND THE 2014 EIA REGULATIONS AS AMENDED

IN RESPECT OF

THE PROPOSED 3D SEISMIC SURVEY ACTIVITIES OFFSHORE, OFF THE WEST COAST, SOUTH AFRICA

APPLICATION DETAILS

Application Reference Number	12/1/043
Holder of Environmental Authorisation	Searcher Geodata UK Limited
Location of the Activity	Located between approximately 250km offshore of St Helena Bay, extending north along the western coastline to the approximately 220km offshore of Hondeklip Bay over a number of Petroleum License Blocks.
Size of the Reconnaissance Permit Application Area	Approximately 3 000 000 ha (30 000 km²)

This authorisation does not negate the holder of the authorisation, of the responsibility to comply with any other statutory requirements that may be applicable to the undertaking of the proposed activity.

2223

DECISION ON ENVIRONMENTAL AUTHORISATION

ACRONYMS

BAR:	Basic Assessment Report
DEPARTMENT:	Department of Mineral Resources and Energy
ECO:	Environmental Control Officer
EA:	Environmental Authorisation
EIA:	Environmental Impact Assessment
EIA REGULATIONS:	EIA Regulations, 2014, as amended
EMPr:	Environmental Management Programme
I&APs:	Interested and Affected Parties
MPRDA:	Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002), as amended
NEMA:	National Environmental Management Act, 1998 (Act 107 of 1998), as amended
Agency:	Petroleum Agency South Africa

The Department is satisfied with the information made available to it, and subject to compliance with the conditions of this Environmental Authorisation, that the applicant should be authorised to undertake NEMA EIA listed activities specified below. Details regarding the basis on which the Department reached this granting decision are set out in Section 5 and Annexure 1 of this Environmental Authorisation.

ACTIVITY (S) AUTHORISED

By virtue of the powers conferred on it by the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA") and the Environmental Impact Assessment Regulations, 2014 ("EIA Regulations"), the Department hereby grants the Environmental Authorisation to Searcher Geodata UK Limited to undertake the NEMA EIA listed activities specified in section 3 below and as described in the BAR/EMPr submitted on 01 November 2022.

The granting of this Environmental Authorisation is subject to compliance with conditions specified under section 5 below.

1. DETAILS OF THE HOLDER OF THIS ENVIRONMENTAL AUTHORISATION

The Directors
Searcher Geodata UK Limited
Unit 6 Albion House
High Street
Working
United Kingdom
GU21 6BG

Contact Person: Ms Debbie Sewell

2224

- Second round of advertisements announcing public meetings were placed in the same newspapers between 13 and 15 July 2022.

e) Poster placement in English, Afrikaans and IsiXhosa were placed at local public gathering places at various onshore locations.

f) Radio adverts were aired on KFM, Radio Namakwaland and Radio NFM in IsiXhosa, Afrikaans and English respectively.

g) A series of first round public meetings were held between 25 and 30 July 2022, and second round public meetings between 19 and 27 September 2022.

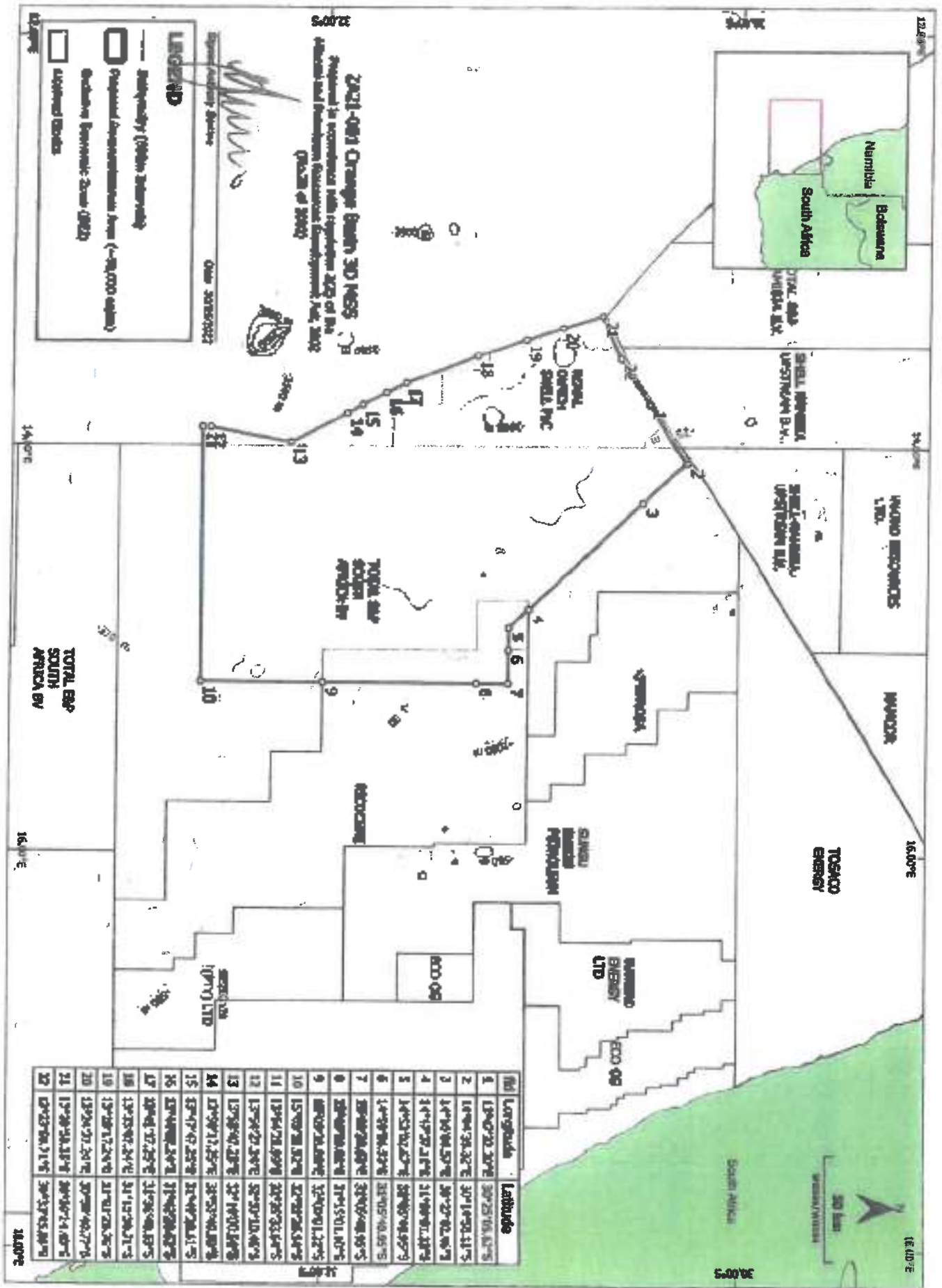
h) Comments and issues raised by Interested and Affected Parties were adequately addressed in the EIAR/EMPr.

4. Conclusion

In view of the above and having taken into consideration environmental management principles as set out in section 2 of NEMA, this Department is satisfied that the proposed activities will not be in conflict with the objectives of the Integrated Environmental Management set out in Chapter 5 of the National Environmental Management Act, 1998 and will not result in any detrimental risks to the environment and public. The authorisation is accordingly granted.

MR JACOB MBELE
DIRECTOR-GENERAL
DATE OF THE EA: 20/12/2022

5CDS


Namibia
Botswana
South Africa
TOTAL EAP SOUTH AFRICA BV
TOTAL EAP SOUTH AFRICA BV
TOTAL SA
TOTAL SA
SHELL NAMIBIA UPSTREAM B.V.
SHELL NAMIBIA UPSTREAM B.V.
ROYAL DUTCH SHELL PLC
MAUREL & PROM
TOTAL EAP SOUTH AFRICA BV
TOTAL EAP SOUTH AFRICA BV
TOTAL EAP SOUTH AFRICA BV

"A20"

MINISTER
FORESTRY, FISHERIES AND THE ENVIRONMENT
REPUBLIC OF SOUTH AFRICA

Reference: LSA 226116

APPEAL DECISION

APPEAL AGAINST THE DECISION TAKEN BY THE DIRECTOR GENERAL OF THE DEPARTMENT OF MINERAL RESOURCES AND ENERGY TO GRANT AN ENVIRONMENTAL AUTHORISATION TO SEARCHER GEODATA UK LIMITED

The Green Connection NPC	1st Appellant
Greenpeace Africa Volunteers	2nd Appellant
Patrick Bond	3rd Appellant
Shafeeqah Goolam Hoosen	4th Appellant
Whale Coast Conservation	5th Appellant
Thandi Davies	6th Appellant
David George Reynolds	7th Appellant
Jihaan Hafejee	8th Appellant
Dr Jacqueline Sunde	9th Appellant
Michelle Rivarola	10th Appellant
Oceans Not Oil	11th Appellant
Chevonne Elizabeth Snyman	12th Appellant

APPEAL AGAINST THE DECISION TAKEN BY THE DIRECTOR GENERAL OF THE DEPARTMENT OF MINERAL RESOURCES AND ENERGY TO GRANT AN ENVIRONMENTAL AUTHORISATION TO SEARCHER GEODATA UK LIMITED

Gerhard Gerber	13th Appellant
Paula Giusti	14th Appellant
Jennifer Whittingham, Dr Anna James & Paula Giusti	15th Appellant
Nicolaas Brand, Mario Brand, Susan Swain & Heather Zeller	16th Appellant
Rosey Shoshole	17th Appellant
Chris Adams	18th Appellant
We are South Africa- Gilbert Martin	19th Appellant
Olivia Devids	20th Appellant
Natural Justice	21st Appellant
Searcher Geodata UK Limited	Applicant
Department of Mineral Resources and Energy	Competent Authority

Appeal: This is an appeal lodged against the decision taken by the Director General (DG) of the Department of Mineral Resources and Energy (DMRE) (competent authority), on 20 December 2022, to grant an Environmental Authorization (EA) to Searcher Geodata UK Limited (the applicant) for listed activities pertaining to the proposed seismic surveys on approximately 256 kilometres offshore of St. Helena Bay, extending north along the Western Coastline to approximately 220 kilometres offshore of Hondeklip Bay, adjacent to the Namakwaland and West Coast Municipalities: Western Cape Region.

1. BACKGROUND AND APPEAL

1.1 On 08 September 2022, the applicant lodged an EA application with the DMRE for listed activities pertaining to the proposed seismic survey on approximately 256 kilometers offshore of St. Helena Bay, extending North along the Western Coastline to approximately 220 kilometers offshore of Hondeklip Bay, adjacent to the Namakwaland and West Coast Municipalities: Western Cape Region. This application was lodged and processed in terms of the Environmental Impact Assessment Regulations, 2014, as amended (2014 EIA

EOS

2.52.4.2. I have noted the response by the applicant that the Namibian Government was pre-identified as a potential stakeholder / interested and affected party from the inception of the project in July 2022.

2.52.4.3. According to the basic assessment undertaken by the applicant/EAP, no transboundary impacts is expected as a result of the proposed activity, however, I&APs, including the Namibian government were consulted.

2.52.4.4. This ground of appeal is accordingly dismissed.

3. DECISION

3.1. In reaching my decision on this appeal, I have taken the following into consideration:

3.1.1 The information contained in the PROJECT FILE 12/1/043, with specific reference to the EA, BAR and EMPr.

3.1.2. The appeal submitted by the appellants on or about 09 February 2023;

3.1.3. The comments submitted by the DMRE on 24 March 2023; and

3.1.4. The responding statement submitted by the applicant on 22 February 2023.

3.2. In terms of section 43(6) of NEMA, I have the authority, after considering the appeal, to confirm, set aside or vary the decision, provision, or condition or directive, or to make any other appropriate decision.

3.3. Having considered the abovementioned information, and in terms of section 43(6) of NEMA, I have decided to dismiss the appeal, and to uphold the decision of the competent authority.

3.4. In arriving at my decision on the appeal, I have not responded to every statement set out in the appeal and/or responses thereof, and where a particular statement is not directly addressed, the absence of any response thereto should not be interpreted to mean that I agree with or abide by the statement made.

3.5. Should any party hereto be dissatisfied with any aspect of my decision; such party may apply to a competent court to have this decision judicially reviewed. Judicial review proceedings must be instituted within 180 days of notification hereof, in accordance with the provisions of section 7 of the Promotion of Administrative Justice Act, 2000 (Act No. 3 of 2000) (PAJA).

MS B D CREECY, MP

MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT

DATE: 23/9/2023

Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators /Monitoring Tools
13.6 Emergency Response / Disaster Management Planning							
A	• Develop and implement an Emergency Preparedness and Response Plan (EPRP) for implementation during the seismic survey. This should be revised periodically as the various phases of the seismic survey work takes place.	Planning Operation	Prior to Operation and Ongoing	Contractor	ECO (Once-off)	Ensure emergency preparedness and response systems in place.	Verification that EPRP is in place. (ECO Audit) (EPRP) (Incident Reports)
13.7 Socio-Economic Considerations							
A	• TGS should develop a community engagement protocol that is based on the Sea Code of Research Ethics. This should be done in consultation with the affected communities. This should include a communication strategy and grievance mechanism.	Planning Operation	Prior to Operation and Ongoing	Applicant/ Project manager	ECO (Monthly)	Ensure that socio-economic considerations are considered and implemented where necessary	Preparation and maintenance of a community engagement protocol (ECO Monthly Audit) (Consultation register)
	• TGS should contribute to assisting with collaboration on independent research on how fish species on the West Coast such as shoals respond to seismic surveying. TGS will further contact relevant scientific research institutions to offer the potential of collaborating on independent on-water research during the survey.	Planning Operation	Prior to Operation and Ongoing	Applicant/ Project manager	ECO (Monthly)	Ensure that socio-economic considerations are considered and implemented where necessary	Proof of consultation and attempts at collaboration
C	• Consult with communities on potential ways in which to make a positive contribution to the consequence. • TGS should investigate opportunities for the employment of people from local communities and skills development.	Planning Operation	Prior to Operation and Ongoing	Applicant/ Project manager	ECO (Monthly)	Ensure that socio-economic considerations are considered and implemented where necessary	Consultation Register (ECO Monthly Audit)
D	• A representative from TGS should consult with the traditional leadership of the affected communities to establish what their understanding of meaningful consultation is and how communities should be consulted in future. This will assist with adjusting the relationship between TGS and the traditional communities. Given the socio-political environment, opposition to the project and associated non-technical risks, further meaningful engagement with the leadership and communities are critical from a social perspective. • TGS should also initiate discussions in their industry. The seismic survey industry should reassess their position and	Planning Operation	Prior to Operation and Ongoing	Applicant/ Project manager	ECO (Monthly)	Ensure that socio-economic considerations are considered and implemented where necessary	Consultation Register and workshops (ECO Monthly Audit)

"A21" 2231

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	social licence to operate as an industry in a South African context and conduct a strategic environmental assessment of the impact of the industry and embark on an awareness raising and education campaign. Having meetings will not be sufficient. Participatory processes and workshops where communities can engage in experiential learning should be considered. If the seismic survey industry fails to address the community's need for education and cooperation it will result in significant delays and increase the risk for social unrest.						
	TGS should approach the authorities and enter into conversation regarding a strategic impact assessment for the area that should be conducted to benefit the production/ exploration companies involved.	Planning Operation	Prior to Operation and Ongoing	Applicant/ Project manager	EOD (Monthly)	Ensure that socio-economic considerations are considered and implemented where necessary	Proof of consultation with authorities
13.8	Heritage/ Palaeontological Features						
A	Re-assess post-project the potential effects on the identified communities and their intangible cultural heritage. This will require consideration of the socio-economic baseline developed during the environmental impact process against quantified economic damage and losses and human development impacts in a follow-up socio-economic assessment. It will entail the heritage specialist to evaluate the link between the socio-economic changes induced by the proposed project as it relates to changes in the intangible cultural heritage practices of the communities. Based on the outcomes, provide resources and support for communities to develop and undertake safeguarding measures or plans to enhance the mitigation capacity of their intangible cultural heritage by fostering dialogue, mutual understanding and reconciliation between and within communities. 3D seismic surveys have the potential to locate wrecks on the seafloor and sometimes bellow sediments on the ocean floor. Any shipwrecks or places thereof noted during the survey must be shared with the SAHRA MUCH Unit for inclusion into the national database. These could then be identified and be incorporated into the EMPr.	Planning Closure	During Operation	Applicant/ Project manager in consultation with specialists	EO – once off	Re-assess post project the effects on the identified communities and their intangible cultural heritage Enhance mitigation capacity of intangible cultural heritage	Safeguarding measures or plans in place post survey

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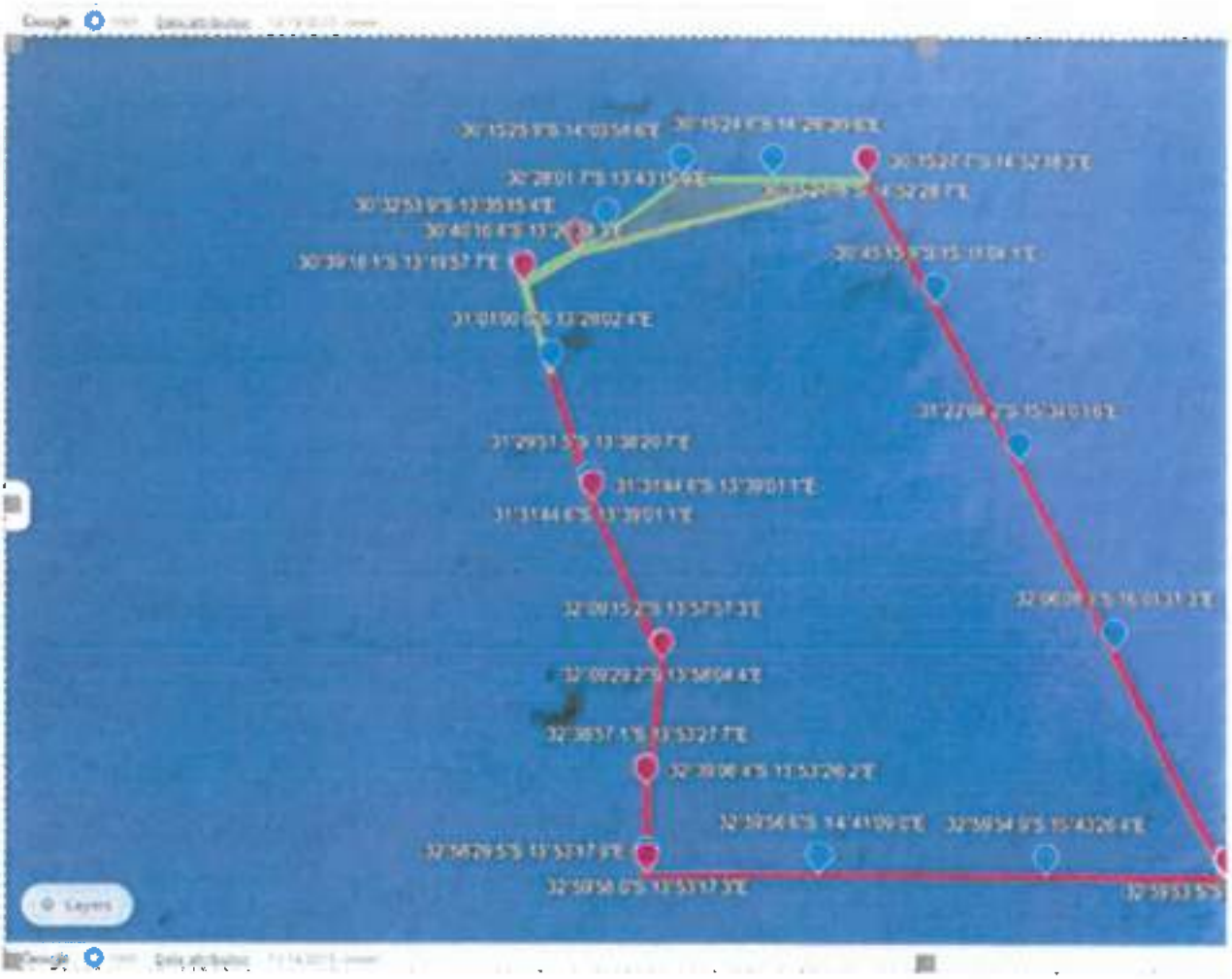

IN THE HIGH COURT OF SOUTH AFRICA
(WESTERN CAPE DIVISION, CAPE TOWN)

Case No ... ./2024

In the matter between

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	**First Applicant**
THE GREEN CONNECTION	**Second Applicant**
NATURAL JUSTICE	**Third Applicant**

And

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	**First Respondent**
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	**Second Respondent**
TGS GEOPHYSICAL COMPANY (UK) LTD	**Third Respondent**
MINISTER OF MINERAL AND PETORLEUM RESOURCES	**Fourth Respondent**

EXPERT AFFIDAVIT: MICHELLE FOURNET

I, the undersigned,

MICHELLE E H FOURNET

do hereby make oath and say:

1. I am an adult female residing in New Hampshire, New England, in the United States of America.

2. I hold various degrees and am employed as an Assistant Professor, Marine Bioacoustics and Behaviour Lab in the Department of Biological Sciences, College of Life Science and Agriculture, at the University of New Hampshire in the United States of America. I attach hereto, as Annexure "MF1", a copy of my Curriculum Vitae. I respectfully submit that I am qualified by my qualifications, training and experience to express the expert opinions which are set out in the report referred to below.

3. The facts contained in this affidavit fall within my personal knowledge, except where I indicate otherwise and are, to the best of my knowledge, true and correct. To the extent that I rely on information supplied by others, I believe that such information is true and correct.

4. I authored the report titled "Marine Acoustic Ecology Expert Comments on "Environmental Basic Assessment Report: Proposed Orange Basin Reconnaissance Permit", a copy of which is attached hereto as Annexure "**MF2**".

5. I further confirm that the report is to the best of my knowledge and belief true and correct.

MICHELLE E H FOURNET

This signed and sworn before me at Durham, NH on this 13th day of November 2024 by the deponent who has acknowledged that she knows and understand the contents of this affidavit, that she has no objection to taking the prescribed oath and that the prescribed oath is binding on her conscience.

AMY LAU
Notary Public - New Hampshire
My Commission Expires
August 18, 2026

NOTARY PUBLIC

Name: Amy Lau

Designation: Notary Public

Date: November 13, 2024

MF

2237
"MF1"

Michelle E.H. Fournet, Ph.D.
University of New Hampshire
Department of Biological Sciences, College of Life Science and Agriculture
Durham, NH, USA,
michelle.fournet@unh.edu

(A) PROFESSIONAL PREPARATION

Institution	Area	Degree & Year
Oregon State University	Wildlife Science	Ph.D., 2018
Oregon State University,	Marine Resource Management	M.S., 2014
University of Alaska, Southeast	Biology/Anthropology	Post-Bac, 2011
Boston University,	Theatre Arts	B.F.A., 2014

(B) POST GRADUATE APPOINTMENTS

2023 - present	Assistant Professor of Marine Bioacoustics, Department of Biological Sciences
2022-2023	Associate Director for Education, Center for Acoustics Research and Education, Institute for Earth Ocean and Space, University of New Hampshire,
2022-2023	Visiting Assistant Professor of Acoustic Ecology, Department of Biological Sciences, University of New Hampshire
2018-2022	Postdoctoral Associate, K. Lisa Yang Center for Conservation Bioacoustics, Cornell University
2018	Instructor, Oregon State University

(C) SELECTED PUBLICATIONS *(19 peer reviewed publications since 2015. H index = 11)*

Laute, A, Glarou, M, Dodds, F, Gomez Rasand, SC, Grove, T, Stoller, S, Rasmussen, MH, and MEH **Fournet**. (2023). Underwater sound of three unoccupied aerial vehicles (UAV) at varying altitudes, horizontal distances, and sea states. Journal

Laute, A, Grove, TJ, Rasmussen, MR, Smith, A, Loisa, O, and **MEH Fournet**. (2023) Impact of Covid-19 on acoustic habitat, vessel activity, and humpback whale calling behavior on an Icelandic foraging ground. Marine Ecology Progress Series

Fournet, MEH, Stabenau, E, Madhusudhana .S, and AN Rice. (2022). Altered acoustic community structure indicates delayed recovery following ecosystem perturbations. Estuarine, Coastal and Shelf Science. 274:107948.

Fournet, MEH, Silvestri, M, Clark, CW, Klinck, H, and AN Rice. (2021). Limited vocal compensation for elevated ambient noise in bearded seals: implications for an industrializing Arctic Ocean. Proceedings to the Royal Society: Biological Science. 288: 20202712

Fournet, MEH, Stabenau, E, and AN Rice. (2019). Relationship between salinity and sonic fish advertisement behavior in a managed sub-tropical estuary: making the case for an acoustic indicator species. Ecological Indicators 106: 105531

Fournet, MEH, Matthews, LP, Gabriele, CM, Haver, S, Mellinger, DK and H Klinck. (2018). Humpback whales (*Megaptera novaeangliae*) alter calling behavior in response to natural and manmade sounds. Marine Ecology Progress Series. 607: 251- 268. DOI:10.3354/meps12784

(D) SELECTED GRANT RECORD *(Total support ~$850k since 2012)*

2023 National Geographic Explorers Grant (PI, $20,000)
2022 Generations Trust Grant in Support of Research (PI, $25,000)
2022 Dale Prouty Sponsored Gift in Support of Tropical Research (PI, $100,000)
2021 Dale Prouty Sponsored Gift in Support of Polar Research (PI, $100,000)
2021 Atkinson Foundation COVID-Rapid Grant, (Co-PI, $12,000)
2021 Jammy Heal Foundation Research Grant, (PI, $2500): Functional Communication in Southeast Alaskan Humpback Whales
2020 Cornell University, Cornell Migrations Initiative Grant (Co-PI, $15,000)
2019 Templeton Foundation, Diverse Intelligences Development Grant (Co-PI, $15,000)
2018 Templeton Foundation, Diverse Intelligences Grant (Co-PI, $293,000)
2015 Merlin Foundation Research Grant (PI, $10,500): Investigating the Impact of Anthropogenic Noise on Humpback Whale Communication and Behavior
2015 National Park Foundation Alaska Coastal Marine Grant (project participant; $275,709):): Investigating the Impact of Anthropogenic Noise on Harbor Seal and Humpback Whale Communication and Behavior in Glacier Bay National Park, Southeast Alaska

(E) SYNERGISTIC ACTIVITIES

Reviewer (Scientific Journals): Behavioral Ecology and Sociobiology, Conservation Biology, Conservation Science and Practice, Endangered Species Research, Frontiers in Marine Science, Journal for the Acoustical Society of America, Journal of Comparative Psychology, Marine Biology, Marine Mammal Science, North Pacific Research Board, Polar Biology, Royal Society Open Science, Scientific Reports. Reviewer (Funding Agencies): North Pacific Research Board, Graduate Women in Science.

(F) FELLOWSHIPS AND ACADEMIC AWARDS

2018 Laurel Diversity Fellowship ($3500)
2018 Savery Outstanding Doctoral Student Award for Excellent in Natural Resources Research
2018 Hatfield Marine Science Center Outstanding PhD Student Research Award
2017 OSU Graduate School Travel Award for Excellence in Research ($1,500)
2017 Mamie Markham Research Fellowship ($9,000)
2017 The Wildlife Society: Oregon Chapter Advanced Graduate Student Scholarship ($500)
2017 OSU Chairmen's Leadership Award
2016 Thomas G. Scott Scholarship for PhD Student Excellence ($2,000)
2016 Oregon Lottery Merit Scholarship ($2,250),
2016 OSU Fisheries and Wildlife Shining Star Award for Service and Teaching
2015 Coombs-Simpson Memorial Fellowship ($500)
2015 OSU Fisheries and Wildlife Bruce Coblentz Teaching Assistant Award
2014 Hatfield Marine Science Center Student Teaching Award
2013 Oregon Sea Grant Robert E. Malouf Marine Science Fellowship ($10,800)
2012 Joan Crebbin Memorial Fellowship ($3,000)

Conference Awards: (9) conference level awards including (4) awards for best oral presentation at national/international conferences

MARINE ACOUSTIC ECOLOGY EXPERT COMMENTS ON "ENVIRONMENTAL BASIC ASSESSMENT REPORT: PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT"

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1 OVERVIEW

This document provides commentary and expert opinion on the scientific soundness of activities related to a planned seismic campaign in the Orange Basin region off the west coast of South Africa. Specifically, it examines whether Appendix 3.5 – "TGS: SOUTH AFRICA ORANGE BASIN 3D SEISMIC SURVEY SOUND TRANSMISSION LOSS MODELLING" (hereafter referred to as the "Acoustics Specialist Report") and Appendix 3.1 –"PROPOSED 3D SEISMIC SURVEY IN THE ORANGE BASIN OFF THE WEST COAST OF SOUTH AFRICA: BIODIVERSITY AND ECOSYSTEM SERVICES ASSESSMENT" (hereafter referred to as the "Marine Ecology Report")—both in support of the document "ENVIRONMENTAL BASIC ASSESSMENT REPORT: PROPOSED TGS ORANGE BASIN RECONNAISSANCE PERMIT, PASA REFERENCE: 12/1/040" (BAR)—adequately assess the environmental impact of anthropogenic noise associated with seismic operations and related maritime activities. This document includes commentary on the appropriateness of the content in the Acoustic Specialist Report and the Marine Ecology Report for developing mitigation strategies outlined in Section 9 ("Environmental Impacts Assessment," EIA) within the BAR, and the suitability of the proposed mitigation strategies in addressing potential harms related to sound produced by the proposed seismic operations.

1.1 PROJECT DESCRIPTION

TGS Geophysical Company (UK) Ltd is planning a seismic campaign in the Orange Basin off of the west coast of South Africa, pending the approval of the Reconnaissance Permit and vessel availability (the "project"). The Reconnaissance Permit Area spans approximately 57,400 km², located about 120 km offshore from St Helena Bay, extending to around 230 km offshore from Hondeklip Bay across several petroleum license blocks.

The survey will utilize a single 100 m seismic ship equipped with seismic sources and streamers, supported by up to two escort vessels of unknown size, and is expected to last around 70 days. The towed hydrophone streamers would be 8,000 meters in length and 2,000 meters, approximately the area of 3,000 football fields. The seismic pulse would be discharged every 2-6 seconds continuously during exploration operations at source levels (loudness at the source) between 200-255 dB re 1 µPa; for reference this is among the loudest produced anthropogenic sounds on the planet and is in the range of military weapons or explosions.

1.2 SUMMARY OF OPINION

The Acoustics Specialist Report and the associated Marine Ecology Report solicited by TGS fail to adequately demonstrate that anthropogenic noise generated by the proposed seismic campaign will not have significant ecological consequences for marine organisms and habitats at the permit location. This is primarily due to (1) the failure to recognize the anthropogenic noise from the project as chronic, (2) the failure to consider the full spatial extent of the noise generated by the project, (3) the omission of an assessment of underwater ambient sound conditions at the site prior to the proposed activities, (4) the failure to evaluate potential impacts on the broader marine community, including population-level effects, and (5) the failure to incorporate the most up-to-date and relevant scientific recommendations for assessing industrial noise impacts on marine ecosystems.

Consequently, the mitigation actions proposed in the associated Environmental Impact Assessment (EIA) are based on an inaccurate assessment of noise impacts and fail to meaningfully address the potential or likely impacts of anthropogenic noise on the marine environment related to the seismic exploration. Moreover, the mitigation actions proposed in the EIA fail to address the full range information contained in the specialist reports and reiterated within the text of the EIA, this willful omission results in even less comprehensive or appropriate mitigation measures.

1.3 PRIMARY FAILURES OF THE BAR and ASSOCIATED SPECIALIST REPORTS

1. Inadequate Premise and Limited Scope of Impact
   The Acoustics Specialist Report is founded on a flawed temporal premise and exhibits a narrow scope that fails to comprehensively address the complexities of anthropogenic noise impacts on the environment. As the primary resource used to assess mitigation needs associated with anthropogenic sound, the report is severely lacking. The fault of this should be attributed to TGS- who commissioned the report and determined the scope assigned to the contracting agency.

2. Appropriateness of Inference in Marine Ecology Report
   The Marine Ecology Report uses the outputs of the Acoustics Specialists Report in concert with data from a desk study to assess acoustic impacts on the marine environment; as such it contains the same flaws as the Acoustics Specialist Report and additionally underestimates the severity of seismic survey noise impacts. The report suggests insufficient mitigation strategies that fail to consider population-level impacts, soundscape level impacts, or chronic impacts associated seismic operations.

3. Insufficient Mitigation Measures within the EIA
   The proposed mitigation measures do not adequately address the potential acoustic impacts of the proposed project on the marine ecosystem, leaving significant risks unmitigated. The best available science was not considered when assessing the impact of the project, the scope of the available information was overly narrow, and the EIA selectively omits information included in the specialist reports and the broader literature.

2 GENERAL INTRODUCTION TO ANTHROPOGENIC NOISE IN THE MARINE ENVIRONMENT

Anthropogenic noise refers to sound generated by human activities, including infrasonic (below the range of human hearing) and ultrasonic vibrations (above the range of human hearing), as well as sounds within the human audible range. Anthropogenic noise poses a significant threat to organisms that rely on sound for vital life functions such as foraging, breeding, migration, and social interaction. Its effects are particularly severe in marine ecosystems, where sound travels vast distances with minimal energy loss. Most marine species have evolved to depend on sound as their primary sensory modality.

Social cetaceans and seabirds, including whales, dolphins, and penguins, rely on acoustic signals for communication, foraging, and social cohesion. Bottom-dwelling animals, fish, and invertebrates also respond to environmental sounds; for example, larval stages of various species use sound cues to time their transition from open water to benthic habitats. Alterations to the marine soundscape impact how marine animals interact with their environment, have the potential for both short term individual harm, and may result in shifts in long-term population dynamics.

Anthropogenic noise impacts ecosystems by disrupting communication, displacing species from critical habitats, altering foraging and predator-prey behaviors, increasing physiological stress, causing physical harm (including hearing loss), and even leading to mortality. Assessing these effects requires an interdisciplinary approach, combining ecology, resource management, acoustics, and statistics. Research on marine responses to noise has documented behavioral changes, auditory impairments, increased mortality, and reduced reproductive success. As such, any activity that generates noise may have significant ecological consequences, underscoring the need for comprehensive environmental impact assessments.

2.1 RELEVANT DEFINITIONS AND EXPLANATIONS

Characterizing Sounds

When determining the impacts of noise on an organism or an ecosystem, the sound must first be characterized. Sound is broadly characterized according to the following:

1. Duration: how long each signal lasts
2. Frequency (or pitch): how high, low, or broadband (simultaneously high and low) a sound is
3. Pulsivity: whether a sound is impulsive (like a series of bangs from fireworks) or continuous (like traffic noise)
4. Chronic versus discrete: Does the noise occur in a single short time period (like a jackhammer outside of an apartment window for a morning) or does it persist over long time periods (like an apartment which abuts a train track with trains passing by every day for many years).

Inappropriately characterizing noise has severe implications on individuals or organisms, and improper characterization can hide ecological impacts that may be significant. For example:

1. Duration: It would be misleading to characterizing the duration of a fireworks display that took place from 7pm until 11pm as having an average duration of 1.1 seconds (the length of time of a single firework).
2. Frequency: It would be misleading to say that simultaneously blowing 10,000 dog whistles (which are too high pitched for humans hear) would not impact a mother dog and her pups that were feeding 1 meter from the whistle blowers, simply because it doesn't substantially contribute to overall low frequency sound levels.
3. Pulsivity: It would be misleading to say that animals were capable of adjusting the timing of their calls to vocalize in between sound signals, if the sounds were continuous and there was no break between sounds.
4. Chronic vs. discrete: It would be misleading to say that the sound of a jackhammer outside of a bedroom window would have negligible effects on the apartment residents because it only occurred for three hours, when in reality the sound of the jackhammer occurred for three hours every day at 3am for 20 years.

Determining Ecological Baselines

To assess whether elevated noise levels associated planned human activities will impact an ecosystem, it is crucial to understand the environment's sound profile prior to the proposed human interference. This process is referred to as "determining the baseline soundscape," defined as the acoustic condition of a site before anthropogenic disturbance.

Components of a Baseline Soundscape Assessment: A baseline soundscape assessment should provide a thorough analysis of the sonic environment prior to proposed anthropogenic activities, focusing on spatial and temporal variations in sound levels and frequencies. Key components include:

1. **Identification and Characterization of Natural Sound Sources**: This includes biophony (sounds from living organisms), geophony (natural environmental sounds), and anthrophony (human-generated sounds).

2. **Data Collection Across Habitats and Seasons**: The assessment should capture sound data across different habitats and seasonal variations within a proposed site, enabling the detection of changes in sonic diversity and diel sound patterns associated with alteration.
3. **Evaluation of Sound Pressure Levels**: This includes assessing sound levels across ecologically relevant frequency ranges and identifying key signals, correlating these findings with ecological functions.
4. **Establishment of Reference Points for Ambient Noise Levels**: Identifying pre-project sound levels and sources is essential for future impact assessments and for effective project management and harm prevention. In the absence of pre-project sound levels, contributions of the project to the soundscape cannot be assessed, and preventative mitigation cannot be employed.

Mischaracterization or omission of baseline soundscape elements can significantly impact ecological interpretation, leading to negative ecological consequences across several scales. For example:

1. **Erroneously Assigning Acoustic Baselines**: An urban task force tasked with determining whether traffic noise affects the foraging habitat of a rare bird compares ambient noise levels during moderate traffic and a period with a single tractor-trailer truck. They conclude noise has no impact based on equivalent noise levels. However, a second task force compares recordings from a traffic-free Sunday morning and a Monday rush hour, revealing a 300% increase in ambient noise due to traffic—an important change that would be overlooked with a mischaracterized baseline.
2. **Omitting Frequency Analysis**: The same task force examines whether new power lines interfere with bat echolocation (ultrasonic frequencies >20 kHz). They report a small increase in average sound levels between 1 kHz and 30 kHz, concluding the noise increase is not ecologically significant. However, noise levels in the bats' communication range exceed 400% when power lines are active, indicating that their findings could lead to hearing loss in bats.
3. **Omitting Temporal Patterns of Sound Sources**: A contractor records baseline sounds for only 10 seconds each hour over a single autumn day, outside the typical mating and migration seasons. Consequently, the report lacks data on these critical signals and inaccurately concludes that elevated noise levels won't impact them. In reality, migrating and mating animals acoustically present for several months each year were simply not recorded.

3 SPECIFIC COMMENT AND CRITIQUE OF SPECIALIST REPORTS

3.1 INADEQUATE PREMISE AND LIMITED SCOPE OF ACOUSTICS SPECIALIST REPORT

3.1.1 Appendix 3.5 – "TGS: South Africa Orange Basin 3D Seismic Survey Sound Transmission Loss Modelling" (Acoustics Specialist Report), prepared by Environmental Impact Management Services Inc. (EIMS), presents a Sound Transmission Loss

Modeling (STLM) study to assess the spatial extent of noise impact on marine fauna within the proposed survey area off the West and South-West Coast of South Africa. This report was commissioned by TGS and used as the basis for risk assessment and mitigation planning associated with the proposed project.

3.1.2 The science contained within the report appears to be thorough. Due to fundamental flaws in its initial assumptions and the project scope requested by TGS, however, the Acoustics Specialist Report fails to accurately represent the real-world impacts of 3D seismic exploration on the marine soundscape and marine organisms within and beyond the proposed permit area. The report is based on incorrect premises regarding both the temporal and acoustic characteristics of the noise. EIMS' study focuses on the impact of discrete, 24-hour, pulsive noise on low-frequency sound levels in an otherwise pristine marine environment. Specifically, EIMS was tasked with identifying zones of impact from single airgun pulses and the cumulative effects of multiple airgun pulses over a 24-hour period (Acoustics Specialist Report, p. i).

3.1.3 In reality, the proposed project involves chronic pulsive noise coupled with continuous vessel noise over several months (70 days), significantly raising ambient sound levels in the low and mid-frequency ranges that affect marine mammals, fish, and invertebrates, both within and beyond the proposed project area. If the project were limited to 24 hours and only involved airguns, the study's assumptions might be valid. However, the cumulative effects of sustained high-intensity noise from multiple sources over 70 days are far more impactful than the short-term effects modeled in the report.

3.1.4 The Acoustics Specialist Report's failure to consider the added impacts of multiple sound sources on both direct (injury) and indirect (behavioral) effects on animals significantly undermines the assessment and its use for determining robust mitigation plans. The study exclusively considers the threats posed by airguns, primarily modeling the temporary threshold shifts (temporary deafness, TTS) and permanent threshold shifts (permanent deafness, PTS) associated with their use, with moderate to minimal consideration for behavioral impacts. However, additional sound sources—including two support vessels, a seismic ship measuring 100 meters in length, and generator noise on the ship—are also critical sources of noise associated with the proposed project. Recent research investigating marine mammal response to noise associated with seismic operations indicates that the behavioral response to seismic vessels is at the same magnitude as the airguns themselves[1] Notably, while airgun noise is generally considered low-frequency (<200 Hz), the frequency range produced by vessels is broader (also including mid-high frequency components), which were not included in the noise impact assessment. Noise from these additional omitted sources contributes to the overall ambient sound levels, collectively affecting the acoustic environment that marine organisms rely on for survival.

3.1.5 No baseline soundscape assessments were made for the proposed permit region within the Acoustics Specialist Report nor the BAR. No effort was made to quantify the naturally occurring sound levels for this region, the sources of naturally occurring sounds, or the seasonal and temporal cycles in ambient sound levels that may serve as

ecologically important cues. Given that marine organisms use sound for navigation, prey detection, predator avoidance, and foraging, alterations to the natural soundscape within and beyond the permitted region may have severe ecological consequences. In the absence of known natural ambient noise levels, it is not possible to assess how much the proposed activities will increase ambient noise levels in the soundscape—and therefore also not possible to assess underwater noise impacts.

3.1.6 The contribution of this project to the ambient soundscape is particularly relevant given that airguns produce some of the loudest known underwater sounds on the planet[2,3] and in some cases, can be detected 4,000 kilometers from the source[4]. The Acoustics Specialist Report failed to quantify how many total square meters would be ensonified as a result of the proposed project (see Wood 2010 for an example)[5]. However, based on the modeling reported, the detection of airguns is certain to expand beyond the permitted area and into the Critical Biodiversity Areas (CBA) and Marine Protected Areas (MPA) within and beyond the permitted area (Acoustics Specialist Report, Figure 17; Marine Ecology Report, Figure 42). Additionally, seismic and support vessels will operate beyond the limits of the proposed permit region, transiting through both CBAs and MPAs. The contributions of these sound sources to sensitive habitats were not modeled or addressed. Soundscape impacts and ensonification ranges were not solicited by TGS, and would have indicated a much broader spatial impact of the project than is currently reported

3.1.7 Noise produced from industrial activities cannot be physically contained underwater and may inundate critical biodiversity locations proximate to proposed operations and associated vessel activities. This requires careful consideration given the known impact of noise on marine mammals (stress, behavioral responses, reduction in foraging[6]), fish (behavioral responses, physiological responses, antipredator responses, death[7,8]), larval invertebrates (reduction in settlement, larval deformation [9–11]), and pelagic zooplankton (death[12]). Anthropogenic noise within CBAs and MPAs may harm, alter, or lead to death or population decline across a wide range of organisms and life stages that make up both ends of the trophic web. Because noise cannot be contained to the project site due, the impacts of noise are further reaching than the directing region of interest and must include coastal and adjacent pelagic areas as well.

3.1.8 An adequate baseline assessment of the acoustic properties of the soundscape—including biological sources of ambient sound, environmental sources, and ambient sound levels—is needed to complete an assessment of underwater noise impacts. Broader-scale sound propagation modeling, including the total range of ensonification associated with airguns and general project operations (seismic ship returning to port, support vessels, aircraft), throughout both pelagic and coastal habitats – inclusing seismic ship travel routes – is essential for adequately assessing project impact, risk, and mitigation strategies. This is particularly relevant for the Child's Bank, the Tripp Seamount, Cape Canyon and Cape Valley, which will likely experience changes in ambient soundscape conditions associated with the project. The report models ensonification up to 200 km, and notably the project is associated with high noise values up to that range (e.g., Acoustics Specialist Report, Figure 17).

3.1.9 The Acoustics Specialist Report overlooks the broader ecosystem-scale consequences of injuries caused by anthropogenic noise. The report focuses primarily on direct physical injuries to marine organisms, such as hearing damage from airgun blasts. This is not a comprehensive assessment. Temporary or permanent hearing loss, stress, and direct or indirect death in fishes and invertebrates are all physical consequences of anthropogenic noise exposure. However, the repercussions of such injuries extend beyond individual organisms and can affect entire ecosystems. When marine mammals or fish experience hearing loss, their ability to communicate, navigate, and locate predators or prey is compromised. This impacts their survival and can also disrupt predator-prey dynamics within the ecosystem, leading to population imbalances. Additionally, both injuries and anthropogenic noise in isolation can lead to stress responses in affected species, potentially resulting in altered reproductive success and decreased population resilience. The failure to adequately assess these ecosystem-level consequences limits the understanding of how noise pollution can disrupt ecological interactions and degrade marine biodiversity.

3.1.10 In addition to the direct impacts on individual animals, the report fails to consider the population-level consequences of behavioral changes induced by noise exposure. Noise from airgun activities can lead to significant shifts in the behavior of marine species. Responses of fishes to anthropogenic noise include reduction of anti-predator response, which leave individuals at higher risk of being eaten, acoustic masking of breeding sounds which may impact species at the population level, and reduced breeding success [2,13,14]. Marine mammals may alter their vocalization patterns, leading to reduced communication effectiveness. Fish may also exhibit changes in schooling behavior or abandon critical habitats due to increased noise levels. Such behavioral changes can affect reproduction rates, survival, and population dynamics over time. Furthermore, if key species alter their foraging behaviors or habitats, the repercussions can cascade through the food web, impacting other species reliant on them. The Acoustics Specialist Report's neglect of the consequences of behavioral shifts and their population-level impacts undermines the comprehensive assessment needed to understand the full ramifications of the proposed project on marine ecosystems.

3.1.11 The report also fails to quantify the number of marine animals likely to be acoustically impacted by airgun and other anthropogenic noise sources, missing an opportunity to address critical factors such as sex and behavioral state that influence vulnerability to noise exposure. Research indicates that certain demographics, such as nursing females, may be more sensitive to noise due to their specific behavioral contexts[15]. To fully understand the implications of noise exposure, it is essential to estimate the proportion of populations that could be affected by the proposed activities, particularly for vulnerable species. Furthermore, long-term consequences for impacted individuals can include decreased reproductive success and altered migration patterns[16,17], which can lead to population declines over time. A robust assessment would not only quantify the number of individuals affected but also evaluate the potential implications for population viability, particularly in the context of ongoing anthropogenic pressures[18]. This level of analysis is critical for informing appropriate mitigation strategies and ensuring the long-term sustainability of marine populations.

3.1.12 Since the release of the Acoustics Specialist Report, more recent scientific studies have emerged that challenge the premise of using blanket sound exposure level (SEL) or sound pressure level (SPL) thresholds to assess the impacts of anthropogenic sound on marine animals (Southall 2024). The Acoustics Specialist Report heavily relies on Southall (2019) to justify using these thresholds to determine varying levels of risk, while omitting the caveats included in the 2019 publication. Southall 2019 states that "***The approaches [in Southall (2019)] are not applicable in evaluating potential auditory effects of chronic noise exposure over periods of weeks, months, or years.***"[19]

3.1.13 In the updated guidelines, Southall (2024) again explicitly states that "simplistic received level-only step-function 'thresholds' indicating a binary lack or presence of response for any sound type are outdated and inconsistent with the best scientific information available"[19]. The Acoustics Specialist Report relies on exactly these binary thresholds, despite strong scientific evidence that this method is flawed[18,19]. Moreover, Southall (2024) highlights the issue of appropriately assessing the temporal scale (chronic impacts versus acute impacts) as a major flaw in the method used in the Acoustics Specialist Report. According to Southall (2024), "Where the acute exposure-response severity scale-based assessment approach really falls short is in the evaluation of repeated or sustained exposures for aggregations and/or local populations of animals on broader spatial and temporal scales." Given the multiple months of sound exposure to this ecosystem (70 days), this should be considered a chronic rather than acute sound source.

3.1.14 Beyond the 2024 publication, which the agency responsible for the Acoustics Specialist Report may not have had access to, Southall (2021) offers clear recommendations on acoustic exposure and the types and severity of behavioral responses, focusing on vital rates during acute events. Notably, Southall (2021) was not cited in the Acoustics Specialist Report, despite the report's goal of determining zones of impact for behavioral responses Acoustics Specialist Report, p. i). Given the Acoustics Specialist Report's reliance on Southall (2019), it should be assumed that the work of Southall—internationally regarded as industry standard and best practice—is considered reliable by EIMS. The omission of the most recent work is yet another indication that the Acoustics Specialist Report fails to reach the necessary depth to be used for reliable environmental impact assessment. These flaws can be predominantly associated with the scope of the project as requested by TGS.

Summary of Comments on Acoustic Specialist Report:

1. **Inaccurate Assumptions in Acoustic Specialist Report:** The report is based on incorrect assumptions, primarily focusing on short-term impacts from 24-hour airgun pulses. However, the actual project will involve 70 days of chronic, high-intensity noise, including both airguns and continuous vessel noise, leading to significantly higher impacts than modeled.
2. **Underestimated Noise Sources:** The study overlooks the noise contributions from multiple sources, including support vessels and generator noise, which affect both low and mid-frequency ranges critical to marine fauna and elicit behavioral responses. These omitted noise sources exacerbate the overall impact of seismic operations on the marine soundscape.

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3. **Lack of Baseline Soundscape Assessment:** No baseline data on natural ambient noise levels or soundscape characteristics in the project area were collected, making it impossible to accurately assess how much the proposed activities would increase ambient noise levels.
4. **Broader Spatial Impact Unaccounted For:** The report fails to quantify how far noise will travel beyond the project area, particularly into Critical Biodiversity Areas (CBAs) and Marine Protected Areas (MPAs), where noise could have far-reaching ecological consequences.
5. **Insufficient Consideration of Ecosystem-Level Consequences:** The report focuses primarily on direct physical injuries (such as hearing loss) but does not adequately address the indirect effects on behavior, communication, and predator-prey dynamics, which could disrupt entire ecosystems.
6. **Failure to Address Behavioral and Population-Level Impacts:** Noise-induced behavioral changes, such as altered communication or abandonment of critical habitats, are not properly assessed. These changes could lead to population-level consequences, affecting reproduction, survival, and overall ecosystem stability.
7. **Outdated Noise Thresholds and Methodologies:** The report relies on outdated sound exposure thresholds that fail to account for the chronic nature of the project's noise impacts. More recent scientific guidelines suggest that this approach is insufficient for assessing long-term impacts on marine animals.
8. **Missing Quantification of Impacted Marine Animals:** The report does not estimate the number of marine animals likely to be affected by the noise, nor does it consider the heightened vulnerability of specific demographics, such as breeding males or nursing females, to noise exposure.
9. **Need for Scaled Sound Propagation Modeling:** The report requires a broader-scale sound propagation model and an assessment of the full spatial and temporal extent ensonification.

3.2 COMMENTS ON APPROPRIATENESS OF INFERENCE IN MARINE ECOLOGY REPORT

3.2.1 Appendix 3.1 – " PROPOSED 3D SEISMIC SURVEY IN THE ORANGE BASIN OFF THE WEST COAST OF SOUTH AFRICA: Biodiversity and Ecosystem Services Assessment " (Marine Ecology Report), builds on the information provided in the Acoustics Specialist Report. As such, it shares same shortcomings, as well as additional issues with scope, depth, and inappropriate inference of acoustic information and application to mitigation strategies.

3.2.2 The Marine Ecology Report mirrors the shortcomings of the Acoustics Specialist Report by considering TTS an acceptable impact after mitigation, despite significant unknowns regarding the consequences of temporary hearing loss for affected populations and species. The Marine Ecology Report fails to account for the potential impacts of repeated noise exposure over multiple days, which could have more serious long-term effects that those assumed in the report. Established methodologies, such as those from Wood (2010) and Southall (2024), provide

guidance on assessing environmental impacts based on sex and behavioral states. However, the Marine Ecology Report neglects to incorporate these variables or critically to estimate the total proportion of marine populations of any species likely to be affected by the 70-day project. This omission occurs, despite the acknowledgement that portions of the proposed permit area are ecologically valuable for critical species and are in some cases considered vulnerable to human activities (Marine Ecology Report, "3.4.2 Conservation Areas and Marine Protected Areas"). Instead, the report applies the same simplistic binary threshold approach as the Acoustics Specialist Report, without considering chronic impacts or population level consequences.

3.2.3 In the case of marine mammals, prolonged exposure to noise is associated with chronic stress, internal and external injuries, displacement from breeding and foraging areas, altered migratory patterns, and permanent hearing loss[17,20-23]. Despite the vulnerability of local cetacean species such as humpback whales, sperm whales, Bryde's whales, and beaked whales found in the proposed permit area (Marine Ecology Report, Table 7) neither the Marine Ecology Report nor the Acoustics Specialist Report adequately addresses the risks associated with chronic noise exposure for these animals at the individual or population level. The assumption was made that animals would likely leave the area, but there was no quantitative estimation of the number of individuals impacted, the probability of habitat abandonment, the change in probability associated with age, sex, or behavior state (e.g. cows and calves versus adult males). This is particularly critical for data deficient species (fish, invertebrates, benthic organisms in abyssal regions) and deep diving odontocetes expected to use much of proposed region.

3.2.4 The Marine Ecology Report and associated EIA recommendations (BAR Section 9: Environmental Impact Assessment) fail to adequately suggest mitigation measures that will address the acute risks of seismic operations to the marine environment. The proposed measures, including a 500 m buffer around sensitive areas, a 500 m mitigation zone, Marine Mammal Observers (MMO), Passive Acoustic Monitoring (PAM), and operational responses based on animal proximity, are inadequate. For example, the report acknowledges that certain species, including beaked whales, are at risk of fatal acoustically induced decompression sickness —a behavioral response with an acute outcome (Marine Ecology Report, p. 67). Very high frequency cetaceans, which includes most odontocetes and beaked whales and will be impacted at ranges of 650 m (injury) and 3.8 km (behavioral responses), yet the mitigation zone is only 500 m. This is a clear misalignment between the proposed mitigation strategies and the data driven spatial extent of impact to marine species. Per the information included in the Marine Ecology Report, this misalignment may result in odontocete fatality.

3.2.5 Similarly, the Marine Ecology Report downplays the impact of noise on invertebrates and prey species, and the report suggests ineffective mitigation strategies to minimize the impact of seismic operations. While the report acknowledges the physiological and behavioral responses of squid (Marine Ecology Report, "4.3.6 Impacts of Seismic Noise

on Marine Invertebrates")— a primary prey source for marine mammals, including beaked whales, in Southeast African waters [24,25]—it incorrectly downplays squid mortality as having a LOW impact due to temporal and spatial scale. The report claims the impact on squid would be REGIONAL and IMMEDIATE- 1.5 months, but mortality is permanent and behavioral responses of surviving squid will likely occur beyond the permitted region, as the acoustic influence zone (2–5 km) extends beyond the survey area during operations (EIA, p. 215, area (Acoustics Specialist Report, Figure 17; Marine Ecology Report, Figure 42). The loss of squid would significantly affect trophic interactions, especially in a system already low in food sources. The report's claim that the removal of squid (a scarce resource) is low impact, is akin to draining a desert oasis and labeling the impact low because water is rare there anyway.

3.2.6 Additionally, the proposed mitigation measure intended to minimize harm to cephalopods —"Terminate seismic shooting upon observing any obvious mass squid mortalities estimated by the MMO as a direct result of the survey"—is ecologically unsound. Squid, which are found at depth, are neutrally or negatively buoyant and will not float to the surface for meaningful observation [26]. Even if they did float to the surface, they are highly camouflaged and ship movement would scatter them, making detection by the MMO virtually impossible. This suggestion that MMO's would be capable of reporting squid mortality is unrealistic, and the consequences of squid mortality are ecologically meaningful.

3.2.7 Impacts to Plankton and Ichthyoplankton were considered MEDIUM before mitigation, and LOW after mitigation. However, the proposed mitigation measures – for example no seismic operation within 5 km of important ecological areas – directly minimize the duration or extent of high source level sounds inundating the marine soundscape (see Figure 45a, Marine Ecology Report for a visualization of spatial scale, see also Madsen et al 2006)[27]. Noise associated with seismic operations will extend well beyond 5km, and vessel noise within ecologically vulnerable areas may have meaningful impacts that were omitted from this assessment. Fishes exposed to anthropogenic noise experience reduced anti-predator responses, leaving them more vulnerable to predation, acoustic masking of breeding sounds, reduced breeding success, temporary or permanent hearing loss, stress, and death[17,28,29]. Many larval invertebrates and fishes, such as corals, shellfish, and crustaceans, rely on sound to locate suitable habitat for settlement—the transition from their pelagic phase to a permanent location.[30–37] Acoustic masking of environmental cues within MPAs CBAs or other vulnerable habitats exposed to both seismic and vessel sounds may disrupt this process for key structure-building organisms.

3.2.8 Importantly, like the Acoustics Specialist Report, the Marine Ecology Report fails to consider population-level consequences for any species of interest. It makes no effort to quantify the number of individuals affected by the proposed activities or to assess the potential short- and long-term impacts on population dynamics. These omissions minimize the overall consequences of the proposed seismic activities. Understanding population-level impacts is critical, as disruptions to even a small number of individuals can have cascading effects on the species' reproductive success, genetic diversity, and

long-term survival, or may have meaningful trophic implication as prey species (like squid) grow scarce.

3.2.9 Lastly, the Marine Ecology Report fails to quantify soundscape properties in relation to other oceanographic features, such as bathymetry and currents. Since sound is the primary way marine organisms interact with their environment, the omission of a basic soundscape description and the potential impacts of the proposed project on it is a significant oversight.

Summary of Comments on Marine Ecology Report:

1. **Inadequate Consideration of Temporary Threshold Shifts (TTS)**: Based on mitigation suggestions the Marine Ecology Report TTS an acceptable post-mitigation outcome and fails to address the long-term consequences of temporary hearing loss to individuals of specific species or populations. There is also no consideration for the cumulative effects of multiple days of noise exposure. It overlooks more detailed approaches, such as assessing impacts based on species' sex and behavioral states, and neglects to estimate how much of the marine population will be affected by the 70-day project.
2. **Chronic Noise Exposure Risks**: The report downplays the significant risks of prolonged noise exposure for vulnerable cetacean species (e.g., humpback whales, sperm whales, beaked whales). It fails to assess how chronic noise might cause stress, injuries, altered migration patterns, and permanent hearing loss. There is also no quantitative estimation of how habitat alteration might affect these species.
3. **Insufficient Mitigation for Acute Noise Impacts**: The mitigation strategies proposed, including a 500 m buffer zone, are insufficient to minimize acoustic impacts to marine species (e.g, beaked whales and cephalopods). This highlights a failure to align mitigation efforts with the real world risks.
4. **Failure to Address Population-Level Impacts**: The report does not estimate how many individuals will be affected or assess the broader population-level consequences of direct or indirect harm, which downplays the long-term impacts of seismic exploration to this marine ecosystem.
5. **Omission of Soundscape Analysis**: The report neglects to assess the soundscape in relation to key oceanographic features (e.g., bathymetry, currents), despite sound being critical for marine organisms' interactions with their environment.

Overall, the report underestimates the severity of both acute and chronic noise impacts on marine life and offers inadequate mitigation strategies without accounting for population-level or soundscape effects.

3.3 INSUFFICIENT MITIGATION MEASURES PROPOSED WITHIN BAR SECTION 9 "ENVIRONMENTAL IMPACT ASSESSMENT" (EIA)

Throughout, the EIA fails to effectively propose mitigation measures that will address the acoustic impacts of seismic operations on the marine environment. Broad criticisms of the BAR's approach to mitigating acoustic impacts as well as specific criticisms on mitigation measures are below.

Broad Concerns Associated with BAR Section 9, Environmental Impact Assessment (hereafter "EIA")

3.3.1 **Failure to Address Habitat Variability:** The BAR fails to adequately account for the variability in habitat sensitivity within the proposed permit region. The region in question displays significant bathymetric variability (BAR, p. 46), with habitat use and biodiversity differing greatly throughout the area (Marine Ecology Report, p. 19). For example, the Marine Ecology Report highlights the continental slope region (200–2000 meters in depth) as likely to support cetaceans and endangered fishes (Marine Ecology Report, Table 1 & p. 50), yet, the EIA (BAR, Section 9 "Environmental Impact Assessment") does not propose targeted mitigation measures for activities on the continental slope. Environmental mitigation measures should consider different operational behaviors based on habitats expected to harbor higher biodiversity or be home to species of concern.

Different marine habitats support distinct species assemblages, each with its own sensitivities to human-induced disturbances. The lack of appropriate mitigation in certain regions could result in physical damage to sessile organisms that inhabit specific habitats but lack the ability to abandon an environment when seismic operations commence. Alternatively, mobile organisms like cetaceans are more likely to congregate along continental slopes where nutrient upwelling attracts prey (Marine Ecology Report p. 50). Ignoring habitat-specific sensitivities increases the risk of disrupting critical ecological processes

3.3.2 **Inconsistencies within the BAR**: The BAR and associated EIA contain inconsistencies. For example, the BAR proposes a long-term soundscape analysis for acoustics mitigation (BAR, p. 259) but fails to specifically include this measure in mitigation plans or to indicate spatial and temporal extent as part of the preventive strategies. The BAR also specifically acknowledges the need to minimize ambient sound levels associated with seismic operations (BAR, p. 245), yet requires no concrete mitigation measures regarding implementing technological or operational adjustments.

The EIA makes broad recommendations without considering the specific environmental conditions or the species most at risk at any given location or time of year. For example, seismic operations are proposed for January-May to minimize impact to baleen whales and commercially important fisheries - yet the BAR states that "it should also be kept in mind that some of the migratory species are now present year round off the West Coast, and that certain baleen and toothed whales are resident and/or show seasonality opposite to the majority of the baleen whales" (BAR, p 244). Despite this acknowledgment, these data were not meaningfully incorporated into planning or mitigation.

Effective EIAs should provide consistent, integrated, and transparent evaluations of all potential risks. A fragmented approach can result in a gross underestimation of cumulative or synergistic effects, where multiple stressors interact to amplify the harm caused.[38]

3.3.3 **Overly Optimistic Reliance on MMOs and PAM** The EIA fails to provide a clear scientifically driven, adaptive plan for real-time responses based on monitoring during the seismic survey. The existing plan incorporating real-time monitoring data (e.g., Passive Acoustic Monitoring (PAM) or Marine Mammal Observers (MMOs) is touted as a catch all to mitigate nearly every acoustic impact. MMOs, however, are limited in the scope and scale of their observations and PAM only captures loudly vocalizing animals (essentially omitting invertebrates and fish). Research indicates that the visual extent of MMOs from large ships is limited to 1 km, [5,18] yet per the Acoustics Specialist Report and the Marine Ecology Report acoustic impacts to marine mammals occur well beyond this range. MMOs are tasked with documenting mammals, fish, turtles, seabirds, fishes and invertebrates. This is both unrealistic and unreasonable. Many species of concern (e.g., odontocetes like sperm whales or beaked whales) have dive times in excess of one hour and surface intervals of less than a minute[39,40], making them hard to sight. Invertebrates, like squid, are negatively or neutrally buoyant[41] and aren't likely to be at the water's surface. Similarly, most fish species can't be reliably cited from a ship observation platform. Thus, while MMOs and PAM operators are crucial for reducing seismic operation impacts, they are not a panacea to address all potential risks.

3.3.4 **Incorrect Temporal Scale** The EIA focuses on short-term acoustic impacts (seconds to hours), despite the project involving approximately 70 days of seismic operation. This narrow focus disregards the long-term implications of chronic noise exposure. Prolonged anthropogenic[20,42,43] noise can lead to cumulative effects such as chronic stress, hearing damage, and altered behavioral patterns in marine species.[17] These chronic impacts, especially over the course of two months, are more likely to disrupt population dynamics, such as habitat avoidance or disrupted breeding patterns, which were overlooked in the assessment. Noise from the seismic survey is both chronic and spatially far-reaching, making the EIA's temporal scope inaccurate (See Commentary on Acoustics Specialist Report).

3.3.5 **Unknowns Are Disregarded** The EIA does not sufficiently account for unknown variables, including species-specific responses, role of behavioral states, lack of biodiversity data and ecosystem sensitivities. Uncertainty is inherent in ecological impact assessments, particularly when dealing with complex, dynamic marine ecosystems. It is essential to adopt the precautionary principle in such cases, ensuring that mitigation measures err on the side of caution to protect ecosystems from unforeseen consequences [18,44]. By failing to address these unknowns, the EIA underestimates in the scoring system and in its overall assessment the potential impacts of the seismic activity on species and habitats. The failure to collect baseline data significantly increases uncertainty; despite this, the EIA does not recommend commissioning ecological studies to address biological unknowns.

3.3.6 **Disregard for Far-Field Sound** The EIA does not adequately consider the effects of far-field sound, which can propagate over long distances and affect distant marine life. On page 58 of the BAR states that for areas that "receive the sound in the far field only, no detrimental effects to the communities or to individual benthic species are expected" (BAR, p. 58). However, seismic noise can travel thousands of kilometers [4], disrupting long-range communication among marine species such as cetaceans.[45] Far-field sound from seismic airguns will extend well beyond the immediate operational area, including into Critical Biodiversity Areas (CBAs) and Marine Protected Areas (MPAs) (see commentary on Acoustics Specialist Report and Marine Ecology Report), yet the EIA does not quantify the extent or ecological consequences or far field sound, nor does the EIA recommend broader scale acoustic modeling.

3.3.7 **Generalized Masking Effects** The EIA, acknowledges the importance of acoustic masking to marine organisms (BAR, p. 198) but overgeneralizes the effects of noise masking, failing to account for species-specific auditory ranges and behavioral needs. Different marine species rely on unique frequency ranges for communication, predator detection, and prey location [35,42,46–47]. A generalized approach that does not differentiate between species' auditory sensitivities can result in inadequate mitigation. For instance, what may be a moderate disturbance for one species could be catastrophic for another. Masking effects should be assessed separately for each species, given their varying hearing thresholds and reliance on the sonic environment.

3.3.8 **Disregard for Chronic Impacts** The EIA does not sufficiently consider the long-term effects of temporary injuries, such as hearing loss, resulting from seismic exposure. Temporary hearing loss can have severe long-term consequences if it impairs an animal's ability to communicate, forage, or avoid predators. Chronic exposure to noise may also lead to habitat abandonment or reduced reproductive success, ultimately affecting population resilience.[17,42,50] Seismic operations, particularly over 70 days, will result in chronic, not just temporary, impacts, leading to long-term harm to individuals and populations that depend on the proposed permit region.

3.3.9 **Disregard for Cumulative Impacts of Project Stressors** The EIA does not adequately consider the cumulative impacts of multiple noise sources, such as airguns, vessels, and ambient noise, over the duration of the 70-day seismic survey. Despite including a discussion on Cumulative Impacts (e.g., BAR section 9.2) generally, the BAR adopts a siloed approach in assessing risks Per the EIA impact assessment protocol, the criteria required to score a "High" Cumulative Impacts is stated as: "Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change" (BAR, Table 39). Yet there is no transparent measure assessing the interactive impact of each potential threat. Instead, the TOS appeared to assess risks in isolation rather than integrating them. For instance, there is no apparent analysis concerning the impact to species that

experience temporary hearing loss (TTS) alongside habitat displacement- and although this would change the temporal and spatial scale of impact that is not reflected in the mitigation assessment. Similarly, the combined effects of anti-predator behaviors triggered by vessel noise and physiological stress associated with seismic noise may change reproductive output in fishes, which would alter the temporal scale of impact – but this scientific probability did not appear to change the risk assessment rating. This piecemeal approach – or at the very least the lack of transparency pertaining to how cumulative impact criteria were scored – significantly underestimates the true impact of the proposed activities.

3.3.10 **Disregard for Cumulative Impacts of Possible Multiple Projects** The EIA fails to propose adequate mitigation to prevent the impact of multiple exposures to marine organisms in association with other proposed survey projects in the region (e.g., Searcher and Gx Technologies). This scenario – multiple projects occurring simultaneously – was not quantitatively modeled within the Acoustics Specialist Report, addressed in the Marine Ecology Report, and therefore adequately assessed in the EIA. The EIA within the BAR considers the impact of the proposed exploration project isolation, with one brief mention of isolated impacts of multiple project (BAR, p. 211). This is a gross oversight that requires comprehensive consideration and mitigation strategies based in realistic data to remedy.

Each additional project in or near the proposed survey region is associated with a set of risks that compound when they occur in close spatial or temporal proximity. Most mitigation measures proposed to address the impact of anthropogenic noise in the EIA would be minimized or completely invalidated by the presence of additional exploration. Part of the EIA mitigation plan hinges on there being a 'safe place' for marine organisms to retreat to avoid the impacts of extremely high amplitude sound, or by minimizing the spatial and temporal scale of sound exposure associated with the project. These assumptions are untrue if multiple project occur simultaneously. The scale of sound propagation greatly exceeds the proposed 40 km mitigation zone proposed to account for the occurrence of simultaneous projects (BAR, p. 211). Moreover, depending on the temporal scale of the other project, this would extend the overall high noise exposure to the environment, rendering the modeled SEL in the Acoustics Report incorrect, increasing the probability for both PTS and TTS for marine organisms, and increasing the probability for elevated stress levels in marine organisms at a regional level. Noting that the sound of seismic exploration, vessels, and other anthropogenic noise sources can travel for hundreds or even thousands of miles, the 40km buffer between ships would have minimal mitigation impact. No additional mitigation measures were proposed (e.g. adjusting the timing of operations, altering seasonality, stopping in the presence of other operations, etc.).

3.3.11 **Flawed Scoring System** The EIA employs a scoring system that does not allow for population-level impacts or the meaningful incorporation of uncertainty. In data-deficient situations, this scoring system biases the assessment toward assuming minimal impact, leading to underestimation of real risks. There is a need to factor in

uncertainty and variability in population responses to ensure a precautionary approach is taken.

3.3.12 **Inadequate Mitigation Zone** The EIA's reliance on a 500 m mitigation zone is insufficient to protect marine life from the harmful impacts of seismic noise. The Acoustics Specialist Report explicitly indicates that behavioral impacts are expected for marine mammals at distances up to 3.8 km from the array source and for fish at 1.3 km. Similarly, a zone of 2-5 km is necessary to avoid significant impacts on squid and other cephalopods (BAR, p. 215). A 500 m zone does not adequately mitigate the risk of injury or behavioral disruptions, especially given the repetitive use of airguns over 70 days. The BAR and associated specialist reports failed to incorporate the best available statistical methods to model habitat abandonment or avoidance, which would provide a more accurate assessment of indirect impacts[18,19,31,32]

3.3.13 **Failure to Use Best Science** The EIA fails to incorporate the best available scientific practices in its mitigation strategies. For example, in the absence of comprehensive biological surveys, best practice recommends assuming the presence of sensitive species and applying conservative mitigation measures to avoid harm. The reliance on outdated scientific recommendations from the Acoustics Specialist Report results in insufficient mitigation strategies. The Specialist Report critiques this failure to integrate the latest scientific guidelines, such as those from Southall et al. (2021), which provide more accurate frameworks for assessing long-term noise impacts (Specialist Report, p. 57).

Selected section specific comments associated with proposed mitigation within the EIA

9.3.1.1 ACOUSTIC IMPACTS OF SEISMIC SURVEYS ON MARINE FAUNA
This section outlines the importance of sound in the marine environment and the broad impacts of the noise associated with seismic operations to the marine environment and fauna. The following specific points are made (p. 128, statistics per the BAR):

1. **Shipping noise** is a significant and persistent source of anthropogenic sound, particularly at low frequencies, and can propagate over large distances, affecting vast marine areas.
2. The **Application Area** for the proposed project lies within busy shipping routes, where ambient noise is expected to be high (90-130 dB) due to shipping traffic.
3. **Seismic surveys** use intense sound sources, which can also propagate over great distances, with sound transmission being influenced by factors like water depth, distance, and ocean conditions. Sound pulses change in character due to reflective boundaries (sea surface, seafloor, etc.).
4. In **shallow waters**, seismic sound can travel up to 75 km, while in **deep water**, detection ranges can exceed 1,000 km under ideal conditions.
5. **Marine animals' auditory masking** occurs when background noise interferes with their ability to detect important environmental sounds. The duration and repetition of seismic impulses can affect animals' hearing thresholds

Despite the BAR's identification of these threats, most of these concerns are not adequately addressed by the proposed mitigation measures. Below is a point-by-point consideration of these omissions.

1. ***Shipping noise:*** *is a significant and persistent source of anthropogenic sound, particularly at low frequencies.* Despite this, the BAR neither commissioned the modeling of noise associated with the seismic ship and vessel operations, nor conducted a baseline soundscape analysis to measure the potential changes associated with seismic operations. Mitigation measures did not include vessel speed limits or daily maximum hours a day of use, both which would minimize vessel noise associated with shipping operations. The EIA within the BAR determined pre-mitigation impact of vessel noise on marine fauna to be "LOW" however, there is no empirical data to support this.

2. ***The Application Area*** *for the proposed project lies within busy shipping routes, where ambient noise is expected to be high (90-130 dB) due to shipping traffic.* TGS failed to measure the *in situ* contributions of vessel noise to the proposed permit area or the adjacent areas likely to be ensonified by seismic operations. It is not possible to test this claim, or to assess how the proposed operations will alter baseline soundscapes. In the absence of *a priori* measurements and comprehensive modeling. While vessels within an environment are loud, seismic operations including vessel operation and have been demonstrated to elevate ambient noise conditions in all known cases, and in broader frequency ranges than anticipated.[4,53–58] Per the Acoustics Specialist Report, ambient sound values will well exceed the 90-130 dB range within and beyond the permitted area in association with seismic operations (Acoustics Specialist Report, Table 11).

3. ***Seismic surveys*** *use intense sound sources, which can also propagate over great distances, with sound transmission being influenced by factors like water depth, distance, and ocean conditions. Sound pulses change in character due to reflective boundaries (sea surface, seafloor, etc.).* In keeping with this point, the Acoustic Specialist Report indicated that "the directivity of received noise is dominated by the directionality of the source array." Simply put, the direction the sound is produced in, dominates the direction the sound impacts. Despite this, no mitigation measures were suggested to restrict directionality of sound sources to minimize impact to biologically sensitive areas within and beyond the proposed permit zone.

4. ***In shallow waters,*** *seismic sound can travel up to 75 km, while in deep water, detection ranges can exceed 1,000 km under ideal conditions.* While this statistic is an underrepresentation (seismic has in certain context been detected for up to 4,000 km [4]), the BAR is correct that seismic sound can be very far reaching. Despite this acknowledgment, and the demonstration in the Acoustic Specialist Report that loud persistent sound sources associated with the proposed project are up to at least 200 km (maximum modeled distance), there were no concrete mitigation measures suggested that would minimize the acoustic energy input into the ocean throughout the project or to assess impact at a broader spatial extent.

5. ***Marine animals' auditory masking*** *occurs when background noise interferes with their ability to detect important environmental sounds. The duration and repetition of seismic impulses can affect animals' hearing thresholds.* It is true that the sound associated with seismic operations can mask critical sounds; behavioral responses also include altering the timing of calling – which may also interfere with important information transfer. Additionally (though unaccounted for in the Acoustics Specialist Report) the seismic ship and support vessels will also mask sounds. Moreover, animals experiencing temporary hearing shifts, will have altered decreased hearing sensitivities, thus increasing the likelihood and impact of masking. Despite these realities, mitigation measures do not adequately prevent the elevation of ambient sound that will lead to masking at broad scales or at altered thresholds, or indeed measure changes in the soundscape from baseline levels. Further, while the zones of behavioral response were modeled in the Acoustics Specialist Report, zones of masking were not solicited by TGS for the report.

9.3.1.1.1 NOISE IMPACT ON WHALES AND DOLPHINS

The overall assessment of seismic noise impact on cetaceans was calculated based on the impact to the individual, rather than the population, thus downplaying the potential impact to cetaceans over broader temporal scales. The proposed mitigation zone falls well below the zone of acoustic response expected for physiological, behavioral, or masking impacts. The Acoustics Specialist Report indicates that behavioral impacts are expected in cetaceans at 3.8 km from the array source. The maximum zones of temporary threshold shifts (TTS, temporary deafness) for very-high-frequency cetaceans are within 650 m of the source (Acoustics Specialist Report, p. i). Under normal operations, TTS zones for low-frequency cetaceans extend up to 5 km from the survey lines. Based on the research available and integrated into the BAR, a 500 m zone is insufficient to prevent injury to animals, especially given the repetitive use of airguns over 70 days. This strategy does not minimize harm. Similarly, because it is currently unknown how the seismic operations will elevate ambient sound (no baseline soundscape analysis was conducted) or how far the sound is expected to travel (lack of total ensonificaiton range) it is not possible to calculate the potential range over which cetaceans will experience acoustic masking. Lastly, while MMOs and PAM operators are extremely useful in mitigating negative impacts on marine mammals, many species (e.g., deep diving odontocetes) surface after long (>60 minute) dives and are extremely difficult to identify at distances greater than 1 km, thus minimizing the effectives of MMOs for long range impacts.

9.3.1.1.6 NOISE IMPACTS ON MARINE INVERTEBRATES

Despite the information contained in the Marine Ecology Report indicating the potential impact of seismic operations on marine invertebrates, and squid specifically (death, injury, displacement), and the acknowledgment that the zone of acoustic impact of for cephalopods is broad (2-5 km, BARp. 204) the BAR and its associated reports erroneously claim that impact of seismic on invertebrates is LOW (see specific comments on the Marine Ecology Report on squid). The proposed mitigation, that MMO would watch for mass squid mortality is functionally meaningless. Squid are neutrally buoyant and therefore would not float to the surface, even if squid did float, given the size of the ship, the water current associated with vessel transit, and the camouflage of the animals, mass mortalities of squid wouldn't be visible from the seismic ship.

9.3.1.1.7 NOISE IMPACT ON PLANKTON

The EIA indicates that pre-mitigation impacts on planktonic communities (the base of the marine food web) would be MEDIUM pre-mitigation. Indicating, by the TGS' admission a potentially biologically meaningful impact. Despite this the BAR states that the "Application Area is located far offshore, it is not deemed necessary to implement mitigation measures to avoid the key spring spawning periods thereby mitigating potential impacts on plankton to some degree." (BAR, p. 204). Put plainly, the mitigation plan is to do nothing; yet according to the EIA this will reduce the threat from MEDIUM to LOW. This is unreasonable, and not based in science.

9.3.1.2.1 IMPACTS OF NON-SEISMIC NOISE (VESSEL AND HELICOPTER NOISE)

The significance of non-seismic noise is said to be "low" before and after mitigation. This cannot be assessed according to the BAR's own criteria in the absence of a baseline soundscape analysis. Vessel noise, particularly as it reaches CBAs, MPAs, and regions of ecological importance (seamounts and caverns containing deep water corals), will alter the soundscape in potentially meaningful ways. This could impact larval recruitment, predator-prey dynamics, and beyond. The EIA, and the reports it relied on for assessment, failed to quantify, model, or predict, elevated ambient noise associated with vessel or aircraft within or beyond the proposed permit area. The assumption that this noise does not meaningfully impact the environment cannot be assessed. No mitigation was suggested, this course of action is not based on scientific information.

4 SUGGESTIONS FOR REASSESSMENT OF NOISE IMPACTS

NOTE This is a **minimal** selection of suggested assessment and mitigation measures pertaining to acoustics impacts associated with the proposed seismic operations. These measures alone will not be sufficient to minimize the acoustic impact to the marine environment within and beyond the proposed permit region. These suggestions are needed in order to assess if or how to develop mitigation plans to minimize acoustic impacts..

1. **Comprehensive Soundscape Analysis (1-Year Minimum) Prior to Project Implementation**
   Objective: Conduct a thorough baseline analysis of the soundscape within the habitat over a minimum of one year before project activities begin. This will help establish a baseline understanding of natural noise levels and seasonal variations, providing critical context for assessing the potential impact of the project's noise on the ecosystem.

2. **Model Full Spatial and Temporal Range of Ensonification for All Sound Sources**
   Objective: Model the full spatial and temporal extent to which anthropogenic sounds associated with the proposed project will inundate marine soundscapes, including the ensonification range for airgun operations within the proposed permit area, as well as the ensonification associated with seismic ship and support vessel transit within and beyond the proposed permit area.

3. **Inclusion and Consideration Population Level Impacts and Associated Uncertainty**
   Objective: Acknowledge the necessity of modeling population level impacts (including estimated proportion impacted) and incorporate uncertainty in population density

estimates for the relevant species (e.g., marine mammals, fish, etc.) by developing multiple density scenarios. This includes:

a. Assessing the risk to species under a range of plausible population densities, especially considering variability in population numbers.
b. Where available, use population abundance data and apply variability factors to estimate the proportion of the population that could be exposed to noise during the project's operational period (e.g., 70 days).

4. **Separate Mitigation for Direct (Injury) and Indirect (Behavioral) Impacts of Noise**
Objective: Differentiate between the direct impacts (e.g., physical injury) and indirect impacts (e.g., behavioral disturbances) of noise exposure on species and propose mitigation for each
   a. **For direct impacts,** model potential injury thresholds based on noise exposure.
   b. **For indirect impacts,** consider the latest version of the **probabilistic disturbance approach,** which incorporates various behavioral states (e.g., feeding, resting, migrating) and estimates the time spent in each state. This method will help refine understanding of how noise affects species' daily activities.
   c. Develop mitigation relevant to spatial and temporal ranges of each.

5. **Exposure and Risk Assessment Based on Behavioral States**
Objective: Rather than adopting a blanket seasonal approach, model exposure levels and risks based on species' behavioral states (e.g., breeding, feeding, migration) and proportion of the population engaged in each activity. This will allow for the development of an **operation schedule** that minimizes noise during critical behavioral periods, thus reducing potential disruptions.
   a. The model should take into account how noise influences different states, adjusting operations to align with periods when species are least sensitive to noise.

6. **Integration of Southall et al (2024) Recommendations**
Objective: Implement the recommendations outlined by Southall et al. (2024) on managing anthropogenic noise. The study critiques current regulatory approaches adopted in the BAR which rely on simple thresholds for noise exposure criterion. Southall et al (2024) calls for more nuanced criteria that consider species-specific and context-dependent responses, including behavioral responses.

7. **Required Evaluation of Proposed Mitigation Measures**
Objective: Evaluate the effectiveness of proposed mitigation strategies for both direct and indirect impacts that include uncertainty. This should involve a **comparative analysis** of different mitigation approaches, such as noise reduction technologies, spatial or temporal restrictions, and habitat protection measures. The evaluation should include:
   a. Quantitative and qualitative assessments of the potential success of each measure.
   b. A comparison of the potential impacts before and after the implementation of mitigation measures.

c. Consideration of adaptive management approaches based on scientifically based zones of impact to allow for adjustments if initial mitigation measures prove inadequate.

8. **Incorporation of Real-World Detection Probabilities of Marine Mammal Observers into Risk Assessment and Mitigation Strategies**
Objective: Integrate **real-world detection probabilities** of Marine Mammal Observers (MMOs) into the risk assessment process and the development of mitigation strategies. These detection probabilities can vary significantly based on factors such as:
   a. **Species size** (larger species are easier to detect)
   b. **Group size** (larger groups are more noticeable)
   c. **Time of day** (e.g., detection can be lower during low light conditions such as dawn, dusk, or night)
   d. **Observer experience** (more experienced observers are likely to have higher detection success)
   e. **Animal behavior state** (for example, animals in more active states may be easier to spot than those resting or submerged)
   f. This incorporation will help **refine risk assessments** by accounting for the inherent variability in detection rates and potential missed detections, especially during times of high operational noise or challenging environmental conditions. Additionally, it ensures that mitigation measures (such as shutdowns or noise reduction) are based on more realistic expectations of detection success, thereby improving overall protection for marine mammals.

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IN THE HIGH COURT OF SOUTH AFRICA

(WESTERN CAPE DIVISION, CAPE TOWN)

Case No ...../2024

In the matter between:

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	First Applicant
THE GREEN CONNECTION NPC	Second Applicant
NATURAL JUSTICE	Third Applicant

and

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	First Respondent
MINISTER OF ENVIRONMENTAL AFFAIRS	Second Respondent
TGS GEOPHYSICAL COMPANY (UK) LTD	Third Respondent
MINISTER OF MINERAL AND PETROLEUM RESOURCES	Fourth Respondent

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EXPERT AFFIDAVIT : G K HAMILTON

I, the undersigned,

GILLIAN KAY HAMILTON

do hereby make oath and state:

1. I am an economist specializing in climate change, particularly in climate mitigation, energy, and development economics.

2. The facts contained in this affidavit fall within my personal knowledge, except where I indicate otherwise and are, to the best of my knowledge, true and correct. To the extent that I rely on information supplied by others, I believe that such information is true and correct.

3. I hold a Master's degree in Sustainable Development from Stellenbosch University, a BPhil (Honours) in Sustainable Development from Stellenbosch University, an Honours in Economics specializing in trade and development from the University of Johannesburg, a Postgraduate Diploma in Management from Wits Business School, and a BCom from Pretoria University.

4. With over 20 years of experience, I have conducted extensive research and identified solutions to developmental challenges in South Africa, including economic models of development. As the former Branch Manager for Al Gore's NGO in Africa, the African Climate Reality Project, I possess comprehensive knowledge of climate change and climate mitigation policies. In this capacity, I represented civil society in discussions on various climate mitigation and economic policies in South Africa, including the carbon tax regulations and the green taxonomy.

5. In 2021, I authored a literature review titled "The Socioeconomic Consequences of Offshore Oil and Gas Activities on South Africa" for The Green Connection. I presented my findings at the African Oceans Tribunal and to the Energy Governance Network of South Africa. I have also published several opinion pieces advocating for sustainable economic practices, such as

"The GNU must come to grips with energy transition" and "Gas is a risky investment for SA amid renewables push."

6. My experience and qualifications are set out in my curriculum vitae, a copy of which is attached marked Annexure **"GH1"**. By virtue of my qualifications, training and experience, I submit that I am qualified to give expert evidence on the issues traversed in this affidavit.

7. In order to arrive at a balanced assessment of whether or not the 3rd Respondent's proposed offshore 3D seismic survey (a technology used for the acquisition of seismic data for possible future oil and gas exploration) is socially, environmentally and economically sustainable, it is necessary to assess, evaluate and consider the social, environmental and economic impacts (and risks) of those activities, both positive and negative.

8. In the 2nd Respondent's Appeal Decision, it is recorded that the 1st Respondent indicates that "...It is also important to note that the proposed project has the potential to produce long-term benefits to South Africa, even though immediate benefits are limited..." (at para 2.9.3) and "...Whilst there are no immediate benefits from the proposed activity, however, dependent on the success of the proposed project, there might be future benefits" (at para 2.9.8).

9. The 2nd Respondent notes in her evaluation (reasons for decision) that "...some of the concerns raised by the Appellants extend beyond the proposed project activity in respect of which the EA was granted. I confirm that any activity beyond the EA will be subject to a separate application and a separate assessment process. Accordingly, it is not necessary to consider submissions made in respect of activities that fall outside the EA for the purposes of this

appeal" (para 2.21.2). The 2nd Respondent indicates further she is "...satisfied that the socio-economic impacts and mitigation measure on *inter alia*, marine fauna, small scale and commercial fishing have been considered and assessed..." (at para 2.21.6) and that "Many of the comments made by the appellants were made on the assumption that the impacts associated with production had to be considered, not just those associated with exploration. This approach is incorrect. The EA and accordingly, this appeal is limited to considerations of the impacts of exploration which are far less significant and far less invasive than they will be if extraction and production takes place. As such, it is not necessary to consider the possible impacts of a project that is not yet planned and falls outside the scope of the EA" (at para 2.21.7).

10. As a consequence, the potential negative economic impacts and risks of developing an oil and gas sector in South Africa have not been assessed, evaluated or considered.

11. In this affidavit, I explain the potential negative economic impacts and risks of developing an oil and gas sector in South Africa, based on an extensive literature review and research. The views expressed in this affidavit are dealt in more detail in the Addendum '***Literature Review: The Negative Economic Impacts of Developing an Oil and Gas Sector in South Africa***' (**Annexure "GH2"**).

12. In Summary, the research shows (among other things) that:

12.1. The disparity between the narratives of African leaders and the realities faced by communities in sacrifice zones (A sacrifice zone refers to a geographic area that has been permanently impaired by environmental

damage or economic disinvestment) illustrates a fundamental misunderstanding of the adverse effects fossil fuel investments can have on local economies.

12.2. Research shows that establishing an offshore oil and gas industry within South Africa is unlikely to yield significant economic benefits. Instead, it may exacerbate existing challenges. Past experiences across Sub-Saharan Africa indicate that actual benefits often fall short of forecasts.

12.3. With an accelerated global energy transition through increased shifts towards renewable energy and increasing climate mitigation commitments, the risks associated with oil and gas developments are profound. The financial, environmental, and social repercussions may well outweigh any anticipated economic gains in the form of increased levels of sovereign debt, lower credit ratings

12.4. It is imperative for South Africa to adopt a sustainable and renewable energy-focused economic approach, acknowledging the importance of protecting the socio-economic well-being of its citizens and environment.

Differentiating between Economic impacts during the reconnaissance (3D seismic survey), exploration and extraction phases

13. The economic impacts on South Africa of developing an oil and gas sector will differ during the reconnaissance (3D seismic survey), exploration and extraction phases:

- During the reconnaissance phase (3D seismic survey), the impacts are likely to be short term in duration (due to the surveys estimated to take no more than 70 days). However, if these surveys have a negative impact on the fish stocks and the fishing industry then there are likely to be long-term, negative ramifications in the longer term on the local economy.[1]
- During the exploratory phase, the impacts are likely to be largely localised and positive, albeit, of a relatively short-term duration (likely around six months) and smaller in magnitude. This assumes there won't be negative impacts on the fishing industry which will have extensive longer-term impacts on the local primary, secondary and tertiary industries reliant on fish stocks.
- During the extraction phase, the impacts are likely to be negative both at a national and local level. Moreover, these impacts will have large, long-term consequences.

14. The reconnaissance (3D seismic survey) phase will likely require local service providers for refuelling, catering as well as transport and accommodation for crew members i.e. a small, positive impact.

15. The exploratory phase will likely require local service providers for refuelling, catering, goods as well as transport and accommodation for crew changes –

[1] For instance, the research on Saldanha Bay Municipality 'Socio-Economic Futures' notes that in Saldanha Bay Municipality (SBM), 'Livelihoods in the area are heavily dependent on fishing and, to a less extent, agriculture. Fishing accounts for 31% of all jobs, agriculture 6% and food processing, which is predominately fish processing, a further 5%.' The research adds that '..while the 'financial, insurance and business services' sector is large it only exists because of the income generated from fishing, 'food, beverages and tobacco' and construction.' Fishing is the most important economic sector in Saldanha Bay Municipality, at 15% of the total value added in the SBM. The report concludes that the local municipal area is overwhelmingly dependent on fishing and fish processing as nearly all the tertiary industries are a product of these industries. A downturn in these sectors will largely increase unemployment, poverty and inequality at a local scale.

with impacts more similar to tourism. This is due to the specialised nature of the survey vessels and drilling unit which are sourced from international contractors. The technical nature of the operations means that the survey vessels and drilling unit are crewed by highly skilled and experienced personnel largely recruited internationally.

16. The extraction phase could last for decades and during this time, South Africa's 'resource curse' (explained below) is likely to be magnified, and experience both in South Africa and internationally has indicated extensive negative local economic development, essentially maldevelopment.

Experience from other African Countries

17. Lessons learnt from other African countries indicates that there are numerous challenges that arise between the reconnaissance (3D seismic survey) and exploration phase and the actual production, and that these have economic consequences that must be taken into account:

- **Overvaluation of oil and gas finds**: For oil and gas to be commercially viable, the deposit size of the find is important. Many oil and gas finds in Africa tend to be overestimated due to companies wanting to emphasize positive results to inflate their share prices. This misled governments and other companies exploring in the same areas.
- **Timeline from discovery to production**: Oil and gas projects frequently have time and cost overruns, especially in Africa. Globally, the average amount of time it takes to get from discovery to production is 7.5 years. In Sub-Saharan Africa, the average time is around 12 years. For gas assets, the average time is 9 years globally, versus 15 years in Africa. The

extensive time and cost overruns may make these extractive projects less commercially viable.

- **Government revenues generated tend to fall significantly short of forecasts**: Revenue projection is on average 63% lower than is initially estimated. The shortfall has been attributed to lower rates of production than originally forecast; challenges associated with taxing production as the resource sector can be hard to tax effectively; underestimates of costs or cost deduction; and, mistaken fiscal assumptions in modelling. Consequently, the share of after-cost revenues that flow to the government as opposed to companies (known as the 'government take') is lower than initial expectations.

18. Senegal and Mozambique are recent examples of countries that have faced these challenges. Senegal's oil and gas sector has faced project delays, political uncertainties, mismanagement while their domestic energy poverty has not declined. Mozambique estimated that Area 1 and Area 4 within the Rovuma Basin would earn between $31 and $63 billion in government take over the lives of the two projects, with the likely figure (its base case scenario) being in the region of $49 billion. However, these revenues are significantly overstated and modelling undertaken in 2021 indicates that revenues are likely to be in the region of $18.4 billion, 70% of which will only come after 2040.

The Resource Curse and Localised Maldevelopment

19. The resource curse, also known as the 'Paradox of Plenty' refers to the failure of states to improve the social and economic conditions of their citizens despite being rich in resources such as oil and gas. In addition, countries rich in

extractive resources tend to have higher levels of inequality and lower levels of democracy. South Africa already suffers from the resource curse, experiencing many of the symptoms outlined in the resource curse literature. These symptoms include relatively slow GDP growth, gross inequality and entrenched poverty. Most of the SA population has failed to benefit from natural resource wealth – with sections of society actively harmed through the process of mineral extraction.

20. There is an assumption that the establishment of an oil and gas industry brings extensive local economic benefits to the areas in which the industry takes hold. International experience indicates that regions rich in non-renewable resources have tended to be cursed, rather than blessed and tend to suffer from localised maldevelopment. For example, evidence from the United States and Canada shows that the influx of people that follows the emergence of extractive industries results in increased demand for public services for several complex and often interrelated reasons. A growing population clearly demands increased infrastructural support in terms of basic municipal services such as health, education, emergency services, water and sanitation, electricity, and transport.

21. The influx of people to local areas also has other negative social ills or consequences such as:

- Increases in prostitution.
- Sex trafficking, including children, in oil boomtowns linked to 'a confluence of underlying forces including big oil money, an increase in drug cartels

and drug use, degradation of women in a male-dominated workforce, increased access to weapons, and a rise in transient populations'.

- Increases in domestic violence, dating violence, sexual assault, and sexually transmitted diseases.
- Increases in traffic violations, traffic accidents and fatalities.
- Increased drug abuse and drug trafficking.
- Crime levels increase compared to before the extraction of oil and gas and compared to other towns without extractive industries.
- Unemployment levels in these towns tends to increase.

22. An excellent example of the resource curse and local maldevelopment in South Africa is the platinum boom in Rustenburg. Between 1994 – 2009, platinum output increased by 67% between 1994 and 2009, changing Rustenburg from an agricultural community to city. By 2012, Rustenburg contributed almost 5% to South Africa's GDP. During this period, people migrated to Rustenburg to find jobs in the platinum sector which resulted in the population growing from about 68 000 in 1996 to 626 522 in the 2016. The most significant increase was among the male population in the 20 – 34 age group. However, the impact of the platinum boom has been largely negative.

23. The rapid increase in population density has led to numerous social challenges, including increased unemployment rates, increased crime rates (and frequently noted as the most dangerous city in Africa), substantial increases in HIV and AIDS rates, and significant poverty levels and income inequality threaten social cohesion as almost 62% of the population live in poverty. Evidence shows that the local government is unable to meet the demand for basic services such as housing, water, electricity, sewerage, public transport, health facilities and

schools. This inability to meet with the demands for social goods has been hampered by the mismanagement of local public finances, inadequate government capacity, and questionable policy decisions.

The Reduction in Demand for Fossil Fuels and Transition Risk

24. It is widely agreed that the world is currently transitioning its energy sources from fossil fuels to clean energy. A number of global energy scenarios forecast a global decline in oil and gas use (some from as early as the 2020s) although the pace and scale of the transition differ amongst scenarios. The drivers responsible for these differences range from the implementation of stronger climate-friendly policies, improvements in technology, increasing energy efficiency and the cost competitiveness of oil substitutes amongst other factors. Mass-manufactured technologies such as solar photovoltaic (PV), wind turbines and electrical vehicles (EVs) are leading the way. Sales of residential heat pumps and stationary battery storage are also rising. At the same time, implementation and updating of government policies and the slowdown of China's growth rate are expected to continue to drive the global energy transition.

25. Transition risk is the risk that the value of assets and income are less than expected because of climate policy and market transformations, such as the transition away from fossil fuels i.e. a reduction in demand. Modelling indicates that both current and emerging African petrostates should be cautious when considering investing in gas and gas infrastructure because investments in African gas are ultimately value destructive. Notably, this declining demand is important for new oil and gas projects to take into account when considering

the economic, financial and climate change risks of major new oil and gas projects.

26. If South Africa plans on exporting oil and gas, as a newcomer to the market, its costs would likely be higher than established players and due to the global transition to net zero, South African gas will not be sufficiently price competitive to be exported or there will be no market for South African oil and gas. If the intention is to use the oil and gas domestically, then models developed in South Africa indicate that South Africa's power needs can be met with very little gas and the large majority of new energy new generation capacity should be wind and solar, with an increasing requirement for flexible (dispatchable) capacity to support this. Moreover, gas power is almost triple the cost of renewable energy and thus not cost-competitive. Research by National Business Institute (NBI) indicates that either way South Africa will have to substitute gas with greener alternatives and phased out by 2050 for South Africa to achieve a net-zero 2050 target. This indicates a high probability of stranded assets if South Africa invests in both the upstream and downstream oil and gas sector.

The Risk of Stranded Assets

27. **Stranded assets** are assets that become devalued or fail to generate an economic return before the end of their economic lifetime or can no longer be monetised due to changes in circumstances. Simply put, stranded assets are projects that fail to deliver adequate returns as conditions change. Economic modelling shows that to achieve Net Zero Emissions in 2050 (NZE2050), with the current levels of investment in oil and gas, over US$350 billion in African oil

and gas assets would be stranded, with more than US$90.3 billion in stranded assets in Nigeria alone. The implication for South Africa is that it is likely that investments in an oil and gas industry will end up being stranded assets as the demand from fossil fuels falls and the energy transition gains momentum.

Fiscal Breakeven Price

28. The fiscal breakeven price or price necessary for an oil-exporting state to balance its budget is another way to measure a state's vulnerability or economic resilience. Although oil and gas producers do not know what demand and price will do in the future, it is likely that an early excess of supply is likely to push down prices, leading to low subsequent investments, and resulting in higher prices in the short term.

29. Essentially, the lower the production price is for a state, the less vulnerable these states are – it is important that a petrostate's fiscal breakeven price is higher than the average price of Brent crude oil (approximately USD 80 per barrel in 2023). Therefore, only those petrostates that have reduced costs and carbon intensity and become aggressively competitive will be viable as overall demand and markets become more competitive during the energy transition. The Global Energy Scenarios forecasts that in the Net Zero Emissions scenario oil will be around $15 per barrel and the Mean scenario forecast oil price at around $65 per barrel from 2027 to 2050. At this stage, few petrostates will have a breakeven fiscal price i.e. their costs are not profitable. As an emerging Petrostate, South Africa's investments in an oil and gas sector are unlikely to be low enough to breakeven, never mind be profitable.

Additional Economic Risks and Decreased Macroeconomic Stability to be

Considered

30. The anticipated negative economic impacts (external costs) of developing a domestic offshore oil and gas sector at this juncture include, but are not necessarily limited to, the social costs of carbon, increasing sovereign debt and fiscal risk, a downgrade in our credit ratings (making capital more expensive), an increase in illicit financial flows and a reduction in our trade and competitiveness. These factors are likely to decrease South Africa's macroeconomic stability.

Increase in Sovereign Debt

31. The increase in sovereign debt levels in low- and middle-income countries is not only attributed to oil and gas dependency however **oil and gas production tends to exacerbate fiscal risks.** Petrostates tend to become locked into debt dependency because they tend to have increased fiscal dependence on oil and gas revenue, increasing their debt levels when the oil price is high because their credit ratings rise and hence make cheaper finance available, **and when it is low,** in order to fill their resulting fiscal gaps. It is likely that **the energy transition will further exacerbate the levels of sovereign debt** as countries credit ratings decline and debt becomes more expensive while also seeing revenue from oil and gas falling and debt servicing becoming more important.

32. South Africa's debt has ballooned and is expected to increase to 77.7% of GDP in the 2025/26 fiscal year. This limits government's ability to channel resources into the productive side of the economy as debt service costs are crowding out social spending as debt repayments form a greater share than social protection, health, community development, or economic development, with one in every

five rands being spent on servicing the debt. However, if SA has to take out further loans to develop an O&G sector, our debt and debt repayments would rise even more which could lead us to default on debt repayments and to shift into a full economic recession. If the oil and gas sector cannot deliver on increasing economic growth, as predicted with the increase in transition risk, it is questionable whether it is prudent to be investing in volatile commodities like oil and gas which could become a serious financial burden on the South African economy.

Downgrade in credit ratings

33. Credit ratings are described as **independent mechanisms to assess creditworthiness** or the ability – and willingness – **of debt issuers to meet repayment**. Credit ratings provide international investors with a rapid, standardised way to assess and price debt, and are particularly important for borrowing in international capital markets.

34. Although **fossil fuels** were once considered to be credit positive, credit ratings agencies now issue **specific warnings about the financial risks of fossil fuels** including oil and gas as these now face substantial financial risks. There has already been a trend emerging of petrostates' credit rates being downgraded. As petrostates earn less revenue from their oil and gas production, their **creditworthiness declines** i.e. they will have **lower credit ratings and thus borrowing on international capital markets will become more expensive** for these petrostates. The consequences are likely to be a devaluation of currency, rising debt levels, reduced access to capital markets and economic contraction leading to lower investor confidence.

35. South Africa's credit ratings have been somewhat volatile over the last decade and these ratings are lower than investment grade ratings, making it more expensive to borrow on international markets. It is likely that investment in the O&G sector in SA would result in credit ratings agencies further downgrading us, making it more challenging to borrow on international markets.

Increase in Illicit Financial Flows

36. **Illicit financial flows** (IFFs) are methods, practices and crimes aimed at **transferring financial capital out of a country, in contravention of laws.** IFFs include money laundering, bribery and tax evasion. Research indicates that the **extractive industries, like the oil and gas sector, are particularly prone to IFFs.** Illicit financial flows (IFFs) are difficult to measure due to their secrecy but it has been estimated that South Africa is losing more than $62 billion a year because of illicit financial flows and tax evasion. It is likely that IFFs will take place in an oil and gas sector in South Africa where it is difficult to govern and measure extraction of oil and gas – which further impacts on the lack of profitability of an oil and gas sector and will reduce government take.

Decrease in trade and competitiveness

37. There has been an increasing focus on **climate measures to prevent the risk of carbon leakage** (i.e. the movement of production and associated emissions between countries due to different levels of decarbonisation effort through carbon pricing and climate regulation) and is designed to **support increased ambition on climate mitigation**. These are known as carbon border adjustment mechanisms (CBAMs) or taxes. However, South Africa's exports

are at particular risk and South Africa is vulnerable to changes in trade patterns arising from measures aimed at transiting to low-carbon pathways.

38. South Africa's exports are already very carbon intensive due to our carbon-intensive energy system and the country is a large exporter of fossil fuels. And as South Africa has a relatively long distance to its trading partners, this has implications for transport costs and associated greenhouse gas (GHG) emissions. The impact of CBAMs will be determined by the carbon embedded production in goods that are traded. Analysis by TIPS notes that under the EU CBAM, a total of US$2.4 billion (about R45.4 billion) of South African exports (based on 2023 data) is at risk in the short term. The UK CBAM would have a smaller impact but would likely result in a total of US$223 million (About R4.3 billion) of South African exports (based on 2023 data) being at risk in the short term.

39. Thus, if South Africa decarbonises its electricity systems more, the CBAMs will have less impact. However, if South Africa chooses to invest in an oil and gas sector, this will increase its carbon emissions and exports will be negatively impacted through these CBAMs, with substantial negative impacts on our Gross Domestic Product (GDP) and on employment.

Increase in the social costs of carbon

40. The social cost of carbon (SCC) is an estimate of the cost of the damage done by each additional ton of carbon emissions. It also is an estimate of the benefit of any action taken to reduce a ton of carbon emissions. Research estimates that the macroeconomic damages from climate change are six times larger than previously thought. The social cost of fossil fuel combustion for South Africa is

at least R660-billion a year and exceeds, by five times, the revenues government earns from fossil fuel combustion. The social cost includes deaths, disease and working days lost owing to air pollution and GHG emissions.

Decommissioning Costs Must be Factored into Economic Calculations

41. It is important to include the cost of decommissioning of offshore oil and gas infrastructure upfront in all financial decisions – otherwise these costs will be borne by the state and ultimately, by the South African taxpayers. For instance, the total cost of decommissioning UK offshore oil and gas production, transportation and processing infrastructure is estimated to cost £48bn. At present, there is no estimation of what decommissioning of oil and gas infrastructure costs will be for South Africa but these costs must be included in economic models.

Most likely economic scenario for South Africa's oil and gas sector

42. Based on the logic from other African countries, if South Africa were to find oil or gas in 2024, it would likely take at least until 2034 to start producing (but more likely in 2039) – and then South Africa would have a payback period of approximately 15 years (i.e. until 2049 or 2054) before the country would begin to see any profits on these investments. However, South Africa will need to shut operations due to climate change commitments by 2050 (if the global market for oil and gas even exists at that stage, which from the energy scenarios, seems unlikely).

43. During this time, South Africa is unlikely to see fiscal benefits such as increases in economic growth.

44. From a macroeconomic perspective if South Africa pursues an extractive oil and gas policy, it is likely that South Africa's levels of debt will increase and credit ratings are likely to drop further and due to the presource curse, these negative macroeconomic impacts are likely to take place before production begins, amplifying the knock-effect of poor decision-making.

GILLIAN KAY HAMILTON

I hereby certify that the deponent knows and understands the contents of this affidavit and that it is to the best of her knowledge both true and correct. This affidavit was signed and sworn to before me at Johannesburg on this the 11 day of November 2024, and that the Regulations contained in Government Notice R.1258 of 21 July 1972, as amended, have been complied with.

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Leadership, Management:

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- Monitoring & Evaluation
- Policy Development
- Case Study, Report Writing
- Research

Specialist Areas of Expertise:

- Sustainable Development
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- Climate Diplomacy
- Climate Finance, Green Finance
- Climate Transition
- Alternative Economic Models
- Economic Development
- Biodiversity
- Energy Policy
- Public Health
- DFID, Euro Commission Projects
- USAID, UNICEF Projects
- Economic & Political Analysis
- Corporate Social Responsibility

Sustainability, Climate Change Consultant, Analyst, Advisor

EXPERIENCED **sustainability and climate change consultant – leveraging a business and economics background and extensive experience in 'making order from chaos', developing strategy, plans, solutions.**

- 20 years' immersion in Development, Sustainability, Climate Change
- Former Head Africa Climate Reality Project (Al Gore's NPO)
- GIZ Climate Change and Climate Leader (Al Gore) trained
- BPhil *cum laude*, MPhil Sustainable Development (Stell)
- BCom, BCom Hons Economics, PD Management (Wits)

work experience

Principal Consultant – Sustainability, Climate Change

Twig Consulting | Johannesburg, South Africa | 2010 - present

LEAD **development of research, policy, strategy, projects, project evaluations, analysis, case studies and reports for public and private organizations (eg UNICEF, the DTI, InfraSalience, Trialogue and GIBS.) Research, analyse data, write reports on the impact of climate change in Africa and on South Africa's energy and climate policies.**

➢ *Key Areas of Focus:* **Sustainability; Climate Change; Climate Diplomacy; Alternative Economics; Green Finance; Biodiversity; Energy Policy; Politics; Economics**

➢ *Key Projects, Contributions, Outputs:*

- **Lead** a network of African climate experts working on aspects of climate diplomacy.
- **Spearheaded research for NGOs and present** reports to, network with and connect NGO, government and other stakeholders (eg forums such as the SA Oceans Tribunal). Notable research includes making the case for the South Africa's oceans to be declared as sentient beings.
- **Researched and developed** work on the alternative economics front – prepared a proposal ("Koeksister") outlining changes to the economic system as the basis for confronting climate and environmental changes.
- **As a Climate Leader** engage with, contribute to and participate in networks such as: EGSA and The Reilient40, developing ideas, sharing knowledge and up-to-date climate information.
- **Developed an Urban Management Strategy** for Johannesburg's Urban Forest (Food & Trees for Africa).
- **Conducted Monitoring & Evaluation** on Corporate Social Responsibility projects for Trialogue and the British Foreign Office.

- **Wrote Sustainability case studies** for GIBS (Gordon Institute of Business Science), including a study on Transnet's Biodiversity.
- **Produced research** on Agricultural Cooperatives for the DTI (Department of Trade & Industry).
- **Provided strategy and reports** for UNICEF and assisted CARE South Africa-Lesotho with their strategic planning.

Head: Africa (Programme Manager / Branch Manager)

Climate Reality Project ; Johannesburg, South Africa | May 2016 - Aug 2019

(Climate Reality Project is Al Gore's NPO. See www.climaterealityproject.org)

HEADED support to 600 Climate Leaders throughout Africa, driving achievement of objectives such as increasing influence on policy and project managing and reporting on the NPO's activities in Africa.

➢ *Key Areas of Focus:* Climate Change; Environmental Governance

➢ *Key Projects, Contributions, Outputs:*

- **Took over a local Africa office** that was having little impact and lacked credibility. With the team, consolidated, reinvigorated the vision and mission, put together exciting projects with other NGOs, and attracted additional funding for capacity building and projects.
- **Led a successful initiative** to pressure a public finance institution to reduce the funding of fossil fuels; and raised the profile of the NGO through extensive public and media commentary.
- **Successfully engaged** with the Dept of Environment to get the NEVA Study on jobs affected by climate change to be conducted.

work experience: 1998 - 2010

Project Manager | Non-Clinical Director

ECHO (Enhancing Children's HIV Outcomes) | Sept 2006 - Dec 2009

PROMOTED to Non-Clinical Director in 2007. Managed >R50m in donor funding, 100 staff and managed relationships with USAID and UNICEF. Started out managing the Hamet Shezi Children's Clinic (2006).

Early Career and Student Work:

- Independent Consultant (Development) | 2005 – 2006
- Au-Pair | 2000 - 2001
- HR Administrator | Standard Bank | 2000
- Student Work (Part-time) | 1999 – 2000
- Second Lieutenant | SANDF | 1998

education

MPhil – Sustainable Development

Stellenbosch University - Sustainability Institute | 2011

Thesis: "Testing an Alternative Measure of Progress: The Case of the Bakgatla-baKgafela Nation"

BPhil Hons – Sustainable Development *cum laude*

Stellenbosch University – Sustainability Institute | 2010

professional memberships

Resilient40
Member

Energy Governance Group of SA
Member

The Climate Reality Project
Member

courses, certifications

Workshop: Macroeconomics for Policy Makers
TIPS with Dr Seeraj Mohamed | 2024

Climate Governance, Diplomacy and Negotiations Leadership Program
AGNES | 2024

Workshop: Future of the Commons
Exploring Economics | 2021

A Journey Home
Advaya | 2020 - 2021

Planning, Monitoring, Evaluation & Learning
Community Development Resource Association | 2018

Certified Climate Leader
Climate Reality Project | 2017

Climate Leadership Programme
GIZ | 2014

personal details

Nationality, Date of Birth
- South African Citizen
- DoB: 10 January 1980

BCom Hons – Economics (Trade & Development)
University of Johannesburg | 2005 - 2006 (part time)

PD (Postgrad Diploma) in Management (Business Administration)
University of the Witwatersrand (Wits) - Business School | 2002

BCom – Business Management, Economics
University of Pretoria | 2001

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Literature Review:

The Negative Economic Impacts of Developing an Oil and Gas Sector in South Africa

Gillian Hamilton

October 2024

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1. Introduction

The landscape of energy production and consumption in Africa, particularly in South Africa, is at a critical juncture. While African leaders and elites often advocate for investment in oil and gas as a means of catalysing economic development, this perspective starkly contrasts with the realities faced by individuals residing in so-called sacrifice zones—communities impacted directly by the fossil fuel industry.

Activists, climate campaigners, and many politicians recognize the detrimental economic and environmental implications of fossil fuel dependency, arguing for a transformative shift towards sustainable energy solutions. In light of climate science and the evolving global energy landscape, the African continent is poised to either replicate the carbon-intensive pathways of the past or forge a new, cleaner trajectory.

This literature review critically examines the potential economic consequences of pursuing oil and gas investments in South Africa against the backdrop of an impending global energy transition, climate risks, and socio-economic disparities. It highlights existing narratives, emerging scenarios, and pressing challenges while ultimately arguing for an urgent pivot to renewable energy sources that can foster economic resilience and equity.

2. Global Energy Scenarios

> *The large deviations in outcome indicate a high level of uncertainty*. (RystadEnergy 2024)

The International Energy Agency (IEA) noted in their World Energy Outlook (2023) that global energy demand increased by 1.3% in 2022 and it is likely that energy demand will continue to grow. This increase in global demand for energy is due to both a growing economy and population growth (International Energy Agency 2023). Moreover, in Africa, increasing urbanisation and industrialisation will drive an increasing energy demand (Cilliers 2023).

With the increasing demand for energy in mind, the IEA (2023) developed three main scenarios to explore different pathways for the energy sector until 2050. These scenarios largely reflect government energy and climate-related policies, investment decisions, household and industrial strategies that affect the rate at which different technologies might enter the mix (International Energy Agency 2023). The IEA (2023) warns that none

of the scenarios should be considered a forecast- rather the aim is to understand the levers and likely outcomes of different actions.

In addition to the IEA (2023) scenarios, the Organization of the Petroleum Exporting Countries (OPEC) and RystadEnergy, an energy research and business intelligence company headquartered in Norway, also conducted analysis global demand scenarios for oil and gas to quantify risk and resilience (RystadEnergy 2024, Prince, et al. 2023). Both OPEC and RystadEnergy tend to have a more bullish view of the future of demand and commodity prices, however, RystadEnergy notes the high levels of uncertainty and a fast-changing market landscape which require an evaluation of the potential future risks and opportunities in the energy market (RystadEnergy 2024, Prince, et al. 2023, International Energy Agency 2023).

Prince et al (2023) note that most authoritative sources forecast oil and gas demand falling quickly as renewables capture market share but many oil companies – both private and National Oil Companies (NOCs) – are basing their investment decisions on continued or even rising levels of demand and equivalently high commodity prices. Six of the seven scenarios touched on in the literature below forecast demand for fossil fuels declining. The exception is the OPEC forecast which indicates demand for fossil fuels will increase. Each scenario is aligned to a likely global temperature rise above pre industrial levels in 2100, which is an important indication of the impact of energy on climate change.

The scenarios are:

- **Net Zero Emissions by 2050 (NZE) Scenario (1.5 °C):** In addition to keeping the 1.5 °C Goal in reach, the NZE Scenario meets UN Sustainable Development Goals (SDGs) seven i.e. universal access to reliable modern energy services is reached by 2030, and major improvements in air quality are secured. The goal of achieving the NZE Scenario is difficult but possible due to the recent acceleration in clean energy transitions. In this scenario, both behaviour changes and increases in low-emission liquid fuels results in oil demand peaking at 100 million bpd in 2023 and falling sharply to 29 million bpd in 2050. This scenario sees major changes in the composition of product demand, requiring refiners to adapt refinery configurations and business models and to invest more heavily in emission reductions, hydrogen, and biofuels.

- **RystadEnergy –Sigma Scenario (1.6°C):** RystadEnergy (2024) believes this scenario is less likely than their average scenario. In this scenario, oil demand peaks at 105 million bpd in 2025 and then declines to 39 million bpd by 2050; while gas demand peaks at 4.3 trillion cubic metres in 2030 and declines to 1.9 trillion cubic metres in 2050. Assumptions of this scenario include substantial

uptake of electric vehicles (EVs) and governments adopt policies to curtail ICE sales; banning of single use plastic and plastic recycling rates are high for some plastics types; oil substitution notably accelerates with exponential growth of sustainable aviation fuels (SAF) and changes in the maritime sector. At the same time, Asia solely drives gas demand growth in the next 10+ years and gas demand peaks in all other continents in the 2020s; gas demand for power declines through electrification of industrial and residential use intensifies from the early 2030s, supported by strong growth in renewables.

- **Announced Pledges Scenario (APS)** (1.7 °C): This scenario assumes that governments will meet, in full and on time, all of the climate-related commitments that they have announced, including longer term net zero emissions targets and pledges in Nationally Determined Contributions (NDCs), as well as commitments in related areas such as energy access. Pledges made by businesses and other stakeholders are also taken into account where they add to the ambition set out by governments. However, IEA (2023) expresses some optimism about this scenario but says that very considerable progress would have to be made for it to be achieved. Key assumptions about this scenario are that action is taken to increase the use of alternative fuels and cut emissions to achieve the climate goals of governments and targets set by industry organisations. Under the APS scenario, renewables generate approximately half of all electricity by 2030. Oil demand peaks within five years, primarily driven by the early uptake of EVs. Since it factors in the snowballing economic impacts of renewables alongside a 'forceful policy response', this is our proxy for reduced demand and declining commodity prices. This scenario's trajectory leads to 1.8°C of warming by 2100. We refer to this scenario as a moderate transition. (Prince, et al. 2023)

- **RystadEnergy Mean Scenario (1.9°C):** In this scenario, gas demand peaks at 4.7 trillion cubic metres in 2033 and declines to 3.4 trillion cubic metres in 2050; oil demand peaks at 105 million bpd in 2026 and declines to 65 million bpd in 2050. Key assumptions of this Mean Scenario include exponential growth of EVs, plastic recycling and bans on single plastic use reduce plastic demand; increasing recycling rates accelerate the decline of feedstock demand; a shift in both aviation and maritime fuels; robust growth in renewable power generation supported by declining costs will drive electrification of industrial and residential gas use which will intensify in the early 2030s with gas used to balance intermittent renewables; moderate development of hydrogen, batteries and carbon capture, utilization and storage (CCUS). In this scenario, gas is considered an important part of the transition towards a low-carbon world in markets that are currently highly dependent on coal.

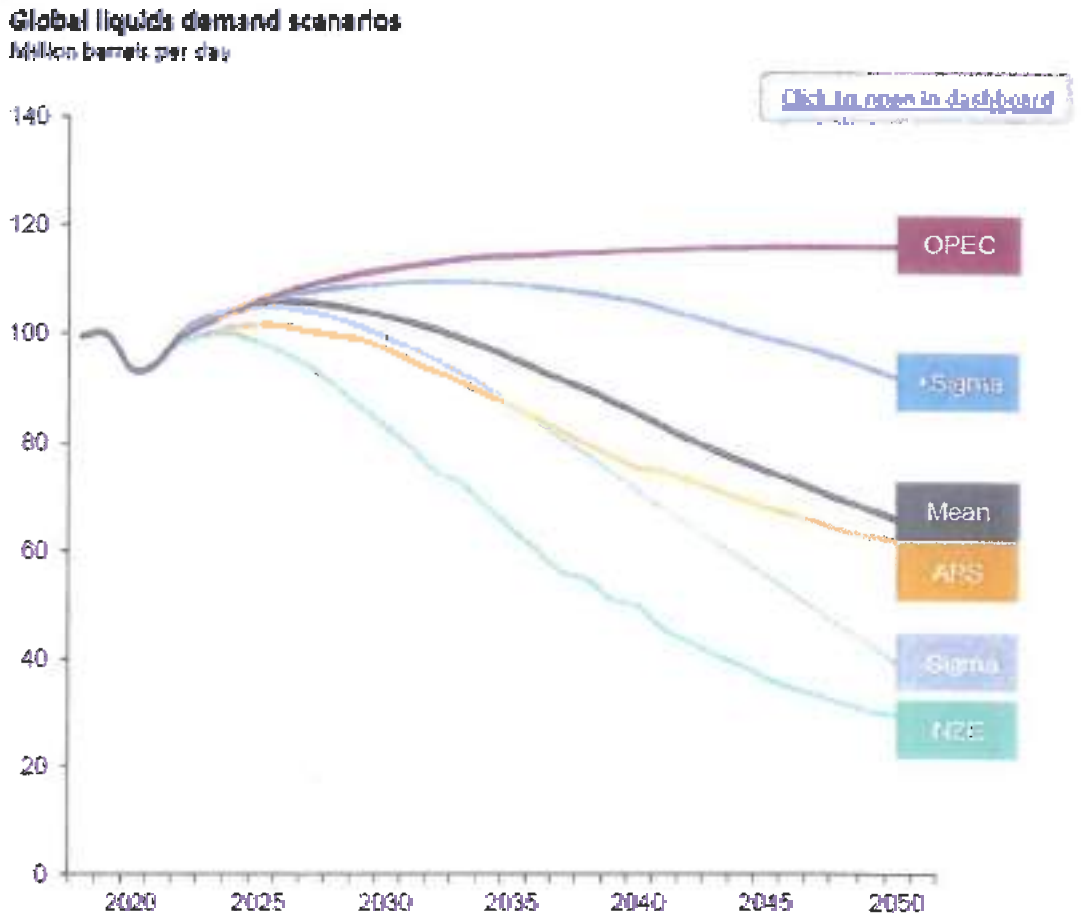
- **RystadEnergy +Sigma (2.2°C) scenario:** the 2.2°C scenario shows gas peaking in 2037 at 5.1 trillion cubic meters and declines to 4.4 trillion cubic meters in 2050; oil demand peaks in 2032 at 109.5 million bpd and declines to 92 million bpd in 2050. The +Sigma sees slow EV adoption, especially in non-OECD countries; low increase in plastic recycling rate; aviation jet displacement is limited, as is maritime gasoil; gas is considered an important part of the transition to a low-carbon world across major gas markets with continuous growth in demand for gas in Asia; gas demand in the power sector continues to grow, replacing coal in the power sector but peaking in 2030 due to slower growth in renewable power generation driven by lower investment in new capacity.

- **Stated Policies Scenario (STEPS) (2.4 °C):** This scenario is a reflection on what governments are actually doing to reach their targets and objectives across the energy economy and aspirational energy or climate targets are not automatically assumed to be met i.e. a proxy for industry business-as-usual (Prince, et al. 2023). IEA's Stated Policies Scenario (STEPS) describes a world where no new climate policies are implemented, beyond those that are already in force. Prior to 2022, STEPS projected rising oil demand until at least 2040 and gas demand until at least 2050, but the 2023 edition projects that coal, oil and gas will all peak before 2030. (Prince, et al. 2023). We refer to this scenario as a **slow transition** (Prince, et al. 2023).

- **OPEC Scenario:** The OPEC scenario sees a bullish liquids demand with gradual increase in demand up until 2045. Global oil demand is expected to rise from 99 million bpd in 2022 to 116 million bpd in 2045. This scenario assumes that the aviation, road transportation, and petrochemical sectors will each see oil demand grow with the largest demand increase from the road transportation sector as internal combustion engine (ICE) vehicles will continue to dominate the global fleet and account for more than 72% in 2045. With respect to refined products, major long-term demand growth is expected for jet/kerosene followed by ethane/liquified petroleum gas, diesel/gasoil, naphtha and gasoline. (RystadEnergy 2024).

Except for the OPEC scenario, these global energy scenarios illustrate the global decline in oil and gas use – most of the scenarios illustrate the peak in oil in the 2020s or early 2030s, and then gradually decline from there. The drivers responsible for these differences range from policy assumptions and the pace of technological advances to the cost competitiveness of oil substitutes and beyond. But it is clear that there is a transition away from fossil fuels, including oil and gas, although scenarios differ as to the pace and scale of the transition (International Energy Agency 2023, RystadEnergy 2024).

Figure 1: Forward Projections for Global Liquids Demand (RystandEnergy, 2024)



3. The Global Energy Transition to Net Zero is Reducing Demand in the Oil and Gas Sector

> ***It also reflects longer term trends: fossil fuel technologies have been losing market share to clean energy technologies across various sectors in recent years, and in many cases fossil fuel-powered technologies have already seen a peak in sales or additions.*** **(International Energy Agency 2023).**

For the first time in the decision text of a UN climate summit, known as a Conference of the Parties (COP), there was a call for "the phasedown of unabated coal power and phase-out of inefficient fossil fuel subsidies" at COP26 in Glasgow in 2016. This was followed by a strong push at COP27 in Sharm el-Sheikh in 2022, supported by 80 governments.

The Global energy scenarios largely indicate a global decline in oil and gas use (some from as early as the 2020s) although the pace and scale of the transition differ amongst

scenarios. For example, McKinsey's "current trajectory" energy transition scenario suggests that global oil demand could peak by 2027, while global gas demand could peak by 2040 (Leke, et al., 2022). The drivers responsible for these differences range from the implementation of stronger climate-friendly policies, improvements in technology, increasing energy efficiency and the cost competitiveness of oil substitutes amongst other factors (Dube, No date; International Energy Agency, 2023; RystadEnergy, 2024).

It is unlikely that the demand outlook will be linear and it is more realistic that in the short-term it is likely that oil and gas prices will remain somewhat volatile and rise and fall (Sanzillo 2024, International Energy Agency 2023). The IEA (2023) uses an example of how heatwaves and droughts could cause temporary jumps in coal demand by pushing up electricity use at a time when hydropower output may be constrained.

However, these changes in price are unlikely to reverse the more fundamental trend of new lower-cost (and lower-carbon) technologies as determinants of economic growth (Sanzillo 2024, International Energy Agency 2023). Notably, this declining demand is important for new oil and gas projects to take into account as the economic, financial and climate change risks of major new oil and gas projects must be taken into account (International Energy Agency 2023).

In addition to the energy scenarios, analysis of the global macroeconomic situation confirms the energy transition. Although developed economies saw an increase in natural gas demand in 2021 and the energy sector showed some financial recovery, this did not last long, and demand in 2022 was below pre-pandemic levels (Sanzillo 2024, International Energy Agency 2023). The Russian invasion of Ukraine in February 2022 resulted in fossil fuel companies earning record amounts due to inflation, fears of oil and gas shortages and higher interest rates (RAN; BankTrack; IEN; OCI; Reclaim Finance; the Sierra Club; Urgewald, 2023). As mentioned above, this did not last long, especially as Europe had an unseasonably warm winter, lowering their demand for oil and gas.

Thus, it is widely agreed that the global energy sector has been in a state of economic decline and this trend will continue (Sanzillo, 2024). Sanzillo (2024) substantiates this statement by noting that:

- The energy sector only has 3.9% of the stock market – declining from 28% of the stock market in the 1980s.
- During the decade before the Ukraine invasion, the energy sector lagged the stock market and for five years it placed last in the stock market.

- At the start of this century, coal was the leading source of electricity, commanding 50% of the electricity market. In 2023, it failed to command 20% in any given month.
- The oil and gas sector faces strong competition in most of its major end-product markets e.g. ExxonMobil CEO Darren Woods anticipates that there will be no new automobiles using gasoline by 2040 and the gas sector will likely decline.
- Plastics use is expected to grow, but recycling will put a damper on industry growth projections (Sanzillo 2024).

4. Key Drivers of the Energy Transition

Market signals, financial incentives and maturing technology have driven investment and deployment of clean energy (International Energy Agency 2023). Mass-manufactured technologies such as solar PV, wind turbines and EVs are leading the way. Sales of residential heat pumps and stationary battery storage are also rising fast (International Energy Agency 2023). Following the Russian Federation (hereinafter Russia) invasion of Ukraine, Europe has seen an accelerated move away from gas (International Energy Agency 2023). At the same time, implementation and updating of government policies and the slowdown of China's growth rate are expected to continue to drive the global energy transition.

Clean energy deployment is accelerating fast

In 2015, the market tipping was reached as renewable energy (RE) crossed average global grid parity, making it the cheapest from of new energy (PWC, 2020). Across the world, renewable energy generation is increasing as steady and continuing cost reductions take place - in 2019, 200 gigawatts (GW) of renewable power plants were built while only 100GW of fossil fuel and nuclear were constructed (Robertson, 2020; Jeliazkov, et al., 2020). Grid scale battery usage is increasing rapidly, and battery cost deflation is faster than wind or solar (Robertson, 2020).

IRENA (2018) notes that the share of renewable energy in the power sector will increase from 25% in 2017 to 85% by 2050, mostly through growth in solar and wind power generation. Investment in clean energy in sub-Saharan Africa increased USD 7.4 billion in 2018, from USD 2.3 billion in 2017 with the REIPPP attracting ZAR 209.4 billion (approx. USD 14.2 billion).

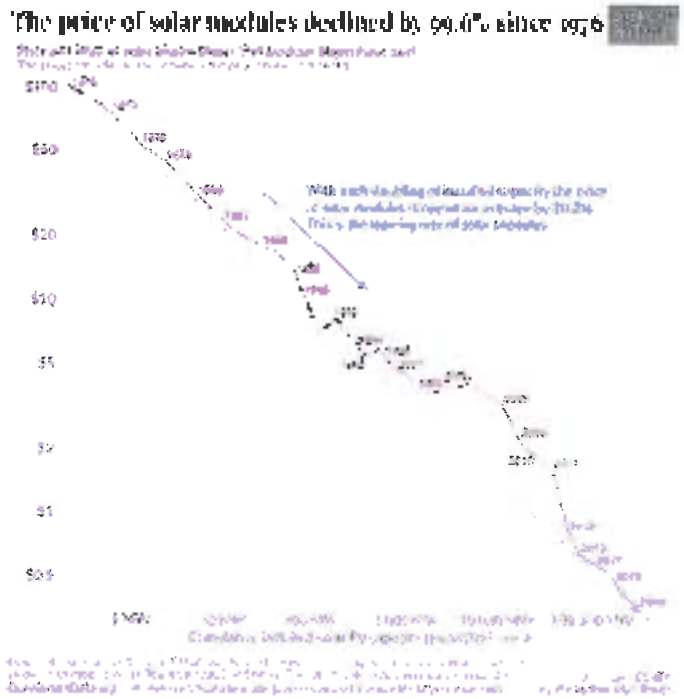
SystemIQ (2020) adds that green finance mechanisms are being developed to accelerate renewable energy deployment and to avoid the impact of stranded assets e.g., the European Commission's €1 trillion European Green Deal investment plan proposed in January 2021 which aims to assist all member states and will be used to support the

renewable energy-skilling of workers, helping SMEs to create new economic opportunities, and overall diversify economic activity, investing in the future of the most affected regions. Moreover, Multilateral Development Banks (MBDs) and investors have shifted their priorities to both financing the transition, and scaling up renewable energy, positing fossil fuel projects as high-risk investment prospect for future finance (SystemIQ, 2020).

As the costs of key clean energy technologies – solar PV, wind, heat pumps and batteries – fell by close to 80% on a deployment weighted average basis between 2010 and 2022, their uptake has increased (International Energy Agency 2023). The falling costs of wind and solar are due to the learning curves of clean energy and it's likely that the price difference between fossil fuels and renewables will become larger in future- with renewables likely to become even cheaper (Roser 2020). The result has been that electricity has expanded to become the basis of the entire energy system (Prince, et al. 2023). 'Importantly, these cost reductions cannot be reversed: the new technologies and means of industrial production cannot be "unlearned".' (Prince, et al. 2023).

As a consequence of increased electrification and deployment of wind, solar and battery technology, the economics of gas power plants have been threatened, making electrification rather than gas a more economical energy source. According to BNEF (2020), two-thirds of the world's population live in a country where either onshore wind or solar photovoltaic provide the cheapest source of new, utility-scale generation. Battery storage is now the cheapest new-build technology for peaking purposes (up to two-hours of discharge duration) in gas-importing regions, like Europe, China or Japan (BloombergNEF 2020).

The IEA (2023) documents the boom in solar manufacturing which has increased ten-fold globally over the last decade. They believe this trend will continue, with investments in the pipeline set to raise global solar module manufacturing capacity from about 640 GW in 2022 to over 1 200 GW in the medium term. The rapid expension of solar manufacturing suggests that the uptake in solar installations will continue.



Increasing energy efficiency

Although increasing energy efficiency hadn't been prioritised in the energy transition this trend is set to change: The IEA (2023) documents in their annual Energy Efficiency Report of 2023, that countries have mobilised $700 billion for energy efficiency projects since 2020. At COP28, nearly 200 countries pledged to double the global average annual rate of energy efficiency improvements by 2030 (from about 2% in 2023 to over 4% in 2030). The IEA (2023) adds that energy efficiency is currently seeing a strong global focus among policy makers as many governments are introducing new or strengthening existing policies and energy saving programmes. These countries include India which has enacted new policies for various sectors and the USA through their Inflation Reduction Act which has stimulated energy efficiency measures coupled with substantial job creation with over 2 million Americans working in energy efficiency, according to the National Resources Defence Council.

Buildings within cities and urban areas tend to represent the biggest sources of GHG emissions, contributing, on average, 60 percent of global emissions. According to C40 Cities (2020), building retrofitting could provide up to 55 percent of the GHG reductions needed to meet global 2030 targets and align the world with the 1.5 degrees Celsius trajectory. As a result, countries like South Africa, who have set targets for carbon reductions in alignment with the Paris Agreement, have identified the retrofitting of buildings as a key element in their climate action initiatives (C40 Cities, 2021; C40 Cities, 2020).

However, the outcomes from increased energy efficiency won't be immediate and energy efficiency gains are likely only to be realised over a period of years (International

Energy Agency 2023). The World Economic Forum estimates energy demand could be decreased by 31% across all sectors if businesses take action to reduce demand by 2030. The IEA (2023) calculates that energy efficiency pledges could cut energy costs in advanced countries by one-third, reducing CO2 reductions by 50% in 2030. Priorities vary by country, but key improvements at the global level come from upgrading the technical efficiency of equipment such as electric motors and air conditioners, from efficiency gains brought about by electrification and the switch away from solid biomass use in low-income countries, and from using energy and materials more efficiently. Further electrification of end-uses is a priority. EVs and heat pumps are central to this (International Energy Agency 2023).

The other benefits of increasing energy efficiency include increasing energy security, reducing air pollution and needing less clean energy to be installed, reducing costs. At the same time, increasing energy efficiency has the ability to create a substantial number of jobs. For South Africa, C40 Cities has calculated building interventions are poised to become a catalyst for job creation by 2030 in South Africa. C40 Cities (2022) highlights that building retrofits have the potential to create and sustain between 342,000 and 560, 000 jobs. This accounts for over 78 percent of the potential job opportunities stemming from the implementation of climate mitigation actions. Building retrofitting also offers the opportunity to create green jobs for vulnerable groups, such as women, youth and the unemployed (C40 Cities, 2022).

As the PWC (2020) report notes: there is no turning back the global energy transition and this market disruption is taking place against increasingly fragile African economies who depend on fossil fuels for foreign revenue. The market shift has impacted oil and gas companies as seen in their announcements of large losses, divestments, downscaling and lay-offs in an attempt to remain profitable (PWC, 2020). **Companies such as BP, Chevron, Shell, Total and Eni have also written off assets** based on the assumed oil price – with an estimated US$87bn reserves that are now assumed uneconomical (PWC, 2020). Another clear indication is that **the accountants and auditors of the big energy firms are beginning to acknowledging the transition** as Total, Repsol, Shell and BP now base their financial statements on price assumptions that are more conservative than their peers (Grant, 2020). BP's auditors, Deloitte, explicitly noted in 2019 that its previous impairment prices were not consistent with the Paris goals, based on a comparison to third party scenarios and BP subsequently amended its assumptions in Q2 2020 (Grant, 2020).

Technology is making it possible to decarbonise heavy industries

The Making Mission Possible Report by the Energy Transitions Commission notes that **it is technically possible to decarbonise heavy industries** (Energy Transitions Commission, 2020). Although many high heat applications for gas can be substituted

with cheap renewable power, there may be some applications for the foreseeable future that will continue to require gas (Robertson, 2020). Due to innovation, many technologies and business solutions are close to being brought to market that will make it possible to decarbonise heavy industries (Energy Transitions Commission, 2020). Similarly, Robertson (2020) predicts that by 2030, green hydrogen will be cost competitive across all 'hard to decarbonise' sectors. IRENA (2020) differs as it believes that the solutions may not be commercially mature or ready for wide adoption quite yet, especially as uncertainties remain about their potential and optimum use, and none will be easy to scale-up.

Rapid increase in Electric Vehicle Sales

Global oil demand is largely due to road transport (45% of demand) and petrochemicals (15% of demand). However, as internal combustion engines (ICE) are phased out and the uptake of electric vehicles increases, road transport will no longer be a source of oil demand growth. This change is expected to take place as soon as 2030, with projections assuming that the sale of ICE vehicles has already peaked (International Energy Agency 2023).

Government commitments and carbon neutral policies are rapidly moving to decarbonise the energy sector

Pressure on governments from civil society, peers and their own increasing concerns about the impacts of climate change have resulted in stronger commitments and policies to drive decarbonisation (International Energy Agency 2023). Globally, developed economies are beginning the shift away from fossil fuels by accelerating green policies and investments as 'carbon neutral' and 'net zero' have become real targets, embedded in national policies and legislation in order to align with the goal of the Paris Agreement (PWC, 2020; Robertson, 2020; Huxham, et al., 2020; IRENA, 2020). Unlike demand shocks like COVID-19 where prices and consumption may recover, the low carbon transition will bring long-term structural changes, influencing the value of physical and financial assets, tax flows, jobs and knowhow. These risks are known as "climate transition risks" (Huxham, et al., 2020).

Europe has increased its ambition to cut gas dependence due to its historic reliance on Russian gas. These commitments include:
Governments have also formed voluntary alliances on fossil fuel phaseout (International Energy Agency 2023). For example:

- Beyond Oil and Gas Alliance (2021) in which core members commit to ending new oil and gas licensing

- Clean Energy Transition Partnership, in which governments and financial institutions agree not to provide international public finance for fossil fuels.

- Targets for net zero emissions have now been set by governments (33 countries and the European Union plus businesses). As of June 2023, net zero emissions pledges cover more than 88% of global energy-related emissions and nearly 92% of global GDP (Net Zero Tracker 2023). 149 countries have pledged to meet a net zero emissions target (Net Zero Tracker 2023).

Bank Fossil Fuel Policies

Article 2.1c of the Paris Agreements aims to make "finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development." (Just Share 2023). The implication of this is that capital needs to be directed towards low-carbon solutions, and away from high-carbon activities (Just Share 2023). Thus, financial institutions, like banks, can support the goals of the Paris Agreement through their lending, investment and underwriting activities. The United Nations–convened Net Zero Banking Alliance (NZBA) and the sector-specific alliance for banks under the Glasgow Financial Alliance for Net Zero (GFANZ) are two alliances that have been formed within the banking sector to align to Article 2.1C (Just Share 2023).

Globally, despite over 125 banks embracing net zero commitments or joining NZBA since 2021, many of the banks have targets that are too low to meet the Paris Agreement or are heavily reliant on false solutions such as carbon offsets and discredited technologies such as Carbon Capture and Storage (CCS) (RAN; BankTrack; IEN; OCI; Reclaim Finance; the Sierra Club; Urgewald 2023). Many banks have policies that expose them to climate risk. However, the Banking on Climate Chaos (2023) report notes that there are some banks that are adopting restrictions on financing hydrocarbons. Examples include French banks Crédit Mutuel (coal policy) and La Banque Postale (strong fossil fuel policy); Danish Danske Bank (new policy excluding companies with upstream expansion plans) and HSBC starting to move towards exclusion policies.

South Africa's five largest banks (Absa Group Limited (Absa), FirstRand Limited (FirstRand), Investec Limited (Investec), Nedbank Group Limited (Nedbank), and Standard Bank Group Limited (Standard Bank) were analysed for their climate-related disclosures, policies and the extent to which their lending and investment activities support their stated commitment to the goals of the Paris Agreement (Just Share 2023). The research found that Investec has signed onto the NZBA; Absa, FirstRand, Investec and Standard Bank are signatories to the PRB while Nedbank is "in support of the Principles for Responsible Banking,". All these banks continue to finance the fossil fuel industry – and during 2022, many of these banks increased their exposure to fossil fuels. However, Investec's fossil fuel financing and exposure decreased, due to a large and unexplained reduction in the bank's oil exposure (Just Share 2023). All five of the SA

banks analysed made progress in their recognition of climate risks and commitment to global climate goals and have committed to reduce their financed emissions to net zero by 2050.

What is interesting is that although neither international nor South African banks are moving as fast as we need to align to the Paris Agreement, there have been some shifts and new policies excluding or limiting fossil fuels investments and exposure to climate change. Moreover, it is likely that SA banks will begin to implement stronger policies as the South African Reserve Bank has issued Guidance notes to both the SA banking and insurance sector in May 2024 (South African Reserve Bank 2024). These guidance notes set out the requirements for banks operating in SA to disclose their climate related risks and to put measures in place to reduce their risks. Amongst other things, the guidance notes also require banks to disclose their Scope 1, 2, and 3 greenhouse gas (GHG) emissions as well as:

- Climate-related transition risks: The amount and percentage of assets or business activities vulnerable to climate-related transition risks through exposure to transition sensitive sectors.
- Climate-related transition risks: The financed emissions of exposures to transition sensitive sectors.
- Climate-related physical risks: The amount and percentage of assets or business activities exposed to physical risks in geographical regions or locations.
- Capital deployment: The amount of capital expenditure, financing and/or investments deployed towards climate-related risks and opportunities (South African Reserve Bank 2024).

A slowdown in China's growth rate

China's growth has shaped energy markets and the global environment, accounting for more than 50% of global energy demand growth and 65% of the rise in energy sector CO_2 emissions over the last 10 years as China experienced rapid electrification. At the same time, China is massively increasing its domestic petrochemical production: petrochemical production is responsible for around 80% of growth in oil product demand in China over the 2019 to 2023 period.

However, China's growth rates have slowed and there is an expectation that its total energy demand will peak around the middle of this decade; with stable and then slowly declining demand, clean energy growth is sufficient to drive a decline in fossil fuel demand and hence emissions.

5. Transition Risk

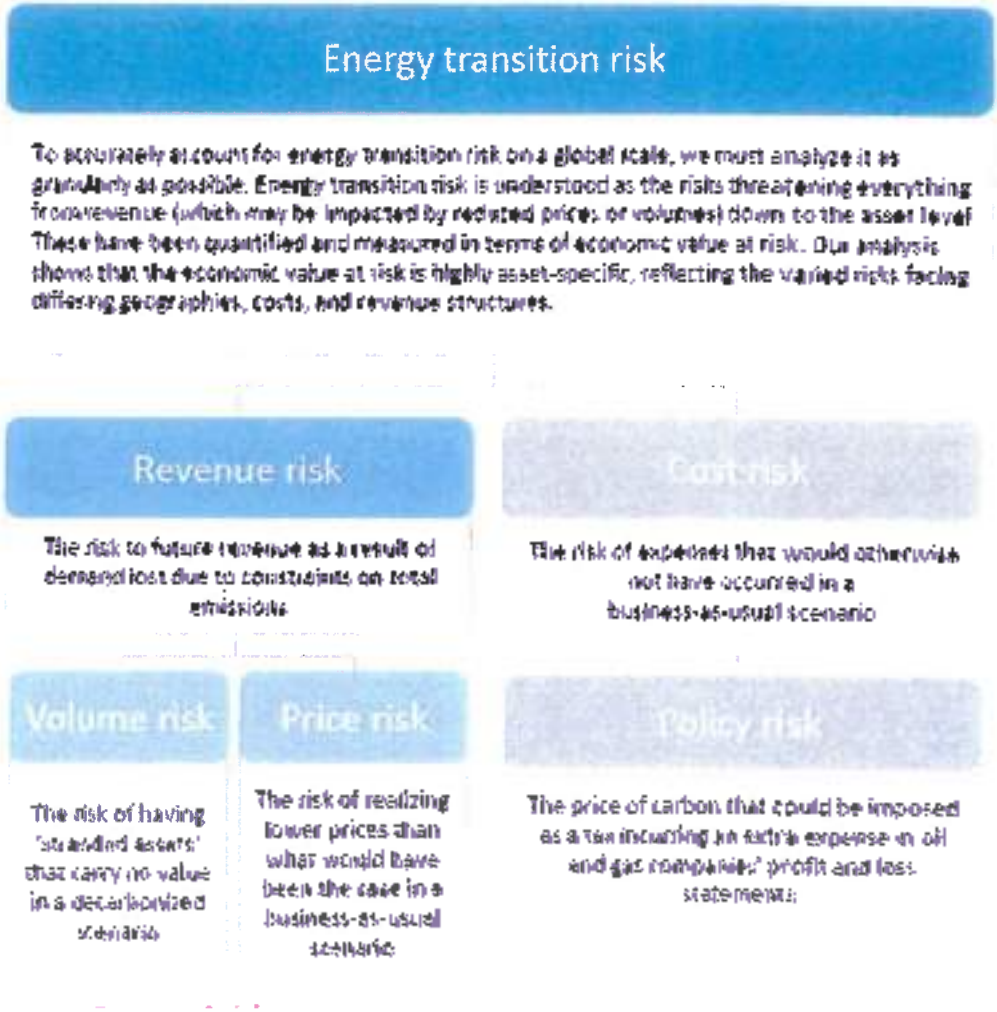
In the report titled, 'Understanding the impact of a low carbon transition on South Africa' Huxman et al (2019) describe transition risk as the risk that the value of assets and income are less than expected because of climate policy and market transformations, such as the transition away from fossil fuels. The African Climate Foundation (No Date) defines transition risks as liabilities that the banking and insurance industries would hedge against. They note that transition risks are increased in countries with poor governance. Carbon Tracker suggests that the O&G industry should practise prudent risk management by having a cautious view of the future, considering higher risk level and limiting capital expenditure to only competitive projects (Carbon Tracker, 2023).

RystadEnergy (2024) finds that the energy transition risk is comprised of both revenue risk and cost risk (RystadEnergy, 2024). Although these risks tend to be highly asset-specific, the economic impact on African countries regarding stranded assets and transition risks are analysed according to whether these countries are existing petrostates[1] (Nigeria and Algeria), emerging[2] gas producers (Mozambique, Tanzania, Mauritania and Senegal) and countries currently exploring for gas (South Africa and Namibia) (Carbon Tracker, 2023). Modelling indicates that both current and emerging African petrostates should be cautious when considering investing in gas and gas infrastructure because investments in African gas are ultimately value destructive (The African Climate Foundation, 2022).

[1] Petrostates are countries economically dependent on the extraction of oil and gas

[2] Emerging petrostates are those countries that have only recently discovered oil and gas and are wanting to exploit these discoveries (Prince, et al. 2023).

Figure 1: Energy Transition Risk



Petrostates

Most producers are ill-prepared for the coming peak. (Prince, et al. 2023)

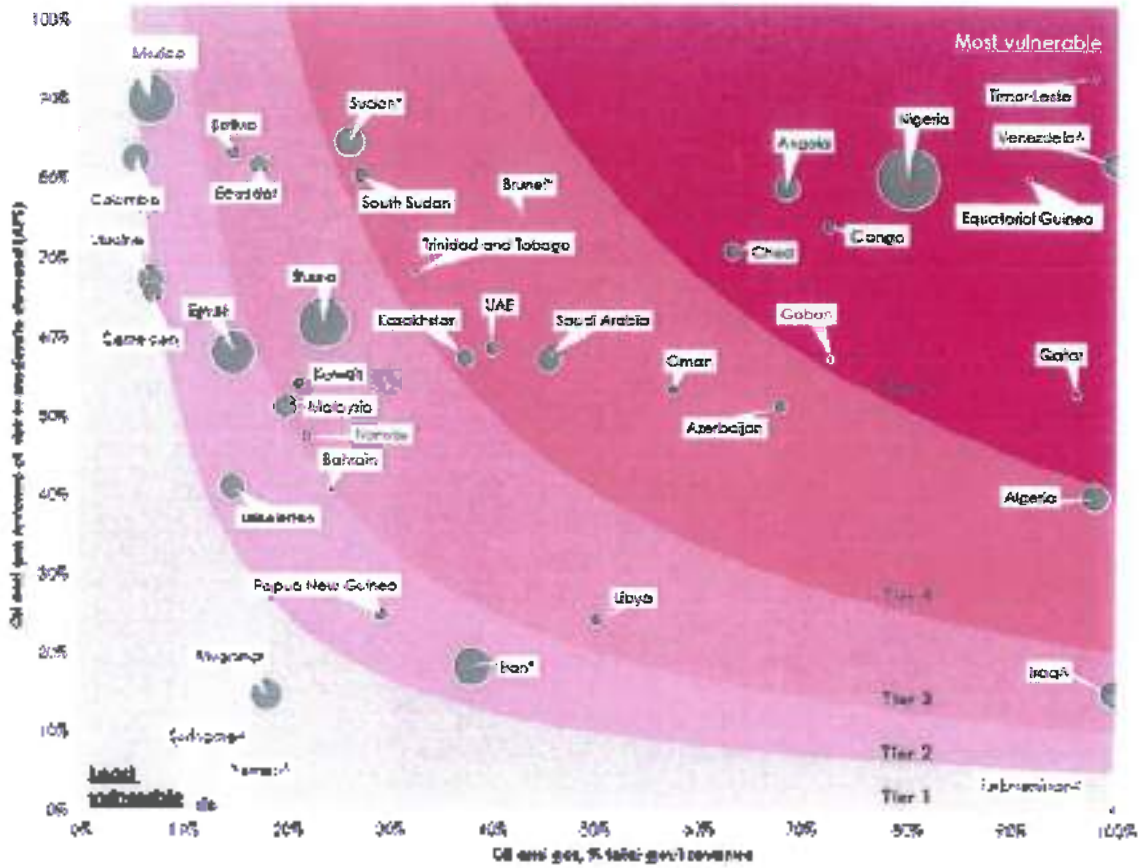
African oil- and gas-producing countries are facing difficult times: they are vulnerable to the global energy transition because it is likely that reduction in the demand for oil and gas, due to the energy transition, will lead to a fall in commodity prices for oil and gas, reducing production volumes and subsequent revenue reductions as their exports decline (Prince, et al. 2023). African countries exhibit a high potential revenue loss, and represent countries with high oil and gas revenue dependence i.e. the percentage of O&G revenue as a percentage of total government revenue tends to be high (Prince, et al. 2023). Moreover, high population growth in African petrostates compound their vulnerability. The most vulnerable African countries are Equatorial Guinea, Nigeria, Gabon, Congo, Angola and Chad (in that order).

At the same time, **additional investments in O&G are highly likely to be stranded assets** (Boyer 2021, Prince, et al. 2023, Dube No date, RystadEnergy 2024). According to McKinsey, replacement of approximately 60 percent of Africa's current oil production could become uncompetitive by 2040, facing the increased risk of stranded assets (Leke, Gaius-Obaseki and Onyekwelli 2022). In Nigeria, petroleum exports make up more than 85 percent of the government's total export revenues (Leke, Gaius-Obaseki and Onyekwelli 2022). African petrostates face extensive risk and projections have questioned the potential revenue in light of the accelerating energy transition:

- More than 2/3 of the Mozambican NOC Empresa Nacional de Hidrocarbonetos' planned investment would end up in projects that would not break even.
- Almost ½ of the Nigeria National Petroleum Corporation's projects would not break even either, putting at risk $13 billion
- Almost ⅓ of the Republic of Congo SNPC's planned expenditures would not yield any profit (between $500 and $600 million)
- Senegal's oil and gas resources might already be stranded, e.g. the Sangomar field original internal rate of return was estimated at 28% but drops to 9% when taking into account the energy transition and operational delays.
- Ghana would see less than half of their projected revenues materialise in net zero by 2050 scenario,
- The nascent oil and gas projects in Uganda would yield no revenues (Boyer 2021).

Oil and gas often make up a high proportion of government revenues, thus if oil prices fall, these **governments will struggle to balance their budgets as they need to continue providing public services for their populations**. Boyer (2021) suggests that governments should be transparent about project costs and contractual terms to allow a proper understanding of each project's economics and viability under different parameters.

Figure 3: **Vulnerability of Petrostates' Total Government Revenues to Reduced Oil and Gas Demand Resulting From A Moderate-Paced Energy Transition**



Source: Rystad Energy, IMF, CTI Analysis

Notes: Bubble size indicates relative population size. ' indicates countries where we have not been able to update oil and gas as % of total govt revenue data since our last analysis. ^ indicates either greater oil and gas revenue than total government revenue (Iraq, Venezuela) or improved oil and gas revenues in our moderate transition, due to unknown gas pricing and demand

The fiscal breakeven price or price necessary for an oil-exporting state to balance its budget is another way to measure a state's vulnerability or economic resilience. Although O&G producers do not know what demand and price will do in the future, it is likely that an early excess of supply is likely to push down prices, leading to low subsequent investments, and resulting in higher prices in the short term. Essentially, the **lower the production price is for a state, the less vulnerable these states are** – it's important that a petrostates fiscal breakeven price is higher than the average price of Brent crude oil (approximately USD 80 per barrel in 2023) (Prince, et al. 2023). Therefore, **only those petrostates that have reduced costs and carbon intensity and become aggressively competitive will be viable** as overall demand and markets become more competitive during the energy transition. The Global Energy Scenarios forecasts that in

the Net Zero Emissions scenario oil will be around $15 per barrel and the Mean scenario forecast oil price at around $65 per barrel from 2027 to 2050. At this stage, few petrostates will have a breakeven fiscal price i.e. their costs are not profitable.

Emerging Petrostates

The global transition to Net Zero increases the financial risk for countries who are "emerging petrostates". Oil and gas producers will face a **declining demand plus lower commodity prices** on future revenues – and these aspects must be **factored into development of new oil and gas projects** as discoveries with less competitive breakeven price risk becoming stranded assets (RystadEnergy 2024., Prince, et al. 2023). At the same time, these **large capital investments** take years to develop the infrastructure required to extract oil plus **need decades of production to recoup costs** something that is highly unlikely to materialise, given the need for the energy transition (and noting that most O&G projects are only economically feasible if most of the products are exported).

Despite these concerns for emerging producers, African countries continue to trying to exploit their oil and gas finds. However, Prince et al. (2023) warn: '...they run the risk of wasting precious capital on upfront oil and gas investments, without realising the future cashflows they may be planning for.' i.e. **these 'assets' will likely be stranded before these countries are able to realise revenues.** Noticeably, faster and deeper energy transitions will affect demand more strongly and trigger higher risks of stranded assets. The analysis by ACF (no date) indicates that numerous LNG projects currently approaching or beyond their final investment decisions (FID) would no longer be economical.

Examples indicate that many countries may only begin exporting their oil and gas after fossil fuels are set to peak in the mid-2020s. Most African oil and gas projects take over 12 years to start producing and then these countries need to payback the investment costs (Payback periods for LNG projects can span 15 years, with contracts often accompanied by 20-year take-or-pay clauses.) before they begin to produce (The African Climate Foundation, no date).

This means **that if countries find gas in 2025, then they will likely only start producing in 2037** but will still **need to payback the investments costs**, at least until 2052 (depending on how big the find and how profitable the markets will be) – by which time they will need to close operations due to being obsolete, uncompetitive and not financially viable as well as due to climate change commitments. During this time, there will not be money flowing into the country i.e. no benefit for the country in question but there will be debt to repay. Added to this, analysis finds that African oil and gas assets are on average 15% to 20% more expensive to develop and operate and 70 to 80 percent

more carbon intensive than global oil and gas assets (Leke, Gaius-Obaseki and Onyekwelí 2022).

These examples include:

- **Uganda** which has faced delays on its oil and gas project e.g. the East Africa Crude Oil Pipeline which is likely to begin oil exports in 2025
- **Mozambique** has billion-dollar investments, on top of the increases in sovereign debt, which will require revenues to pay back well beyond peaking demand
- BP's floating LNG project along the border between **Mauritania and Senegal** has been delayed but is expected to be operational next year.
- The Mauritanian government is hoping to agree a business plan for a major offshore gas field in **Mauritania** in the coming years, with Shell also exploring for oil in the area.
- **Ghana** has been aiming to double its oil production and the government is selling more exploration rights in the hope of boosting production amid a severe economic crisis (Prince, et al. 2023).

Companies are at risk across the entire value chain

The road ahead will be unlike any the industry has travelled before. (RystadEnergy 2024).

RystadEnergy (2024) note that along the full value chain i.e. exploration, development and production, companies in the oil and gas sector are at risk as we transition global energy systems. Included in their stakeholders are investors and banks (likely consultants too) who have traditionally earned an income from the oil and gas sector.

While the whole oil and gas sector will be negatively impacted, some companies might be better positioned to remain competitive for a longer period of time. At this stage, it is estimated that national oil companies (NOCs) hold the most competitive reserves (i.e. produce at lower costs), so they will probably remain more competitive in a low-price oil market environment – although they will face a minimum of a 20% decline in liquid production rates by 2040 (Prince, et al. 2023). Therefore, towards 2050, most NOCs will hold an increasing share of global production and investments in all scenarios. However, these outcomes aren't certain for all NOCs and some NOCs are less competitive than others (Prince, et al. 2023). At the same time, NOCs have fewer incentives to change as governments want to maintain income from petroleum. Public companies are more likely to be spurred by persistent shareholder or external pressure to embrace lower-

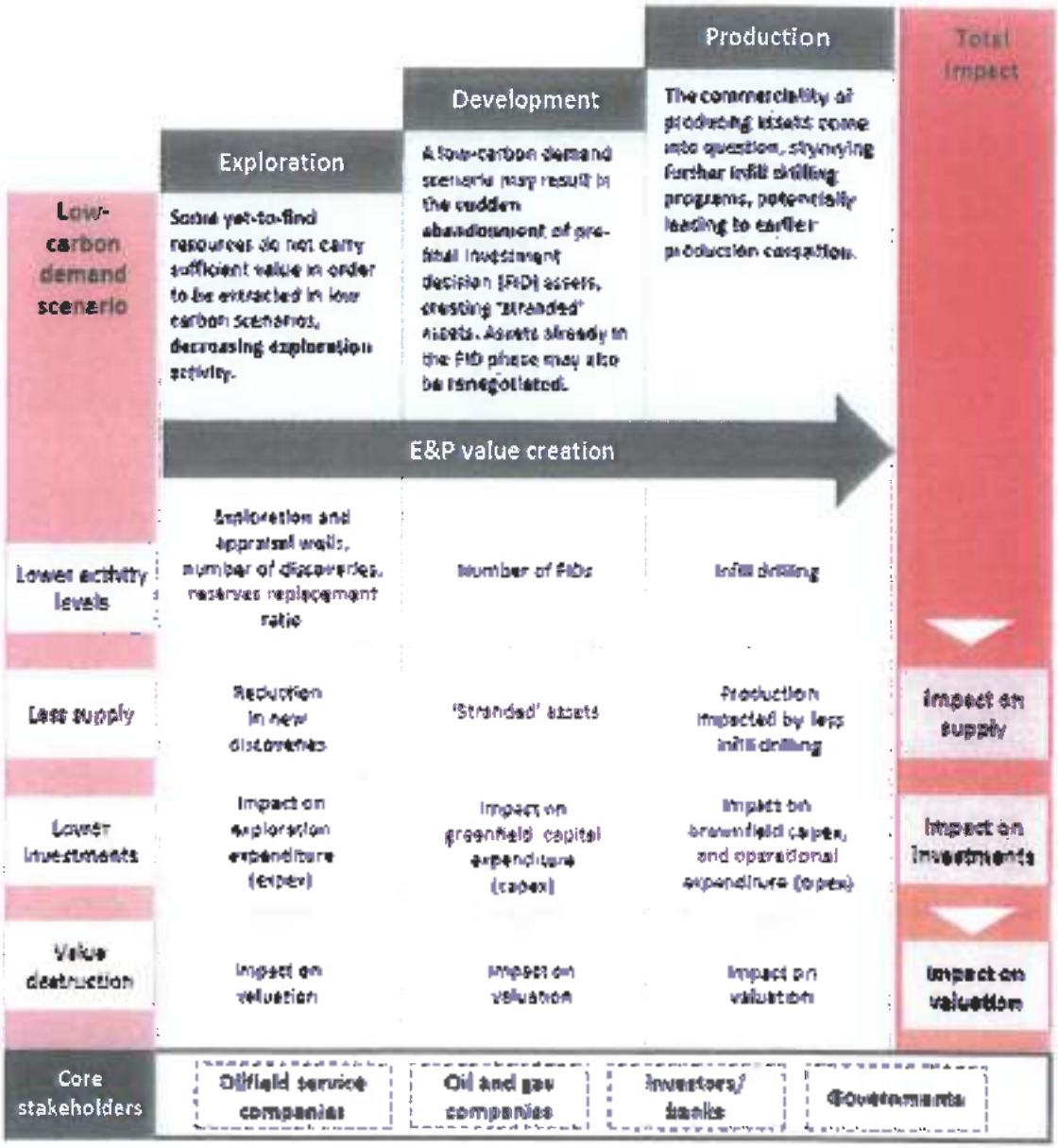
carbon operations (RystadEnergy 2024). Non-NOCs will likely face over 50% decline in demand (Prince, et al. 2023).

Oil and gas companies are in denial about climate change and analysis of eight of the largest integrated oil and gas companies — BP, Chevron, Eni, Equinor, ExxonMobil, Repsol, Shell, and TotalEnergies (the "oil majors") indicate that none of their plans or strategies are aligned to the Paris Agreement (RAN; BankTrack; IEN; OCI; Reclaim Finance; the Sierra Club; Urgewald 2023). Despite signing onto pledges, major oil and gas companies have been backsliding and it is unlikely that any of these companies will willingly make the energy transition (RAN; BankTrack; IEN; OCI; Reclaim Finance; the Sierra Club; Urgewald 2023).

Prince, et al. (2023) suggest that the oil and gas sector is trying to slow down the process of transition by trying to innovate technology that is currently dependent on oil and gas. They use the term the 'sailing ship effect'[3] to describe this inefficient use of capital to delay an inevitable transition – that would have been better spent on new technologies and innovation (Prince, et al. 2023). The example cited is Saudi Aramco's doubling of its spending on research and development in the last five years, with a particular focus on the efficiency of internal combustion engines.

[3] The "sailing ship effect" describes the increase in sailing ship innovation in the mid-nineteenth century to delay their replacement with steamships (Prince, et al. 2023).

Figure 5: Companies are at risk along the whole value-chain



Transition Risk and South Africa

South Africa would be considered an emerging petrostate, thus, if SA plans on exporting O&G, it is likely that due to the global transition to net zero, SA gas will not be sufficiently price competitive to be exported and the global demand is likely to decline by the mid-2020s i.e. there will be no market for SA O&G (IEA, 2024; International Energy Agency, 2023). If the intention is to use the O&G domestically, then models developed in SA indicate that South Africa's power needs can be met with very little gas and the large majority of new energy new generation capacity should be wind and solar, with an increasing requirement for flexible (dispatchable) capacity to support this (Roff, et al. 2022). Moreover, gas power is almost triple the cost of renewable energy and thus not

cost-competitive (Roff, et al. 2022). Research by NBI indicates that either way SA will have to substitute gas with greener alternatives and phased out by 2050 for South Africa to achieve a net-zero 2050 target (NBI, BCG, BUSA, 2022). This indicates a high probability of stranded assets if SA invests in both the upstream and downstream O&G sector.

In 2019, Huxham, et al analysed South Africa's transition risk. They found that **South Africa faces transition risk of more than $120 billion in present value terms between 2013 and 2035.** The authors note that South Africa's trade-offs associated with a low-carbon transition are particularly acute because of the high levels of unemployment and inequality, together with a strong reliance on fossil fuels. **This analysis did not include analysing the risk from the offshore oil and gas industries** but they did make key recommendations for the South African government and businesses prior to investing in these projects. Moreover, they note that if the government took action to mitigate the risks, it could avoid potential economy-damaging risk concentrations and in so doing, reduce the costs associated with the decarbonisation of the South African economy:

> 'The analysis ... demonstrates that the risk to South Africa – its companies, workers and public finances – of **continuing with business as usual is higher than the costs of managing those risks through proactive management of risks to the economy**.' (Huxham, et al., 2019).

A key recommendation was that **South Africa should avoid or delay new investments that could add to South African climate transition risk** until the market for the related product is certain. South Africa needs to understand thoroughly the consequences and likelihood of the transition and related risks as well as determining whether these investments continue to make sense within South African's development ambitions. Thus, South Africa should introduce climate transition risk assessments as a standard condition of application for public sector procurements, financial assistance such as guarantees to finance on preferential terms from state-owned financial institutions or other fiscal incentives, could help avoid investments where the risks outweigh potential or likely benefits (Huxham, et al., 2019).

Making the risk and its eventual allocation explicit may also reduce the incentive for local entrepreneurs to compete to buy emissions-intensive assets from international mining majors, leaving more transition risk with investment grade balance sheets who are strong enough to absorb it. Such a step would also make it easier for government to budget for the effect on the public finances. (Huxham, et al., 2019).

The long-term structural changes in demand for fossil fuels, will have enormous repercussions as they will influence the value of physical and financial assets, tax flows, jobs and knowhow (Huxham, et al., 2020).

6. The Danger of Stranded assets

Stranded assets are assets that become devalued or fail to generate an economic return before the end of their economic lifetime or can no longer be monetised due to changes in circumstances (Dube, No date; Carbon Tracker, 2023). The International Energy Agency defines stranded assets as "those investments which have already been made but which, at some time prior to the end of their economic life, are no longer able to earn an economic return". Simply put, stranded assets are projects that fail to deliver adequate returns as conditions change (Grant & Coffin, 2020). These investments may involve the purchase of rights to explore in a given area, or assets with infrastructure in place actually producing hydrocarbons. Livsey (2020) notes that global investors are shifting their investments away from the traditional energy sector and this poses a big problem for energy groups whose fossil fuel reserves may never be extracted due to climate change. The energy groups will then be left with stranded assets, having to write off substantial amounts of their fossil fuel reserves – estimated to be over $900bn — or one-third to half the current value of big oil and gas companies (Livsey, 2020). Hurst (2020) highlights the impact that COVID-19 has had on companies which have abandoned projects that are no longer viable. Moreover, Livsey (2020) predicts that oil producers will be hit twice – fossil fuels will lose their value while simultaneously carbon taxes will reduce demand further.

Economic modelling shows that to achieve Net Zero Emissions in 2050 (NZE2050), with the current levels of investment in O&G, over US$350 billion in African oil and gas assets would be stranded, with more than US$90.3 billion in stranded assets in Nigeria alone (The African Climate Foundation no date). Global Energy Monitor (2022) documents a US$245 billion planned expansion of gas infrastructure that is underway in Africa- most of this gas is intended to support Europe's short-term energy crisis resulting from Russia's invasion of Ukraine. This will likely lead to stranded assets and a failure to invest as strongly as necessary in Africa's domestic generation capacities and renewable energy future (Global Energy Monitor, 2022).

At the end of January 2021, the risk of stranded assets facing energy companies was highlighted as rating agency S&P increased its risk rating for the entire oil and gas sector from "intermediate" to "moderately high" because due to the move away from fossil fuels, poor profitability and volatile prices (Butler, 2021). As such, 13 oil and gas companies were warned that they may be downgraded in weeks. The companies on notice of a possible downgrade are Australia's Woodside Petroleum as well as multinationals Chevron, Exxon Mobil, Imperial Oil, Royal Dutch Shell, Shell Energy North America, Canadian Natural Resources, ConocoPhillips and French group Total (Butler, 2021). S&P are also considering downgrading four large Chinese producers – China Petrochemical Corp, China Petroleum & Chemical Corp, China National Offshore Oil Corp and CNOOC (Butler, 2021).

'Embarking on a large-scale gas-to-power strategy given these realities creates significant economic and environmental risk.' (Roff, et al. 2022).

If there is no economic rationale for large-scale gas use in power and there is no international market for O&G, then following the SA government's outdated vision would deliver assets that are stranded (Roff, et al. 2022). Moreover, using the logic from emerging petrostates, if SA were to find Oil or Gas in 2024, it would likely take at least until 2034 to start producing – and then SA would have a payback period of approximately 15 years (i.e. until 2049) before SA would begin to see any profits on these investments. However, SA will then need to shut operations due to climate change commitments by 2050 (if the global market for O&G even exists at that stage, which from the energy scenarios, seems unlikely). During this time, SA is unlikely to see fiscal benefits such as increases in economic growth.

From a macroeconomic perspective if SA pursues an extractive O&G policy, it is likely that SA's levels of debt will increase and credit ratings are likely to drop further.

7. Lessons learnt from other African countries

South Africa should look to both African and global countries for lessons on the extraction of oil and gas reserves. In February 2024, Bloomberg documented some of the challenges facing African countries regarding their O&G finds, noting Senegal's economic woes:

> *Senegal joins other African countries that have struggled to ride some of the world's biggest oil and gas discoveries in decades. The finds have rarely lived up to their promise, often doing more harm than good. Everything from project delays to political uncertainties and mismanagement have capped export revenues, forcing the nations into additional borrowings and worsening their financial situations. Senegal's debt is becoming more expensive, Mozambique has had to restructure its loans and Ghana defaulted amid the mismanagement of its oil and gas production.*
>
> *The discoveries have also done little to improve the energy situation at home. Domestic markets across the continent are no match for the lucrative ones beyond its borders. Foreign companies balk at developments that don't target export markets, leaving local economies with limited access to their own gas that can be used to generate electricity for homes and industry. Almost 600 million people, or just under half of Africa's population, lack direct access to energy even as 6% of the world's gas and about 7% of its oil is produced there.*

Mihalyi & Scurfield (2020) highlighted the benefit of hindsight as they analysed 12 Sub-Saharan African countries who had found oil and gas deposits during the period 2001 – June 2020. Their findings were that all 12 countries fell short of forecasted expectations.

The economic outlook of these countries has changed following these disappointments, especially following the slump in commodity prices that began in late 2014 (Mihalyi & Scurfield, 2020).

1. Overvaluing non-renewable resources

For oil and gas to be commercially viable, the deposit size of the find is important. Mihalyi & Scurfield (2020) find that the commercial viability of resources varies significantly and may change over time. Moreover, many of the African countries they analysed suffered disappointment after their initial discoveries. One reason that discoveries were overestimated was due to companies wanting to emphasize positive results to inflate their share prices. This also has the effect of misleading governments and other companies exploring in the same areas (Mihalyi & Scurfield, 2020). The PWC's Africa Oil and Gas Review (2020) estimates that the demand slump in global oil will result in lower prices per barrel over at least the next 20 years which will 'cost' Africa R14,55tn in lost export revenues.

In 2020, Huxham, et al analysed how a global low carbon transitions could affect the profitability and value of Uganda's two principal under-development upstream oil fields; the export pipeline from the Kabaale industrial park near Hoima to Tanga port in Tanzania, and the East Africa Crude Oil Pipeline or EACOP (including the planned oil refinery to be built in the Kabaale industrial park). Huxham, et al (2020) note that in Uganda, the value of the upstream oil reserves has fallen by more than 70% (from R887 billion to R262 billion) since 2013. They argue that if a global low carbon transition consistent with keeping global warming to well below two degrees occurs, the value of Uganda's oil reserves could fall a further R145 billion (or 56% of its value in 2020) and would be worth 88% less than they were in 2013.

2. Timeline from discovery to production

Industry studies indicate that oil and gas projects frequently have time and cost overruns, and more so in Africa (Mihalyi & Scurfield, 2020). Globally, the average amount of time it takes to get from discovery to production is 7.5 years. In Sub-Saharan Africa, the average time is around 12 years. For gas assets, the average time is nine years globally, versus 15 years in Africa (Mihalyi & Scurfield, 2020). The extensive time and cost overruns may make these extractive projects less commercially viable, especially within the context of falling demand.

3. Government revenues generated

African government revenues have fallen significantly short of forecasts. The most recent revenue projection is on average 63% lower than was initially estimated (Mihalyi & Scurfield, 2020). The shortfall has been attributed to; lower rates of production than

originally forecast; challenges associated with taxing production as the resource sector

Mozambique government revenues lower than projected

There is no shortage of natural gas in Mozambique, however, the challenge lies in mobilising investments needed to bring the gas to market (Hubert, 2019). The first project to extract gas in Mozambique is the Coral South Floating project, led by Eni. The first exports are expected in late 2022.

Previous revenue projections generated by the International Monetary Fund (IMF), the World Bank-funded Gas Master Plan, and Standard Bank analysis, suggested very substantial government revenues from LNG by the early- to mid-2020s. These forecasts assumed early first exports, the rapid expansion of production capacity, and very high LNG prices (Mihalyi & Scurfield, 2020).

The predictions for government revenues from FLNG are crucial for Mozambique given the challenges of external debt and declining donor support (Hubert, 2019). Three different government revenue forecasts have been generated: Eni has indicated that the government can expect to generate around $16 billion in revenue over the life of the Coral South FLNG project; the Mozambique Ministry of Finance model suggests the project could generate around $11.5 billion in revenue; while the Mozambique Minister of Mineral Resources and Energy reported that the project could generate up to $24.5 billion.

The IMF projections for Mozambique appear flawed as they estimated that corporate income tax would be paid in the first production year, which experts believe is unlikely (Mihalyi & Scurfield, 2020). Moreover, Hubert (2019) estimates that the construction of the liquid natural gas (LNG) facilities needed for export will cost tens of billions of dollars.

An alternative forecast by Hubert (2019), using an assumed oil price of $70 per barrel in 2022, forecasts government revenues of around $11.6 billion over the life of the project. However, government revenues are highly sensitive to oil prices and if the price increases to $85 per barrel they estimate government revenues of $19 billion, while at $55 per barrel revenues would fall to $5.5 billion. Hubert (2019) suggests that government share of revenues is low at approximately 49% and that timing is a challenge as the rear-loaded nature of the agreement means that government revenues are likely to be very modest in the early years of production, especially if there are cost over-runs, or if prices remain low. This means that the start of significant government revenues will be pushed back even further (Hubert, 2019).

can be hard to tax effectively; underestimates of costs or cost deduction; and, mistaken fiscal assumptions in modelling (Mihalyi & Scurfield, 2020). In addition, the share of after-cost revenues that flow to the government as opposed to companies (known as the 'government take') has not met with expectations (Hubert, 2019).

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8. The Resource Curse and Local Maldevelopment

The failure of states to improve the social and economic conditions of their citizens despite being rich in resources such as oil and gas has been described as the 'Paradox of Plenty' or the 'resource curse'. The paradox is that, on average, countries with an abundance of non-renewable resources tend to have lower levels of economic

development and growth than those without such resources (Lagercrantz & Khabbaz, 2019; Onyeukwu, 2007; Stiglitz, 2012). In addition, countries rich in extractive resources tend to have higher levels of inequality and lower levels of democracy (Stiglitz, 2012; Lagercrantz & Khabbaz, 2019; Overy, 2019).

In general, countries with extensive oil and gas reserves do not develop their own economies by reinvesting their wealth. This is largely because weak political institutions and underdeveloped civil societies make it possible for political elites within mineral or non-renewable resource rich countries to redirect much of the income to themselves. This, often deliberate, mismanagement of resource revenues means that mineral resource rich countries tend to underinvest in education and other important public goods. This underinvestment is exacerbated by the neglect of taxes as a source of revenue because extractive revenues are so high.

In addition, resource rich countries fail to diversify their economies adequately, prioritising the quick gains that come from extraction, over more long-term economic planning. This often results in the agricultural sector being neglected, leading to increased poverty in rural populations. It also leads to underemployment as jobs are not created in other economic sectors. All of this is further compromised by the volatility in non-renewable resource prices which causes unstable revenue streams, a situation made worse by commodity trading (Stiglitz, 2012; Onyeukwu, 2007; Romanova, 2007).

It is unsurprising that this unstable and chaotic context gives rise to conflict between different political forces within countries over access to non-renewable resource rents. Gillies (2020) describes the emergence of the 'rentier state': A political system where elites allocate resource wealth to extend their power rather than to provide public goods (Stiglitz, 2012; Lagercrantz & Khabbaz, 2019; Gillies, 2020).

Seriously compounding the problem of the resource curse, is the phenomenon known as 'Dutch Disease'. Dutch disease, so named after the experience of the Netherlands after its discovery of North Sea gas and oil in the 1960s, describes problems that emerge with the rapid inflow of money that comes from non-renewable resource extraction. Firstly, it leads to currency appreciation, which results in a dramatic fall in the competitiveness of exports, be they manufactured or agricultural. This leads to falls in export revenue for these sectors, which are also battling against cheaper imports caused by currency appreciation. Both capital and labour to abandon these sectors in favour of the booming extractive sector, further damaging these sectors and boosting the extractive sector. This concentration of capital and labour can then become a problem within the extractive sector because it creates localised competition for goods like food (an industry which has already been undermined), and services such as housing. This then results in local costs rising for these types of critical goods and services, and results in economic recession (Lagercrantz & Khabbaz, 2019; Onyeukwu, 2007).

This localised influx of capital and labour can lead to serious social issues. Extensive migration into oil-producing areas places strain on public infrastructure and results in increased poverty rates, poor healthcare, high rates of child mortality, gender and economic inequality and crime. Research also shows how 'Dutch disease' both causes and contributes to the conflicts that occur in these countries (Onyeukwu, 2007; Romanova, 2007; Lagercrantz & Khabbaz, 2019).

Evidence shows that the economic, social, environmental and governance impacts that arise due to the extraction of oil and gas, tend to be localised in the regions where extraction takes (Lagercrantz & Khabbaz, 2019). The following sections explore in more detail the ways in which the paradox of plenty and Dutch Disease manifest themselves in non-renewable resource-rich countries. They look at problems that emerge both at national and local levels.

Moreover, research titled 'The forgotten resource curse: South Africa's poor experience with mineral extraction' finds that SA has experienced many of the symptoms outlined in the resource curse literature including relatively slow GDP growth, gross inequality, entrenched poverty and the creation of a rentier state. Overall, it finds that most of the SA population has failed to benefit from natural resource wealth – with sections of society actively harmed through the process of mineral extraction. This research classifies SA as a resource cursed state (Elbra, 2013).

It is clear from South Africa's macroeconomic outlook that many of the challenges outlined above still exist:

- South Africa's macroeconomic outcome is a bleak picture despite managing to avoid a technical recession in 2023 with real GDP growth at 0.6%. For 2024, South Africa's overall economic outlook is weakly positive with the National Treasury predicting GDP growth of 1.3% in 2024 and 1.6% in 2025 which is lower than the International Monetary Fund's forecast of 0.9% in 2024 and 1.3% in 2025. This low level of GDP growth has partially been attributed to constraints in the electricity and logistics sectors (especially rail and port infrastructure constraints) which needs structural economic reforms (Marais and Spangenberg 2024). To stimulate economic growth, there is a need for capital investment and specifically to invest in infrastructure and crowd in more private sector finance to support and implement projects.
- As of 2023, around 18.2 million people in South Africa are living in extreme poverty[4] and this number is forecast to increase in the coming years. Moreover,

[4] poverty threshold at US$1.90 dollars daily

SA has very high rates of child poverty. Although these levels have fallen as a result of a massive expansion of the Child Support Grant, given that the child population has grown over the past two decades, there were more children living in poverty in 2022 than there had been in 2003: 53% of children (11.1 million) were poor in 2022 and 38% (7.9 million children) were below the food poverty line, meaning that they were not getting enough nutrition.

- According to the most recent data, South Africa has the highest income inequality in the world, with a Gini coefficient of around 0.67. This is attributed to high levels of unemployment; very low wages or income for many of those that are employed; and high income and wealth levels for a small percentage of South Africans (the top 0.01% of people or 3,500 individuals own about 15% of all of the wealth).

- Unemployment levels in SA are estimated to be 32.6% (June 2023) but using the expanded definition of unemployment, it is more likely that over 44% of the working population is unemployed. The IMF predicts that unemployment will increase to 33.5% by the end of 2024 (using the narrow definition).

Local Economic and Social 'MaI/Development'

There is an assumption that the establishment of an oil and gas industry brings extensive local economic benefits to the areas in which the industry takes hold. But as we have seen, this has not been the general pattern in Africa, where regions rich in non-renewable resources have tended to be cursed, rather than blessed by them.

Recent research by the Ohio River Valley Institute analysed the 22 counties which make up the Appalachian methane gas region. While their findings revealed that these counties increased their contribution to US GDP by more than one-third between 2008 and 2019, during the same period measures of local economic prosperity—the economic impacts of that growth—not only failed to keep pace with the increased share of output, but actually declined (O'Leary, 2021) (O'Leary, 2021)

O'Leary (2021) documents this case of economic growth without increasing prosperity, or the resource curse. He notes that the gas wells produced substantially more gas than had been originally predicted which should have created over 200 000 additional jobs and increased tax revenues for these counties as well as other indicators of economic progress. Between 2008 and 2019 the number of jobs nationally increased by 10%, but in the Appalachian methane gas region, despite booming natural gas production, the 22 major gas-producing counties experienced a combined job growth of only 1.6% - with many of the counties experiencing substantial job declines during that time (O'Leary, 2021).

Moreover, the vast majority of Frackalachian counties experienced economic stagnation or outright decline and depopulation. O' Leary notes, '... there is little in the numbers to support the contention that the Appalachian natural gas boom has been or can be an engine for economic prosperity. If high production volumes were capable of creating jobs and prosperity, it would have happened. And there is a great deal which suggests that, in some cases, the industry may have the opposite effect.' (O'Leary, 2021).

Because of the jobs and other economic opportunities that sites of resource extraction appear to promise, local government institutions can become overwhelmed by the demand for social services and public goods. Evidence from the United States and Canada shows that the influx of people that follows the emergence of extractive industries results in increased demand for public services for several complex and often interrelated reasons. A growing population clearly demands increased infrastructural support in terms of basic municipal services such as health, education, emergency services, water and sanitation, electricity, and transport.

Health

Health services come under severe strain because of the negative health consequences of oil and gas extraction. Although the health effects of people exposed to upstream oil industry contaminants has been poorly studied, the health of communities living in close proximity to oil and gas extraction sites is affected by environmental impacts such as the contamination of air and water. Their health is also affected negatively through gas flaring and the long-term impact of climate change on these communities (O'Callaghan-Gordo, et al., 2016; CCAC Secretariat, 2020; Maduka & Tobin-West, 2017). Health outcomes range from chronic and recurrent respiratory diseases, abnormal haematological indices and increased susceptibility to blood dyscrasias, dermatological diseases and malignancies, nausea, dizziness, fatigue, genotoxity and alteration in hormonal status among others (Maduka & Tobin-West, 2017; O'Callaghan-Gordo, et al., 2016). Psychological disorders are also more prevalent in communities living close to oil and gas extraction sites (O'Callaghan-Gordo, et al., 2016). Moreover, persons living in gas-flaring host communities are 1.76 times more likely to be hypertensive than persons resident in communities outside of oil-rich areas (Maduka & Tobin-West, 2017). One resident living next to a flaring site in South Africa told the British *Guardian* newspaper in 2015, 'it's very scary: I feel choked up, I feel my lungs can't get air, I feel starved of oxygen. I get panic attacks' (CCAC Secretariat, 2020).

Research on human health and climate impacts of fracking in Appalachia found that premature deaths caused by the industry's pollution had an economic cost of R335 billion, while one year of life is lost for every three job years created by the industry. It also noted a disproportionate burden on the poor that included higher mortality risks induced by fracking-related air pollution. The lead author of this research stated, 'Private firms across the supply chain have not faced the full costs of natural gas development... and the public has effectively subsidized greenhouse gas and air pollution emissions that result in climate change and health impacts' (Concerned Health Professionals of New York; Physicians for Social Responsibility, 2020).

Education

The demands placed on schooling systems also seems to outstrip the ability of local governments. Research shows that schools in resource-rich towns in the United States and Canada tend to have higher teacher turnover, lower attendance rates, poorer

academic results, and higher drop-out rates (Concerned Health Professionals of New York; Physicians for Social Responsibility, 2020).

At the exact point that demand for public services increases, the negative environmental consequences of the oil and gas industry can act to reduce local government revenues. This is because the oil and gas industry can reduce local taxes and income from other economic sectors such as tourism, forestry and fisheries. In addition, substantial local costs must sometimes be borne by local communities addressing issues such a s water pollution caused by the industry. (Concerned Health Professionals of New York; Physicians for Social Responsibility, 2020).

Emergency Services

There is also increased demand for police and emergency workers because of the myriad of social ills that take place in resource extraction sites as documented by (Concerned Health Professionals of New York; Physicians for Social Responsibility, 2020). These social ills include:

- Increases in prostitution.
- Sex trafficking, including children, in oil boomtowns linked to 'a confluence of underlying forces including big oil money, an increase in drug cartels and drug use, degradation of women in a male-dominated workforce, increased access to weapons, and a rise in transient populations'.
- Increases in domestic violence, dating violence, sexual assault, and sexually transmitted diseases.
- Increases in traffic violations, traffic accidents and fatalities.
- Increased drug abuse and drug trafficking.

Evidence from the United States conclusively shows that crime levels increase compared to before the extraction of oil and gas and compared to other towns without extractive industries. 'With the arrival of drilling and fracking operations, communities have consistently experienced steep increases in rates of crime, variously including assault, rape, sex trafficking, larceny, and auto theft...Crime rates have increased even with additional allocation of funds for public safety' (Concerned Health Professionals of New York; Physicians for Social Responsibility, 2020).

Local Businesses

Although an increase in people from a 'boom' in the oil and gas industry will create opportunities for some businesses, there are several sectors that will be impacted negatively by the oil and gas industry. In addition, volatile oil and gas prices are likely to impact negatively on local businesses as volatility increases business risks (O'Leary, 2021). The Ohio River Valley Institute notes that it cannot be assumed that companies will purchase from local suppliers, as many oil and gas companies already have

preferential suppliers from outside regions, and thus there is often little beneficial impact on local economies (O'Leary, 2021).

Other business can be severely negatively impacted. Findings from the United States and Canada demonstrate that the fishing industry, both commercial and small-scale, tourism, and tourism-related industries such as accommodation, experience downturns with the commencement of oil and gas extraction. (Concerned Health Professionals of New York; Physicians for Social Responsibility, 2020).

Housing

The rapid influx of people seeking work puts extreme pressure on housing and accommodation stocks. Evidence from the United States, Britain and Canada has identified a negative impact on local housing markets. For poorer residents, affordable housing becomes a challenge as there are insufficient houses available to satisfy demand. However, over the longer-term, the negative impacts of the industry, such as pollution and seismic activities, resulted in properties losing value – and these impacts tended not to be covered by home insurance. In some cases, some properties became 'unsellable' or people were unable to cover their home loans – especially during volatile periods (Concerned Health Professionals of New York; Physicians for Social Responsibility, 2020).

Inequality

Evidence also indicates that the combined impact of these challenges exacerbates pre-existing social and economic problems within communities. In particular, inequality between residents tends to accelerate, between those who benefit from the non-renewable resource boom and those who do not, but nonetheless still have to endure its negative impacts. As the Concerned Health Professionals of New York note 'economists are increasingly quantifying community quality of life impacts and the unequal distribution of costs and benefits associated with drilling and fracking.' (Concerned Health Professionals of New York; Physicians for Social Responsibility, 2020).

Conflict

There are numerous global examples of increased conflicts around non-renewable resource extraction sites, largely due to the degradation of natural resources. Indigenous communities are frequently at the forefront of this violence and intimidation (Lind, 2015). Examples include the convergence of state and corporate interests in driving non-renewable resource-violence in Nigeria, Mozambique, South Africa, Uganda and elsewhere. (Lyons, 2016). Another example comes the state-based violence currently being perpetrated against members of the North Dakota's Standing Rock Sioux Tribe who are trying to defend their water rights and way of life against the North Dakota access oil pipeline (Lind, 2015). Conflict also occurs as residents from regions where mineral resources are being extracted feel that they are not benefitting from them but are enduring the negative consequences of the extraction (Rose, 2015)

Babatunde (2020) notes that oil pollution of the marine environment and increased deforestation and the exploitation of marginal land has severely damaged the resources that people traditionally depended upon for their livelihoods in the Niger Delta. This has led to a complex pattern of conflicts in the region since the late 1990s. Local people blame the oil multinationals and the Nigerian government for the environmental degradation and feel they have not been properly compensated for its impact (Babatunde, 2020).

In Turkana, in northern Kenya, relations between the state and local communities are characterised by mistrust and conflict since the mushrooming of oil exploration operations in the area since 2012. Until the oil finds, successive governments showed little interest in Turkana, even though insecurity was rife and poverty levels were high. Many Turkana are dubious of the state's inability or unwillingness to address chronic violent insecurity, which has been so damaging to the livelihoods of local pastoralists over time. (Lind, 2015).

Local Employment

Evidence suggests that few jobs are realised for local community members in the early years of oil or gas developments. The Concerned Health Professionals of New York (2020) documented that in the USA, 77% of the workforce on shale gas drilling projects consisted of transient workers from out of state. Only by the 30th year of the shale gas development would 90% of the workforce be comprised of residents from in state (Concerned Health Professionals of New York; Physicians for Social Responsibility, 2020).

Local towns also suffer from the consequences of Dutch Disease when non-renewable resources become depleted or when demand shrinks. In these areas, finding employment with the extractive has often been the only means of survival. As a result of the decline in demand for coal, oil and gas, and the inevitable decommissioning of rigs, mining communities around the world have seen their local job markets decline or be eliminated entirely (SystemIQ, 2020). This obviously has the effect on exerting yet more pressure on local governments. (Raimi & Newell, 2016) warn that all communities heavily dependent on oil and gas-related revenues must diversify their economies – a major challenge when regional economies have come to thrive on the extraction of finite resources.

In South Africa, our high rates of unemployment will probably result in an influx of unemployed people into oil and gas rich locations who will likely increase the size of informal settlements, while housing and rental costs are likely to increase for middle-income families. Although local governments will probably gain from property taxes, residents will most likely carry the burden of the increased taxes in order to subsidise the increase in demand for municipal services.

The sad reality is that most municipalities in South Africa will be entirely incapable of dealing with the increases in demand for public services and environmental protection services that will come with the emergence of an oil and gas sector in South Africa. In 2020, the Auditor-General reported that 'most municipalities' in the country were in a state approaching chaos. They were 'crippled by debt', could not pay for water and electricity, had 'inaccurate and lacklustre revenue collection', and were plagued with 'expenditure that is unauthorised, irregular, fruitless and wasteful'. He concluded by noting that there was a 'high dependence on grants and assistance from national government' (Makwetu, 2020).

There are also important differing concepts of 'development' and what 'development' actually means to people. It cannot be assumed that all South Africans want the economically determinist development that resource extraction promises to bring. The current battles over mining in the Xolobeni region of the Eastern Cape in South Africa is insightful here.

Within the Xolobeni community many people are opposed to attempts by an Australian company to mine their traditional lands. Community members reject the type of development that they believe will come with mining. As Overy notes, 'they want to continue to use their unpolluted grasslands for pasture, grow their naturally organic food from their kitchen gardens and preserve the health of the rivers they drink from' (Overy, 2019). Xolobeni community leader, Nonhle Mbuthuma, stated last year, 'us and the land, we are connected. If you separate us from the land, you are killing some part (of us)'. (Rosa Luxemburg Stiftung, 2020).

Clearly these important concerns need to be considered within the context of the development of oil and gas in South Africa because much more than simple, reductionist economic views of the world are at stake.

Raimi & Newell (2016) argue that each community experiences oil and gas-driven growth differently and that it is difficult to generalise from one region to the next (Raimi & Newell, 2016). They note that a substantial majority of local governments across the United States have experienced net fiscal benefits from increased oil and gas production, and while they have seen increased demand for public services, revenue from a variety of sources has largely been more than enough to offset these additional costs. However, the data they present is concerning as they do not analyse losses from other industries, increased public health costs, increased pollution, nor do they weigh costs versus the revenue in their data. Moreover, they note that not all local governments have seen net fiscal benefits from oil and gas production. Municipalities that have experienced rapid growth have struggled to provide services for rapidly increasing populations (Raimi & Newell, 2016).

A South African Local Example: Platinum and the City of Rustenburg, South Africa

In Rustenburg South Africa, platinum output increased by 67% between 1994 and 2009, changing Rustenburg from an agricultural community to a more urbanized city (Lagercrantz & Khabbez, 2019; Eunomix, 2016). During this period, people migrated to Rustenburg to find jobs in the platinum sector which resulted in the population growing from about 68 000 in 1996 to 626 522 in the 2016. The most significant increase was among the male population in the 20 – 34 age group (Eunomix, 2016). So rapid was Rustenburg's growth, that by 2012 it contributed almost 4.9% of South Africa's GDP (Eunomix, 2016). However, the economy of Rustenburg became dependent on supporting the mining industry, which accounted for 70% of all local businesses (Lagercrantz & Khabbaz, 2019; Eunomix, 2016).

At the local level, the impact of the platinum boom has been largely negative. The rapid increase in population density has led to numerous social challenges, as documented by Eunomix (2016), Lagercrantz & Khabbaz (2019), and the Bench-Marks Foundation. These social challenges include:

- **Unemployment** - In 2011, overall unemployment in Rustenburg was 26.4%, with youth standing unemployment at 35%. Furthermore, 30% of the economically active population earnt no income, while 24% of households lived on less than ZAR 600 per month.
- **Crime** - Overall levels increased as more thefts, sex crimes, drug-related crimes and residential burglaries take place in Rustenburg than in other South African cities of similar size.
- **Disrupted Households** - Increased numbers of single men, and female-headed households (27% of all households), which has resulted in increased poverty as women struggle to find work due to patriarchal structures (Eunomix, 2016).
- **Substantial increases in HIV and AIDS rates** - between 2001 to 2011, there was a 49% increase in the number of HIV-infected people in Rustenburg. Other health problems among mine workers include tuberculosis, malnutrition, and respiratory illnesses. High levels of substance abuse have also been reported.
- **Lack of access to quality formal education.** The influx of people has resulted in overcrowded schools (up to 65 children per class) and a lack of basic schooling infrastructure. Moreover, only 31% of Rustenburg's population aged over 20 have completed high school, and only 8.9% have some form of higher education.
- Significant poverty levels and income inequality threaten social cohesion as almost 62% of the population live in poverty.

Evidence shows that the local government is unable to meet the demand for basic services such as housing, water, electricity, sewerage, public transport, health facilities

and schools. This inability to meet with the demands for social goods has been hampered by the mismanagement of local public finances, inadequate government capacity, and questionable policy decisions.

9. Additional Economic Risks to Consider

1. Increasing Sovereign Debt and Fiscal Risk

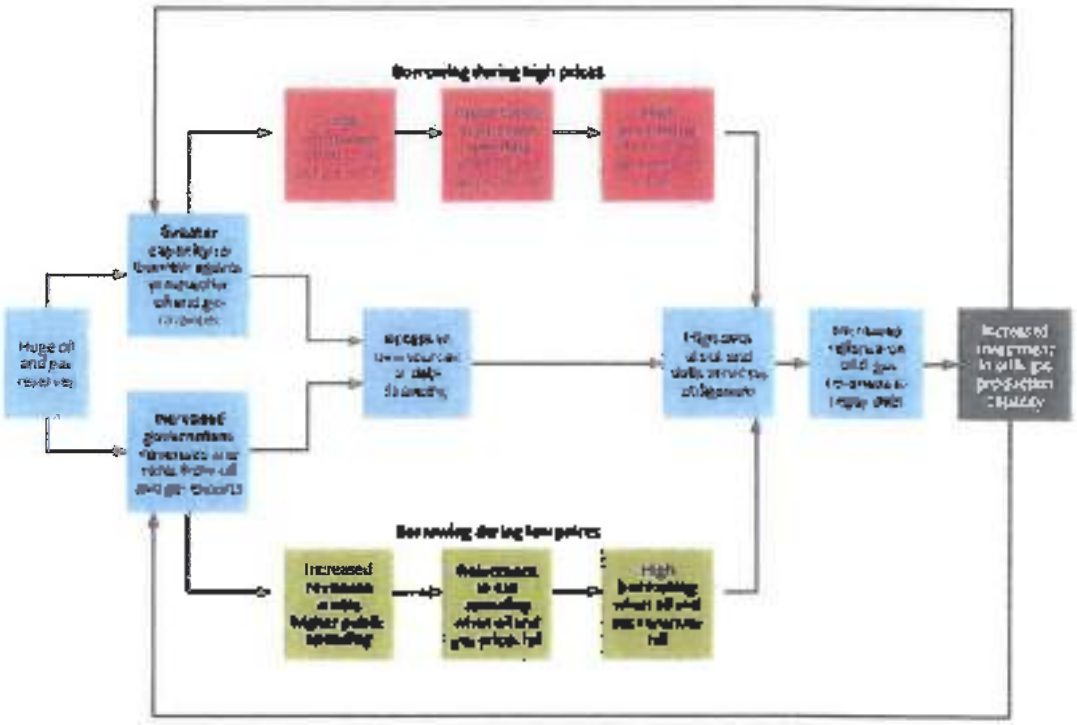
African debt, both continentally and nationally, has been rising (UNCTAD, 2023). In 2022, public debt in Africa reached USD1.8 trillion, increasing by 183% since 2010 (UNCTAD, 2023)[5]. Steadman, et al (2023) note that the increase in sovereign debt levels in low- and middle-income countries can't only be attributed to oil and gas dependency however their findings indicate that **oil and gas production exacerbates fiscal risks.** For oil and gas producers, the risks associated with climate change are high because of both the physical impacts of climate change and the likelihood of disappearing export markets will lead to fiscal and macroeconomic instability (Steadman, et al. 2023).

Petrostates tend to have increased fiscal dependence on oil and gas revenue (i.e. more dependent on the income from exporting oil and gas). Of the 33 petrostates for which the IMF has consistent data, average central government debt nearly doubled from 24% of GDP in 2010 to 46% in 2018. And the assumption was that this debt would increase (Steadman, et al. 2023). **Petrostates tend to borrow both when the oil price is high** because their credit ratings rise and hence make cheaper finance available, **and when it is low**, in order to fill their resulting fiscal gaps (Steadman, 2023). Their diagram below illustrates how countries become locked into debt dependency. Prince et al (2023) **warn that the energy transition will further exacerbate the levels of sovereign debt** as countries credit ratings decline and debt becomes more expensive while also seeing revenue from oil and gas falling and debt servicing becoming more important.

[5] The heavy debt-repayment burden will impact negatively on economic growth and stability in countries (Economist Intelligence, 2023). The higher borrowing costs and increasing debt have reverberated across countries' ability to finance development (and climate-related disasters) (UNCTAD, 2023). A higher share of revenue dedicated toward debt servicing is problematic in that it diverts resources from areas Africans need most including health, education, development and social support, exacerbating the situation of Africa's vulnerable populations. UNCTAD (2023) adds: As Africa's debt continues to rise, the continent is being confronted with a global financial architecture that is misaligned with its needs.

Figure 8: How oil and gas production locks nations into indebtedness and further dependency (Source: Steadman et al 2023)

Figure 8: How oil and gas production locks nations into indebtedness and further dependency



South Africa's debt has ballooned and is approximately 74% of GDP (around R5.2 trillion) (Van Niekerk, 2024). Debt is expected to increase to 77.7% of GDP in the 2025/26 fiscal year, exceeding R6 trillion (debt was R2.3 trillion or 49% of GDP in 2018) (SANews.gov.za, 2023). This limits government's ability to channel resources into the productive side of the economy as debt service costs are crowding out social spending as debt repayments form a greater share than social protection, health, community development, or economic development, with one in every five rands being spent on servicing the debt (Marais & Spangenberg, 2024; Van Niekerk, 2024; SANews.gov.za, 2023).

If SA has to take out further loans to develop an O&G sector, our debt and debt repayments would rise substantially – likely leading us to default on debt repayments and to shift into a full economic recession. Given this debt crisis, serious questions need to be asked about whether it is prudent to be investing in volatile commodities like oil and gas which could become a serious financial burden on the South African economy. There is little doubt that investing in oil and gas in South Africa is risky and has the potential to increase the country's already excessive debt burden.

2. Downgrading of credit ratings

> ... credit rating agencies, have all moved to the arena of comprehensive credit analysis, acknowledging the impact of climate change on traditional risk areas—regulatory, legal, economic, financial, political, and social. The issue has grown to such magnitude that climate has become its own risk category. (Sanzillo 2024).

Credit ratings are described as **independent mechanisms to assess creditworthiness** or the ability – and willingness – of **debt issuers to meet repayment obligations** (Steadman, et al. 2023, Sanzillo 2024). Credit ratings provide international investors with a rapid, standardised way to assess and price debt, and are particularly important for borrowing in international capital markets. But credit ratings agencies have significantly changed their perspectives: **fossil fuels** were once considered to be credit positive but now they are issuing clear, **specific warnings about the financial risks of fossil fuels** including oil and gas as these now face substantial financial risks.

Prince, et al. (2023) find that **there has been a general downgrade in credit ratings for the petrostates as debt has increased.** As petrostates earn less revenue from their oil and gas production, their **creditworthiness declines** i.e. they will have **lower credit ratings and thus borrowing on international capital markets will become more expensive** for these petrostates (Prince, et al. 2023). The consequences are likely to be a devaluation of currency, rising debt levels, reduced access to capital markets and economic contraction leading to concerns among investors and credit rating agencies about a state's ability to service its debt i.e. lower investor confidence (Prince, et al. 2023). Sanzillo (2024) warns that countries that want to capitalise on not yet exploited oil and gas reserves, **the market is more likely to reward low-carbon, fossil-free investments** (Prince, et al., 2023).

A key factor that prospective lenders typically use to assess the creditworthiness of a sovereign government, state-owned entity or private company that controls significant oil and gas reserves is the market price of oil and gas (S&P Global Ratings, n.d.). This is because the entity's ability to service debt is linked to the revenues it can generate from the sale of oil and gas, which are higher when prices rise and lower when they fall. However, commodity markets experience large and unpredictable price fluctuations (Steadman, et al., 2023). Thus, experience indicates that revenues tend to not be predictable.

Figure 2: Credit ratings agencies evaluations of fossil fuel sources

South Africa's credit ratings have been somewhat volatile over the last decade. In January 2024, Fitch credit rating agency disappointed SA by affirming the rating BB- with a stable outlook i.e. indicating an elevated vulnerability to default risk. In May 2024, S&P left SA's rating at S&P has a "BB-/B" rating on South Africa's foreign currency debt and a "BB/B" on local currency debt. These ratings are lower than investment grade ratings, making it more expensive to borrow on international markets for SA.

However, ratings agencies have expressed concern due to the weak economic outlook; power shortages, the struggling logistic sector, high unemployment rates and income inequality, and a high and rising government debt-to-GDP ratio. But the ratings agencies identified positive aspects such as flexible exchange rates, mostly local-currency-denominated, strong institutions, as well as a credible central bank. Were South Africa to increase its debt-to-GDP ratio further, credit would become far more expensive making it challenging to borrow on international markets.

3. Technological Lock-In

If African countries continue to invest in fossil fuels, it will displace investment in clean energy systems – Africa will be locked into old technologies and infrastructure and will be unable (and unaffordable) to change its course (Dube, No date). In 2022, RES4Africa wrote that although Africa's energy system has seen a major transformation, there has been limited uptake of non-hydro renewables. They add that if sustainable energy solutions had played a greater role in the transition from coal, there would have been the opportunity to significantly increase the socio-economic benefits that would have accrued with their development (RES4A; IRENA; UNECA, 2022). In addition to benefits such as the speed and reduction in operational costs of renewable energies, the positive impacts of shifting to renewable energy include:

- For each dollar invested, renewable energy creates two to five times more jobs than fossil fuels
- Other investments for a green economy – like climate adaptation, conservation agriculture, public transport and energy-efficient building retrofits – provide up to 25 times more jobs than those created by fossil fuels (IRENA and AfDB, 2022).

Reff, et al. (2022) note that the economically rational role for gas in power generation is for peaking or standby capacity. For approximately 97% of the time, large-scale gas-fired power generation will stand idle. Thus, locking SA into energy systems largely reliant on gas will create technological lock-in and perverse outcomes. Investing in gas infrastructure would reduce the funding available for cheaper RE and due to the cost of gas, if there is an extensive gas build out, including CCGT, it will be expensive to run these systems (and increase overall costs of energy in SA, likely to be passed onto consumers). Moreover, 'The option to delay this decision has immense value for South Africa, allowing us to evaluate technological developments as they arise and not commit ourselves to carbon lock-in / stranded assets.' (Reff, et al. 2022).

4. Illicit financial flows

   Countries with a high level of dependency on oil are more prone to higher levels of IFFs. (UNCTAD 2020).

Illicit financial flows (IFFs) are methods, practices and crimes aimed at **transferring financial capital out of a country, in contravention of laws. IFFs** include money laundering, bribery and tax evasion (Global Forum Secretariat, 2023). IFFs erode the public revenues that countries need to invest in their social and economic development, erode the investment base of countries and undermine the public's confidence in the integrity of the tax system (OECD, 2022).

Although it's difficult to accurately track IFFs, the report on Tax Transparency in Africa (2023) notes that IFFs as much as 50% of illicit outflows from Africa are generated via trade mispricing. In 2019, it was estimated that Africa loses more than $50 billion annually in IFFs although estimates vary with UNCTAD (2020) estimating that Africa had IFFs of USD 88.6 billion (EUR 85.1 billion) annually, or 3.7% of Africa's gross domestic product (UNCTAD 2020). IFFs are substantially higher than aid and investments in Africa (Global Forum Secretariat, 2023; ECA, 2019).

Research indicates that the **extractive industries are particularly prone to IFFs** (UNCTAD 2020). This is because the extractive industries tend to have high degrees of power and political influence, as key areas of revenue and export earnings, and African countries enter into secret and unequal contracts with multinational companies i.e. a **lack of transparency and accountability** (ECA 2019, Global Forum Secretariat 2023).

Of explicit concern is that IFFs contribute to financing terrorism in Africa:

> Taken together, the illicit exploitation of natural and environmental resources, including gold, diamonds, oil, charcoal, other minerals, timber and wildlife, and illegal taxation, confiscation and looting, account for 64 per cent of finance linked to security threats and conflicts (International Criminal Police Organization et al., 2018). It is further estimated that of the $31.5 billion in IFFs generated annually in conflict areas, 96 per cent is used by organised criminal groups, including to fuel violent conflict (Global Forum Secretariat 2023).

Illicit financial flows (IFFs) are difficult to measure due to their secrecy but it has been estimated that South Africa is losing more than $62 billion a year because of illicit financial flows and tax evasion: $21.9 billion per year in inward flows and $40.9 billion in outward flows (Cokayne, 2023). OECD research indicates that IFFs, not including tax evasion, might be closer to **between USD 3.5 and 5 billion in IFFs are leaving the country each year** (approximately 1-1.5% of South African annual GDP).

IFFs are particularly harmful in South Africa due to the significant fiscal challenges that the country faces. The SA government is trying to effectively address IFFs in SA but this is challenging without sufficient capacity and global support (OECD, 2022). A study on the Illicit Financial Flows (IFF) in the South African mining sector, specifically analysed transfer pricing (TP). The research noted that Trade misinvoicing is a reality impacting the South African mining industry and trade misinvoicing has become normalised in many categories of international trade. This form of IFFs which reduces the ability of SA to capture its legitimate share of the gains from international trade in terms of foreign exchange earnings and fiscal revenue collected from customs and other trade levies. At the same time there are many incentives for trade misinvoicing due to the regulatory environment (tariffs, customs, export subsidies, exchange controls) and imperfect monitoring and poor enforcement of regulations (Ngozo, 2020). Trade misinvoicing generates two sets of losses to the economy:

- Loss of revenues from customs duties, VAT taxes, income taxes, royalties, and other measures.
- Perpetuating the current economic structure through transfers of income and wealth out of domestic earnings, usually into wealthier countries overseas.

The South African mining industry has accumulated and reported net profits of R221 billion, between 2010 and 2019. The declared profits do not include the undeclared IFFs in trade misinvoicing for the silver-platinum group (R296 billion) and iron ore (R108 billion) in 2014 alone (Ngozo 2020). It is likely that IFFs will take place in an O&G sector

in SA where it is difficult to govern and measure extraction of O&G – which further impacts on the lack of profitability of an O&G sector.

5. Trade and competitiveness

According to the National Planning Commission, South Africa's trade accounts for around 60% of GDP (National Planning Commission, 2020). In light of the importance of trade to South Africa, remaining competitive is a particularly important economic factor. In 2020, Montmasson-Clair analysed the impact of the rise of the global climate change regime on South Africa's trade and competitiveness. The findings are highly concerning for South Africa's industrial development and that exports, are at particular risk. The reasons are:

- South Africa's exports are focused on a few destinations and they are heavily concentrated around a small number of value chains. Thus, South Africa is vulnerable to changes in trade patterns arising from measures aimed at transiting to low-carbon pathways.

- Secondly, many of the importers are transitioning away from carbon-intensive pathways, and consequently many of these importers are considering imposing a carbon border adjustment mechanism (carbon border tax) that would reflect the amount of carbon emissions attributed to goods imported into the region creating challenges for industries and countries with a large carbon footprint. This is a form of green protectionism where the justification of trade protectionist measures under the guise of addressing climate change and environmental goals. South Africa's exports are already more carbon intensive due to our carbon-intensive energy system and the country is a large exporter of fossil fuels. Moreover, SA's vulnerability is reinforced by the absence of an ambitious climate change framework.

- Finally, South Africa's relatively long distance to its trading partners has implications for transport costs and associated GHG emissions (PWC, 2020; Montmasson-Clair, 2020).

Border Carbon Adjustments (BCA) are **climate measures to prevent the risk of carbon leakage** (i.e. the movement of production and associated emissions between countries due to different levels of decarbonisation effort through carbon pricing and climate regulation) and is designed to **support increased ambition on climate mitigation** (Monaisa & Maimele, 2023). The EU's BCA, known as the Carbon Border Adjustment Mechanism or CBAM, came into effect in October 2023. The UK is also planning a BCA (Maimele, 2024). The impact of CBAs will be determined by the **carbon embedded production in goods that are traded.** Thus, if we decarbonise our electricity systems more, the CBAs will have less impact on African countries (Monaisa and Maimele 2023).

The **EU CBAM** is a tax on embedded emissions for goods imported into the EU that emit more GHG emissions than allowed for EU manufacturers under the EU Emissions Trading System (ETS). Initially, the CBAM will apply to direct emissions from sectors identified as at risk of carbon leakage, i.e. electricity, cement, fertilisers, steel and aluminium (Monaise and Maimele 2023). The **UK CBAM** is also a carbon tax paid on high emitting exports to the UK and mirrors the EU CBAM with less electricity plus ceramic and glass to its sector coverage (Maimele, 2024).

The EU CBAM will have a larger impact on African countries, as a share of GDP, than all other regions because the EU is an important trade market for African countries and several export commodities from Africa are relatively more carbon intensive than other countries (accounting for 26% of Africa's exports of fertiliser, 16% of iron and steel, 12% of aluminium and 12% of cement) (African Climate Foundation; The London School of Economics and Political Science, 2023). In the long run, **EU CBAM is forecast to reduce African exports to the EU by -5.7% and continental GDP by -1.1%** (equivalent to a $16 billion reduction in GDP at 2021 levels the GDP of the continent by 0.91%, although CBAM is forecast to reduce the GDP of no single African country by more than 0.18% (African Climate Foundation; The London School of Economics and Political Science 2023). A number of African Least Developed Countries would be among the most affected, notably Gambia and Mozambique (African Climate Foundation; The London School of Economics and Political Science 2023).

Analysis by TIPS notes that under the EU CBAM, a total of US$2.4 billion (about R45.4 billion) of South African exports (based on 2023 data) is at risk in the short term. This is about 11.3% of all South African exports to the EU, and about 2.2% of total South Africa exports to the world, and 0.7% of total South African GDP (Maimele, 2024). The UK CBAM would have a smaller impact but would likely result in a total of US$223 million (About R4.3 billion) of South African exports (based on 2023 data) being at risk in the short term. This is about 4.2% of all South African exports to the UK, and about 0.2% of total South Africa exports to the world, and just 0.1% of total South African gross domestic product (GDP). Fertilisers, iron and steel as well as aluminium are primary goods in jeopardy (Maimele, 2024).

TIPS offers recommendations for SA to reduce the impact of CBAs on our exports:

- Decarbonising industries: Companies and government should accelerate the decarbonisation of these carbon-intensive industries. Increasing renewable energy in production processes and investing in energy-efficient technologies will serve to decarbonise industrial sectors.

- Decarbonising South Africa's electricity system: South Africa's over-reliance on coal as a feedstock for electricity and liquid fuels production makes it one of the most carbon-intensive economies in the world. Increasing renewable energy in the national grid will decrease the indirect emissions of sectors that consume large amounts of electricity.

- Introducing more ambitious climate-change policies: South Africa's climate-change policies are not ambitious by global standards. An ambitious national climate change policy is required to steer the country towards a low-carbon development trajectory.

- Reforming South Africa's carbon tax to reflect global carbon pricing will be critical to ensure that the country's carbon-intensive products reflect the social price of carbon. Increasing the South African carbon price will stimulate heavy emitters to reform their business models and operations (Monaisa and Maimele 2023).

If indirect emissions are included in future, South African exporters will face additional risks as the country is heavily reliant on coal for its electricity and liquid fuels (Monaisa and Maimele 2023). Thus, to ensure our exports are as competitive as possible in SA, we can't afford to invest in any further fossil fuels but should focus on transitioning to net zero (Roff, et al. 2022).

6. Financial Flows and Ownership

"This debt will be paid by generations" Sokhna Ba

The financing and ownership of fossil fuel extraction and production in Africa is largely from the global north (Dube No date):

- Between 2016 and 2021, approximately $132.3 billion of investment in fossil fuel companies and projects in Africa, largely from financial institutions from North America, Europe, and Australia

- An estimated 61% of the projected production in Africa between now and 2050 is owned by multinational companies headquartered in Europe, North America, and Asia (Deley, 2023).

The implication of this is that **the profits of the financing tend to accrue to countries in the global north** (Dube No date). At the same time, **African governments and citizens tend to hold the risk** – partially due to the risk of **stranded assets, poor contractual terms** given to African governments and the risk of developing countries becoming liable to pay compensation to private sector fossil fuel companies under **investor** law with the legally binding Energy Charter Treaty which supports investor confidence in part with mechanisms for investor–state dispute settlement (ISDS). The contracts that African

governments get into with investors from the global north need to be scrutinised to avoid risks that come with stranded assets. These contracts would be better off had most of the risks been borne by investors from the global north (Dube No date). Following the ExxonMobil court case in Guyana in 2023, which despite the environmental impact statement for the Guyana project identifying 12 islands with a gross state product of $147 billion that could be affected by an oil spill, ExxonMobil has failed to provide adequate oil spill coverage and insurance and yet will only be liable for $2 billion damage and the rest of the liability for any potential oil spill has been shifted back onto the people of Guyana.

7. The social costs of carbon

The social cost of carbon (SCC) is an estimate of the cost of the damage done by each additional ton of carbon emissions. It also is an estimate of the benefit of any action taken to reduce a ton of carbon emissions. (Asdourian and Wessel 2023). The SCC is used to assist policymakers to evaluate the impact of policies. Recent research by Bilal and Känzig (2024) estimates that the macroeconomic damages from climate change are six times larger than previously thought. They find that a 1°C increase in global temperature leads to a 12% decline in world GDP (Bilal and Känzig 2024). Using a standard neoclassical growth model, research identifies a Social Cost of Carbon of $1,056 per ton of carbon dioxide (Bilal and Känzig 2024). Both are multiple orders of magnitude above previous estimates.

The International Institute for Sustainable Development (IISD) finds in a report on South Africa's energy fiscal policies, that the social cost of fossil fuel combustion for South Africa is at least R550-billion a year and exceeds, by five times, the revenues government earns from fossil fuel combustion. The social cost includes deaths, disease and working days lost owing to air pollution and greenhouse gas (GHG) emissions. https://www.engineeringnews.co.za/article/social-cost-of-using-fossil-fuels-much-higher-than-govt-gains-study-shows-2022-01-31

8. Decommissioning costs

It is important to include the cost of decommissioning of offshore oil and gas infrastructure upfront in all financial decisions – otherwise these costs will be borne by the state and ultimately, by the South African taxpayers. For instance, the total cost of decommissioning UK offshore oil and gas production, transportation and processing infrastructure is estimated to cost £46bn (Oil & Gas Authority, 2020). Australian research highlights the importance of minimising impacts from contaminants when decommissioning infrastructure as these contaminants could escape into the wider environment – with additional costs attached to cleaning these up (Dawkins, 2020).

10. Conclusion

The analysis presented in this literature review underscores the multifaceted implications of continuing to invest in fossil fuels in South Africa. Despite the push from leaders for oil and gas to foster economic growth, the evidence suggests that this path is fraught with significant risks—not just economically, but also socially and environmentally. As the global energy landscape evolves and more nations commit to reducing carbon emissions, South Africa's reliance on fossil fuels threatens to exacerbate existing challenges, including economic instability, social inequality, and environmental degradation.

The emerging realities of transition risks, stranded assets, and climate impacts compel a reevaluation of energy policies and investment strategies. Africa possesses the potential to be a pioneer in renewable energy development, allowing for a sustainable economic future that prioritizes equity and environmental integrity. Therefore, the time to act is now; a shift towards renewable energy sources is not only imperative for mitigating climate risk but also vital for ensuring that the hopes and aspirations of all South Africans are met, fostering a resilient and equitable energy future for the continent.

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2343

IN THE HIGH COURT OF SOUTH AFRICA

(WESTERN CAPE DIVISION, CAPE TOWN)

Case No ...../2024

In the matter between:

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	First Applicant
THE GREEN CONNECTION NPC	Second Applicant
NATURAL JUSTICE	Third Applicant

and

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	First Respondent
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	Second Respondent
TGS GEOPHYSICAL COMPANY (UK) LTD	Third Respondent
MINISTER OF MINERAL AND PETROLEUM RESOURCES	Fourth Respondent

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EXPERT AFFIDAVIT : MARK NEW

I, the undersigned,

MARK NEW

do hereby make oath and state:

MN

1. I am a professor in the Department of Environmental and Geographical Science at the University of Cape Town and the previous director of the African Climate and Development Initiative (2011 – 2023).

2. The facts contained in this affidavit fall within my own personal knowledge, except where I indicate otherwise and are, to the best of my knowledge, true and correct. To the extent that I rely on information supplied by others, I believe that such information is true and correct.

3. I have over twenty-five years of experience in climate change research, teaching and project management. My qualifications and experience are set in my curriculum vitae, a copy of which is attached marked '**MN1**'. By virtue of my qualifications, training and experience, I submit that I am qualified to give expert evidence on the issues traversed in this affidavit.

4. In order to arrive at a balanced assessment of whether or not the exploration for, and production of, oil and gas in South Africa is socially, environmentally and economically sustainable, it is necessary to consider, assess and evaluate the social, economic and environmental impacts of those activities, including disadvantages and benefits. In this affidavit, I set out the basic science underpinning concerns about climate change and the global and national efforts to arrest this phenomenon, and some of the considerations relevant to deciding whether or not to authorise gas exploration and production in South Africa. I point out that authorising those activities would be at odds with South Africa's climate change policies and its international commitment to dramatically reducing greenhouse gas emissions. It would also exacerbate the extent of climate change and thereby contribute to very significant adverse impacts on

people (especially women, vulnerable people and future generations) and the environment.

Paris agreement limits

5. As a party to the United Nations Framework Convention on Climate Change ("**UNFCCC**") and the Paris Agreement, South Africa has agreed to collaborate with the other Parties to limit the increase in the global average temperature to well below 2°C above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. This requires South Africa to do its "fair share" of reductions in the emissions of greenhouse gasses ("**GHGs**"). South Africa has acknowledged this in its first (2016) and updated (2021) Nationally Determined Contribution ("**NDC**") submissions to the UNFCCC, where (in the latter) it states it has committed "to ultimately moving towards a goal of net zero carbon emissions by 2050, which will require various interventions to reduce greenhouse gas emissions".

6. Climate change is already having very significant negative impacts on people and ecosystems throughout the world, including in South Africa. The significance of the Paris Agreement target of 1.5°C above pre-industrial levels is that it reflects a global consensus that the level of risk to humanity becomes unacceptably high once that threshold is crossed. Those include the risk of extremely high impact "tipping point" changes in the climate which I discuss below.

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Remaining Carbon Budget

7. The cumulative "stock" of GHGs (particularly CO_2) in the atmosphere is the primary driver of long-term global warming. This means that even if all human-caused GHG emissions ceased immediately, Earth's climate would still heat up by several tenths of a degree Celsius because the GHGs which are already in the atmosphere will continue warming in the Earth's climate for more than a century.

8. The 'Remaining Carbon Budget" is the amount of CO_2 that can be emitted in the future, while still keeping human-induced warming below 1.5°C or 2.0°C. The remaining carbon budget is not a single number, but a range of budgets each of which corresponds to a specific likelihood of keeping global warming below 1.5 °C or 2.0°C. For example, the IPCC's Sixth Assessment Report published in March 2023 estimated that in order for there to be a 50% likelihood of limiting warming to 1.5°C, the remaining carbon budget from the start of 2020 was 500 Gt (Gigatonnes) CO_2.

9. However the Remaining Carbon Budget is shrinking fast. The Indicators of Global Climate Change ("IGCC") initiative produces estimates for key climate indicators that are consistent with the IPCC's Sixth Assessment Report.[1] The IGCC's updated assessment has determined that the remaining carbon budget has reduced from 500 Gt CO_2 at the start of 2022 to 200 Gt CO_2 as of November 2024. This is largely due to the annual emissions of around 55 Gt CO_2 per year over the last four years. My own estimates, which are more conservative (and therefore generous), place the current remaining carbon budget at 380 Gt CO_2.

[1] See Current Remaining Carbon Budget and Trajectory (climatechangetracker.org)

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Using either determination, this means that the window of opportunity within which humanity can take measures to avoid overshooting the 1.5°C and 2.0°C thresholds for dangerous, and perhaps catastrophic, climate change, is closing fast.

Proven oil and gas reserves far exceed what can be combusted

10. I have prepared the report attached to this affidavit, marked '**MN2**', and confirm that to the best of my knowledge and belief the contents of that report are true and correct.

11. As I explain in that report, as a matter of scientific fact, the total proven oil and gas reserves globally exceed by some margin what it would be possible to combust while still implementing the global GHG emissions reductions necessary to limit the increase in global average temperatures to no more than 1.5°C above pre-industrial levels. Proven coal reserves, if burned, would result in additional emissions more than double those from oil and gas. Investing in more oil and gas exploration and new resource discoveries will inevitably lead to greater production and greater GHG emissions at a time when it is critical to reduce emissions.

12. The abovementioned report shows that the remaining amount of global GHG emissions (specifically CO_2) that can be emitted (as of November 2024) and still have a reasonable (50:50) chance of keeping global mean temperature below 1.5°C is 380 Gt CO_2. Similarly, remaining emissions of CO_2 that would have a reasonable chance of keeping "well below" 2.0°C are 920 Gt. Both of these remaining CO_2 budgets far exceed the emissions that would arise from combustion of already discovered coal, oil and gas, which conservatively, are

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estimated to be 1540, 543 and 350 Gt CO_2, respectively, or 2,433 Gt CO_2 combined. Therefore, today, the extent to which discovered reserves exceed what can be burned while keeping global temperature increases below 1.5°C is already significant, and increases each year by approximately 50 Gt CO_2 as GHG emissions continue.

13. The analysis in my report is echoed in other work. For example, based on a review of selected climate and energy scenarios by intergovernmental organizations, including the IPCC, the International Renewable Energy Agency (IRENA) and the International Energy Agency (IEA), the International Institute for Sustainable Development (IISD) noted a consensus that no new oil and gas fields should be developed if the world is to achieve the 1.5°C target[2]. Similarly, in 2021, the International Energy Agency declared that "there is no need for investment in new fossil fuel supply" in its scenario for achieving net zero emissions by 2050 – a finding it reiterated again in 2023[3].

14. The IPCC's Sixth Assessment reports also show that reducing emissions is no longer sufficient, and that it will also be necessary to remove some of the carbon that is already in the atmosphere or will be in the atmosphere in the years to come.

> *"From a physical science perspective, limiting human-caused global warming to a specific level requires limiting cumulative CO_2 emissions, reaching at least net zero CO_2 emissions, along with strong reductions in other greenhouse gas emissions. Reaching net zero GHG emissions primarily requires deep*

[2] International Institute for Sustainable Development, Navigating Energy Transitions: Mapping the Road to 1.5°C (Oct. 2022), p.16. https://www.iisd.org/system/files/2022-10/navigating-energy-transitions-mapping-road-to-1.5.pdf.

[3] International Energy Association (IEA), *Net Zero by 2050: A Roadmap for the Global Energy Sector*, 2021, p. 21; see also International Energy Agency, *Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach*, 2023, p. 16.

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reductions in CO2, methane, and other GHG emissions, and implies net negative CO2 emissions. Carbon dioxide removal (CDR) will be necessary to achieve net negative CO_2 emissions […]."[4]

The fact that CDR, which is as yet unproved at scale, will be required over the next 25 years to reduce CO_2 levels in the atmosphere to meet the Paris temperature targets, reiterates the need to reduce future GHG emissions as steeply as possible.

Impacts of climate change and tipping points

15. It is important to appreciate that climate change is not linear, and its impacts not necessarily reversible. Non-linear impacts of climate change have been termed "tipping points". A climate tipping point occurs when change in one or more large parts of the climate system change rapidly (or "tip") once a particular global warming threshold is exceeded. Once such a tipping point has been passed, the change will continue regardless of how humans respond, causing so-called 'irreversible' climate change.

16. An example of a climate tipping point is melting of the Greenland Ice Sheet. At somewhere between 1.5 and 2.0 °C global warming, summer melting will exceed winter accumulation of the ice sheet, and its mass balance starts to decrease. As its mass decreases, the elevation of the ice sheet (currently up to 3,300m above sea level) decreases, and surface temperatures become warmer due to this lower elevation (the lapse rate effect). Even if global warming is reversed, the lower elevation and warmer temperatures ensure that melting continues in a positive feedback loop. Complete melting of the

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Greenland Ice Sheet will cause ~6m of sea level rise, inundating nearly all coastal settlements, including those in South Africa, such as Cape Town and Durban.

17. Some tipping points can act to increase GHG emissions, further accelerating climate change. For example, the Amazon forest is projected to collapse and transform into a savanna landscape somewhere around 2.0 °C. The carbon stored in the forest vegetation and soils will be released into the atmosphere as GHGs, adding to those from fossil fuels, and the capacity of this new savanna ecosystem to act as a sink for CO_2 will be much lower than the forest it replaced. This creates "positive CO_2 feedback" which causes the change to accelerate and become self-perpetuating.

18. An article titled "*Exceeding 1.5°C global warming could trigger multiple climate tipping points*" published by leading climate change scientists in Science on 9 September 2022[5] states the following:

> "*Potential causal interactions among tipping elements are such that overall tipping of one element increases the likelihood of tipping others, possibly risking a "tipping cascade" of impacts that may further amplify global warming. In the worst-case scenario, interactions might produce a global CTP.*"
>
> "*The Earth may have left a safe climate state beyond 1°C global warming. A significant likelihood of passing multiple climate tipping points exists above ~1.5°C, particularly in major ice sheets. Tipping point likelihood increases further in the Paris range of 1.5 to <2°C warming. Current policies leading to ~2 to 3°C warming are unsafe because they*

[5] Armstrong McKay et al. 'Exceeding 1.5°C global warming could trigger multiple climate tipping points' Science 377, 1171 (2022) p.1

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would likely trigger multiple climate tipping points. Our updated assessment of climate tipping points provides strong scientific support for the Paris Agreement and associated efforts to limit global warming to 1.5°C."[6]

19. **The Summary for Policy Makers, which the IPCC published with its Sixth Assessment Report on global warming, was approved by government signatories to the UNFCCC, including South Africa. It recorded that human activities are causing an increase in the Earth's temperature, and this poses a risk to health, livelihood, food security and water supply, among others. The following extracts are relevant.**

"In the near term, every region in the world is projected to face further increases in climate hazards (medium to high confidence, depending on region and hazard), increasing multiple risks to ecosystems and humans (very high confidence). Hazards and associated risks expected in the near term include an increase in heat-related human mortality and morbidity (high confidence), food-borne, water-borne, and vector-borne diseases (high confidence), and mental health challenges (very high confidence), flooding in coastal and other low-lying cities and regions (high confidence), biodiversity loss in land, freshwater and ocean ecosystems (medium to very high confidence, depending on ecosystem), and a decrease in food production in some regions (high confidence). Cryosphere-related changes in floods, landslides, and water availability have the potential to lead to severe consequences for people, infrastructure and the economy in most mountain regions (high confidence). The projected increase in frequency and intensity of heavy precipitation (high confidence) will increase rain-generated local flooding

[6] Armstrong McKay et al. 'Exceeding 1.5°C global warming could trigger multiple climate tipping points' Science 377, 1171 (2022) p. 8.

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(medium confidence). (Figure 3.2, Figure 3.3, 4.3, Figure 4.3) (Figure SPM.3, Figure SPM.4)"[7]

'Risks and projected adverse impacts and related losses and damages from climate change will escalate with every increment of global warming (very high confidence). They are higher for global warming of 1.5°C than at present, and even higher at 2°C (high confidence). […]"[8]

20. Climate change is having, and will continue to have, disproportionately severe impacts on South Africa, and on poor and marginalised communities, women, children and future generations. The South Africa government acknowledges this. For example, the Just Transition Framework states:

> *'South Africa is in a part of the world that is severely impacted by climate variability. The country frequently experiences droughts, floods, and other extreme weather events, with evidence that the frequency and intensity of such events are increasing because of climate change (IPCC 2022). These events have already caused enormous damage to infrastructure, ecosystems, lives, and livelihoods, and displaced thousands of people, and continue to be a stark reminder that it is poorer communities—women and young people, the unemployed, those living in informal settlements— that are most vulnerable to climate change.'*

South Africa's emissions and remaining carbon budget

21. South Africa's GHG emissions are relatively high and the Union of Concerned Scientists estimated that in 2016 South Africa was the world's 13th biggest emitter of CO_2, and the largest in Africa. South Africa's per capita emissions of GHGs are also high by African standards. According to Climate Watch, South

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Africa's per capita emissions are 9.01 tonnes of CO_2-eq[9] and while Nigeria's is 1.83 tonnes CO_2-eq.

22. South Africa's remaining carbon budget, if it were to meet its self-defined "fair share" contribution to net zero global GHG emissions by 2050 is in the range of 6-9 Gt CO_2-eq[10]. At current annual emissions of ~455 Mt CO_2-eq, this budget will be exhausted within between 13 and 20 years (2037 - 2044). Thus, the country is already challenged to not exceed its nationally defined remaining carbon budget.

23. If a gas field were to be developed as a deep-water field, and over a ~15 year period it produced between 5 Tcf[11] and 10 Tcf of gas (approximately the minimum viable reserve size for offshore exploration at these depths), the combustion of that gas would release between 258 (5 Tcf) to 564 (10 Tcf) Mt CO_2-eq.

23.1. Those emissions will consume part of South Africa's remaining global carbon budget. By way of illustration, if the total amount produced were to be combusted in South Africa, this would consume a significant amount (3-9%) of the country's remaining carbon budget, meaning that other GHG emitting activities would have to be restricted more severely.

23.2. If such a field were developed, it is reasonable to assume that it would not start producing gas until about 2035. Extremely steep reductions in emissions will be necessary well before this date to meet the goal of net-

[9] CO_2-eq refers to the combined GHG warming effect of all gases emitted from production to burning, re-expressed as the equivalent concentration of CO_2

[10] Marquard, Andrew, et al (2023) Exploring net zero pathways for South Africa - An input study. University of Cape Town. Report. http://doi.org/10.25375/uct.22169150.v2

[11] Tcf = trillion cubic feet of gas

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zero emissions by 2050, meaning that it is extremely unlikely that the field could operate and be consistent with South Africa's 2050 net-zero commitment.

24. It is virtually certain that the world will overshoot 1.5 °C within the next few years and enter a zone of very significant risk. Current implemented and planned emissions reduction policies from countries will result in an overshoot of 2.0 °C, most likely to between 2.1 and 2.5 °C[12], increasing the severity of impacts and the likelihood of tipping points being reached. Widespread failure to implement currently planned emissions reductions, such as those articulated in South Africa's updated Nationally Determined Contribution, could well result in overshoots higher than 2.5 °C.

Natural gas, methane, CO_2 and GHG warming

25. Methane is the main component of natural gas found underground (i.e. the gas which Total is exploring for). The amount of methane in raw natural gas varies, but is typically between 70% and 97%, and on average around 95%. The second most abundant gas in raw natural gas is ethane, which is also a GHG. Natural gas affects climate through two pathways: (i) during its production and transport so called fugitive emissions arise from releases methane, ethane and other gases directly into the atmosphere (e.g., from leakages in pipelines); and (ii) during combustion, CO_2 is produced, in a similar manner to burning of oil and coal.

[12] https://climateactiontracker.org/global/cat-thermometer (accessed 09 October 2024).

26. Methane (from fugitive emissions and other sources such as agriculture) is a powerful GHG. Although it breaks down in the atmosphere faster than CO_2, its Global Warming Potential ("GWP") is ~80 times greater than that of CO_2 when measured over a 20 year period, and ~28 times greater when measured over a 100 year period[13].

27. The magnitude of natural gas production on GHG warming depends strongly on the level of fugitive emissions (gas that escape into the atmosphere during production and transport and is therefore not burnt for energy production). At zero fugitive emissions, production natural gas for electricity results in emissions of ~258 g CO_2-eq/kWh_{el}[14] while 10% fugitive emissions increase the GHG forcing to ~1439 g CO_2-eq/kWh_{el}. Actual fugitive emissions across different natural gas production systems typically fall towards the upper level of this range. In many cases, the net GHG effect of natural gas use is greater than that of oil or coal, because of these fugitive emissions.

28. Therefore, the argument that natural gas is a lower impact "transition fuel" that should be exploited in place of oil and gas is untrue in most gas production cases to date.

[13] Global warming potential (GWP) is a measure of a molecule of a given GHG's warming power, relative to a molecule of CO_2, over a given time period, typically 20, 50 or 100 years. GWP is a function of both a molecule's instantaneous warming power and its lifetime in the atmosphere.

[14] As noted earlier, CO_2-eq refers to the combined GHG warming effect of all gases emitted from production to burning, re-expressed as the equivalent concentration of CO_2, while kWh_e refers to electricity energy produced.

Proven oil and gas reserves far exceed what can be combusted

29. Together with Dr Lawrence Meckel, I have also prepared the report attached to this affidavit, marked '**MN3**', and confirm that to the best of my knowledge and belief the contents of that report are true and correct.

30. This report provides a methodology to transparently estimate national or sub-national hydrocarbon volumes that might possibly be produced by a series of commercially-viable projects in the future and the associated greenhouse gas (GHG) emissions from those projects. We also recommend a rigorous project-based classification and reporting framework that ensures these factors are considered, assessed and quantified across the life cycle of specific projects.

31. The key messages from this report are as follows:

    31.1. Estimation of yet to be discovered, commercially viable, oil and gas reserves for South Africa are possible, using well established methodologies. These estimates carry large uncertainties, but can usefully be applied to determine likely upper and lower limits for these resources.

    31.2. Well established emission factors, which determine the CO_2-equivalent greenhouse gas emissions from use of oil and gas for different purposes, can be used to calculate the emissions that would be emitted from exploitation and use of yet to be discovered oil and gas reserves

    31.3. Such information on GHG emissions from exploitation of future, yet to discovered, oil and gas reserves in South Africa can (and should) be used in support of development of the country's Nationally Determined

Contribution for reducing greenhouse gas emissions, as required by the Paris Agreement of the UNFCCC.

31.4. The South African government should develop a system, using the methods described in this report, to estimate the CO_2-eq emissions from its national yet to be discovered reserves.

31.5. The South African government could include a requirement for oil/gas exploration and producing companies to provide reserve estimates and associated emissions as part of any exploration licensing process.

Mark New

MARK NEW

I hereby certify that the deponent has declared that he knows and understands the contents of this Affidavit and that to the best of his knowledge and belief it is the truth, which Affidavit has been signed to and affirmed to before me at Pietermaritzburg on this the 13 day of November 2024.

SUID-AFRIKAANSE POLISIEDIENS
COMMUNITY SERVICE CENTRE
13 NOV 2024
PIETERMARITZBURG
SOUTH AFRICAN POLICE SERVICES

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Scopus Profile | Google Scholar Profile | Sage Policy Profile

Scopus Metrics
Publications: 133
h-Index: 51
h5-Index: 13
Citations: 23,480
Policy citations: 962

PROFILE

Mark New has thirty years' experience in climate research, teaching and public outreach, thirteen of which were as director of the African Climate and Development Initiative, a cross-faculty interdisciplinary research institute at UCT. He is also Director of the ARUA (African Research Universities Alliance) Centre of Excellence for Climate and Development, in which UCT partners with the University of Ghana and Nairobi University, to drive pan-African research and teaching on climate change in Africa. Mark is internationally recognised as a leading researcher in climate change detection, attribution, impacts and adaptation. He is a recipient of the 2023 Frontiers Planet Prize, which recognises research the offers solutions to planetary environmental challenges and the 2020 Piers Sellers Prize for exceptional climate change research. He has served on several international bodies, most recently as a member of the World Adaptation Science Programme Scientific Committee, as Coordinating Lead Author for the IPCC 6th Assessment Report, and as a member of the World Climate Research Programme Working Group on Event Attribution.

RELEVANT EXPERTISE

- Climate change detection, attribution, impacts and adaptation research.
- Research project management on over 20 research grants since 2010.
- Strategic planning, large-institute management, interdisciplinary leadership and practice
- Systematic reviews, including as a senior author of GAMI (Global Adaptation Mapping Initiative)
- Leading science-policy assessments, including IPCC AR6, WGII, Chapter 17 coordinating lead author
- Adaptation tracking, including the TSITICA project mapping of adaptation projects in RSA, Kenya, Ghana
- Policy-oriented research, such as development of South Africa's adaptation research agenda prioritisation

EDUCATION AND QUALIFICATIONS

10/1993 – 09/1996: PhD, Geography, Cambridge University, UK (graduated 1999).
09/1991 – 07/1992: MPhil, Environment and Development, Cambridge University, UK (graduated 1992).
02/1987 – 11/1987: BSc Hons, Geology, University of Cape Town, RSA, (graduated 1987).
02/1984 – 11/1986: BSc, University of Cape Town, RSA (graduated 1986).

EMPLOYMENT AND EXPERIENCE

07/2023 – present: Professor, Department of Environmental & Geographical Science, University of Cape Town
07/2011 – 06/2023: Professor & Director, African Climate and Development Initiative, University of Cape Town
09/1999 – 07/2011: Lecturer / Professor in Climate Science, School of Geography & Environment, Oxford University
04/1996 – 09/1999: Senior Research Associate, Climatic Research Unit, University of East Anglia
02/1988 – 03/1991: Exploration Geologist, Southern Oil Exploration Corp., Cape Town

SELECTED AWARDS, RECOGNITION AND EXTERNAL POSTIONS

2024-2024. Royal Society Wolfson Visiting Professor Fellowship, University of Bristol, UK
2024-2026: University of Cape Town – Bristol University Joint Professorship
2023-2024: Fulbright Visiting Scholar Fellowship to University of California Santa Barbara, USA
2023: Frontiers Planet Prize (with co-author Dr Petra Holden, et al.)
2022-present: Science Review Board, UK Met Office Hadley Centre
2018-present: World Adaptation Science Programme Science Committee

SELECTED RELEVANT PUBLICATIONS

Carlson, C., et al, incl. **M. New** (2024). Detection & Attribution of Climate Change Impacts on Human Health [version 1; not peer reviewed]. Wellcome Open Research. London, Wellcome Trust. 9:245.

Wood, R. A., et al, incl. **M. New** (2023). A Climate Science Toolkit for High Impact-Low Likelihood Climate Risks. *Earth's Future* 11(4): e2022EF003369.

Taylor, A., et al, incl. **M. New** (2023). Operationalising climate-resilient development pathways in the Global South. *Current Opinion in Environmental Sustainability*, 64: 101328.

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New, M. et al. (2022). Decision Making Options for Managing Risk. In: *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Cambridge University Press, Cambridge, UK.

Berrang-Ford, L., et al incl. **M.New** (2021). A systematic global stocktake of evidence on human adaptation to climate change [Article]. Nature Climate Change, 11(11), 989-1000.

Ziervogel, G., **et al. incl., New, M.** (2022). Climate change in South Africa: Risks and opportunities for climate-resilient development in the IPCC Sixth Assessment WGII Report, *South African Journal of Science*, vol. 118, no. 9-10.

Sibanda, D, et al. incl. **New, M** (2024). Tracking adaptation and mitigation projects in South Africa, Ghana and Kenya. **In review.**

Ofoegbu, C., & **New, M.** (2022). Evaluating the effectiveness and efficiency of climate information communication in the African agricultural sector: a systematic analysis of climate services. *Agriculture*, 12(2), 17.

SELECTED POPULAR SCIENCE PUBLICATIONS

Rebello, A. D., K. J. Esler, P. Holden and M. New (2022). Removing alien plants can save water: we measured how much. In. *The Conversation*.

Holden, P., M. New, et al (2022). Clearing alien trees can help reduce climate change impact on Cape Town's water supply. In: *The Conversation*.

Perumal, L., M. New, W. Liu and M. Jonas (2021). Africa's growing road network may affect ecosystems: we reviewed the evidence. In: *The Conversation*.

Odoulami, R. C. Trisos, and **M. New** (2020). "Dimming the sun could reduce future drought risk in Cape Town – but there's a catch." In *The Conversation*

New, M (2019). "Climate explained: how much of climate change is natural? How much is man-made?" In *The Conversation*.

New, M (2018). "What the latest assessment on global warming means for southern Africa." In *The Conversation*.

New, M, Wolski, P. and Otto, F. (2018). "Global warming has already raised the risk of more severe droughts in Cape Town." In *The Conversation*.

RECENT MAJOR RESEARCH PROJECTS

PI: *Frontiers Planet Prize*. [Frontiers Foundation, 2024-2028, CHF 1.0 M].

The Frontiers Planet Prize is awarded for world leading, solutions-oriented research addressing one of more Planetary Boundaries. The award is to be used to deepen and/or scale out research by the winner and their lab. In my case, I and my team will be expanding our work in joint attribution methodologies to (i) pilot operational impacts attribution and (ii) use attribution methods to assess effectiveness of disaster risk reduction adaptations.

PI: *Building African climate-health attribution data, digital tools and capacity*. [Welcome Trust, 2025-2027, UKP 3.0 M].

AFRIVERSE aims to address the lack of evidence on climate-health impacts in Africa by developing new African climate and health data, digital tools for data access, analysis and visualisation, and human capacity, in parallel with delivering several Africa-focused attribution studies undertaken by teams of African scientists hosted at ASCEND, the University of Cape Town's new climate and development science synthesis centre.

PI: *Heat Adaptation Benefits for Vulnerable Populations in Africa*. [Welcome Trust, 2023-2027, UKP 2.0 M].

HABVIA aims to work with four vulnerable urban and rural communities in South Africa and Ghana to co-design and implement affordable housing and workplace heat adaptation and to assess the social and health effectiveness of these adaptations. The project is a collaboration between the Universities of Cape Town, Ghana, Kwame Nkrumah, Bristol, and also the South African Medical Research Council.

PI: *South Africa Flanders Adaptation Research and Training Programme*. [UKRI GCRF, 2020-2024, EURO 2.4 M].

SAF-ADAPT brings together three South African universities - Cape Town, Fort Hare and Venda – with a consortium of Belgian universities - led by KU Leuven - to: (i) train a cohort of twenty MSc, PhD and Post-doctoral researchers; (ii) fill key adaptation knowledge gaps through student research; (iii) develop knowledge products and data that supports national adaptation practice needs; (iv) provide professional training in adaptation to technical staff in government and civil society.

Co-PI. *TSITICA - Transforming social inequalities through inclusive climate actions*. [UKRI GCRF, 2020-2023, UKP 2.0 M].

TSITICA is a collaborative research project between the Universities of Cape Town, Ghana, Nairobi, Bristol, LSE and East Anglia, which aims to build the evidence base on how climate risk intersects with poverty and inequality, and how national climate actions mandates under the UNFCCC and the Nationally Determined Contribution process can be targeted and reduction of multi-dimensional poverty and inequality.

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"MN2"

Evidence that current proven reserves of oil and gas exceed CO_2 budgets consistent with the Paris Agreement temperature targets

Mark New
African Climate and Development Initiative (ACDI), University of Cape Town
07 March 2022

Summary

1. The Paris agreement of the UN Framework Convention on Climate Change, to which South Africa is a signatory, has the goal of keeping human-induced global warming to well below 2.0°C, ideally below 1.5°C.

2. While the net emissions that are consistent with the Paris targets have considerable uncertainties due to biogeochemical and geophysical uncertainties about the earth system, *net* emissions from 2025 onward need to be below 250 Gt CO_2-eq to have a 50% likelihood of keeping below 1.5°C, and 550 Gt CO_2-eq to keep "well below" 2.0°C.

3. Future emissions from fossil fuels that exceed these 250 and 550 Gt CO_2-eq remaining emissions budgets will require substantial carbon dioxide removal (CDR) to meet the Paris temperature targets. Questions remain as to the viability of large-scale CDR, especially in the 25 years from now to 2050 when net zero emissions are required

4. The CO_2-eq budgets for oil and gas within any overall emissions budget vary depending on assumptions on the future mix of coal, oil and gas. The least-precautionary estimates of budgets for oil and gas consistent with 1.5°C are 248 and 121 Gt CO_2, respectively.

5. CO_2 budgets that are consistent with keeping well below 2.0°C are 396 and 194 Gt CO_2 for oil and gas, respectively.

6. Proven reserves of oil and gas, if burned, would produce *at least* 543 and 350 Gt CO_2, respectively.

7. The emissions from burning already proven oil and gas will substantially exceed the budget available to meet the 1.5°C target, by at least 210% and 290%, respectively

8. Emissions of CO_2 from burning proven oil reserves will also substantially exceed the "well below 2.0°C" oil and gas emissions budgets, by at least 137% and 194%, respectively.

Background context: the Paris agreement

The "Paris Agreement" is a legally binding international treaty on climate change, adopted by 196 Parties to the UNFCCC at COP 21 in Paris, on 12 December 2015 and entered into

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force on 4 November 2016[1]. South Africa is a signatory to the Paris Agreement. One of the goals of the agreement is to limit global warming to well below 2.0 degrees Celsius, preferably to 1.5 degrees, compared to pre-industrial levels.

This report assesses whether proven global reserves of oil and gas – if burned – would lead to greenhouse emissions that cause warming in excess of the Paris Agreement global temperature targets.

Greenhouse gas emissions budgets to meet the 1.5°C and 2.0°C targets

The 2018 IPCC Special Report on 1.5 Degrees (SR15)[2] specifically assessed the greenhouse gas emission reduction pathways that will keep global warming below the Paris Agreement 1.5°C and 2.0°C targets. The SR15 assessment was updated in the 2022 Working Group III report of the IPCC Sixth Assessment[3].

There are a range of possible future emission pathways that meet these targets, but as a rule, the sooner global emissions peak, the less severe are the required post-peak reductions needed to meet these temperature targets. Pathways that peak late and decline slowly will either cause greater warming, possible overshooting 2.0°C, or will need carbon dioxide removal to reduce GHG concentrations to levels consistent with the 1.5°C and 2.0°C targets.

Uncertainties in carbon cycle feedbacks and climate sensitivity mean that any emissions pathway could lead to a range of possible future warming levels. Therefore, scientific literature often presents a likelihood of a particular emissions pathway meeting a given target (e.g. 50%, 66%, 90%). A higher likelihood threshold (a more precautionary approach) will reduce the allowable future emissions.

A common approach to summarising the emissions reduction challenge is to estimate a remaining CO_2 budget (the cumulative total of emissions into the future) that meets the 1.5 or 2.0°C target[4]. In 2018, the IPCC estimated that budget to be 580 Gt CO_2 to have a 50% likelihood of keeping below 1.5°C, and 420 Gt CO_2 for a 66% likelihood[4]. The budget for keeping below 2.0°C was 1500 and 1170 GtCO_2 for 50% and 66% likelihoods, respectively. Given global emissions of CO_2 since 2018 have been approximately 200Gt (2019-2024, 40Gt per year), the current remaining budget for 1.5 degrees can be adjusted down to 380 Gt CO_2 and 220 Gt CO_2 (50% and 66% likelihood) and similarly, the 2.0 degrees budget to

[1] UNFCCC (2015). Paris Agreement to the United Nations Framework Convention on Climate Change. Dec. 12, 2015, T.I.A.S. No. 16-1104, United Nations Treaty Collection.

[2] IPCC (2018). Summary for Policymakers. Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. V. Masson-Delmotte, P. Zhai, H. O. Pörtner et al. Cambridge, United Kingdom, and New York, NY, USA: Cambridge University Press. 1-32.

[3] IPCC, 2022: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, J. et al. (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.

[4] Total greenhouse emissions are greater than CO_2 alone (with contributions from CH_4, N_2O and other gases, and the CO_2-only budgets take these other contributions into account).

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1300 and 970 Gt CO_2. Different estimates of this budget are shown in Table 1. The latest IEA world energy outlook report adopts a budget of 500Gt for 1.5°C, based on similar logic[5].

How a future CO_2 budget could be distributed between different sources (coal, oil, gas, others) depends on the mix of these sources into the future. Table 1 presents estimates of the total CO_2 budget consistent with 1.5°C and 2.0°C from the IPCC SR15 (which itself summarises underlying literature), along with a breakdown of fossil fuel components of that budget between coal, oil and gas, under different emissions reduction scenarios in line with 1.5°C. Although IPCC does not provide a breakdown for other temperature targets, we estimate the budgets by scaling the 1.5°C budgets for the other warming targets. All scenarios assume that coal phases out more quickly than gas and oil, and the higher budgets assume significant carbon dioxide removal (CDR; see Box 1). In addition, scenarios with higher oil budgets are offset by lower gas budgets and vice versa. For oil and gas, the remaining *maximum* 1.5°C budgets (assuming these two energy sources are preferred to coal, and 50% likelihood) for each that do not depend on large-scale CDR are 248 and 121 Gt CO_2 respectively. The combined maximum budget across scenarios is 369 and 468 Gt CO_2, assuming minor and significant CDR, respectively.

If one adopts the recommendation of Matthews et al[6] that the Paris target of "well below" 2.0°C equates to 1.75°C, with a likelihood of 66%, the maximum budgets for oil and gas scale to 396 and 194 Gt CO2, without significant CDR.

*Table 1. Remaining emissions of CO_2 consistent with a 1.5 and 2.0°C warming targets, from the IPCC SR15, adjusted to take account of the 200Gt CO_2 emitted up to 2024. Net emissions represent the difference between emissions and CDR. The IPCC P1-P4 scenarios show total actual emissions that deliver the net emission target, with increasing levels of CDR from P1 to P4. *Note that emissions breakdown for P1-P4 for 2.0°C and 1.75°C are estimates arrived at by scaling 1.5°C estimates by the net emissions estimate.*

	Current Emissions (1)	Emission Budget for Temperature Target / Likelihood of Meeting Target (Gt CO2)																	
		1.5°C/50%				1.5°C/66%		1.75°C/50%				1.75°C/66%		2.0°C/50%				2.0°C/66%	
Total Net Emissions	36.45 / yr	360				220		320				680		1300				970	
IPCC Scenario		P1	P2	P3	P4	P2*	P4*	P1*	P2*	P3*	P4*	P2*	P4*	P1*	P2*	P3*	P4*	P2*	P4*
Coal	14.36 (39.4%)	47	104	79	87	32	53	99	218	164	182	167	140	169	369	280	310	227	190
Oil	12.36 (33.9%)	114	186	136	368	77	120	238	388	287	767	287	590	404	659	626	1309	405	803
Gas	7.62 (20.9%)	77	91	178	148	63	119	180	190	384	305	148	235	272	323	621	521	199	326

(1) Current emissions from Friedlingstein (2020)[7] as reported by Our World in Data

[5] IEA (2021), Net Zero by 2050, IEA, Paris https://www.iea.org/reports/net-zero-by-2050

[6] Matthews, H.D., Tokarska, K.B., Nicholls, Z.R.J. et al. Opportunities and challenges in using remaining carbon budgets to guide climate policy. Nat Geosci. 13, 769–779 (2020). https://doi.org/10.1038/s41561-020-00663-3.

[7] Friedlingstein, P., et al., (2020) Global carbon budget 2020. *Earth System Science Data*, 12(4), pp.3269-3340.

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Box 1: Carbon-dioxide removal as a climate mitigation option

Carbon-dioxide removal (CDR) refers to the "process of removing CO_2 from the atmosphere" so as to achieve "negative emissions"[8,9]. There are two broad categories of CDR, natural and artificial. Examples of natural CDR include afforestation and land restoration, where plants (especially trees) are used to take up CO_2 via photosynthesis and this is then stored in living plant mass and later as dead material on and within the soil. Artificial methods, called "direct air capture and carbon storage" (DACCS), use mostly yet to be proven engineered processes to capture atmospheric CO_2 for subsequent geological storage. A hybrid approach called "bioenergy with carbon capture and storage" (BECCS) utilises biomass for energy, capturing the CO_2 emissions and similarly to DACCS, storing them geologically. Land-based approaches such as afforestation and BECCS frequently will involve trade-offs with use of land for other purposes, especially food production, and their feasibility depends strongly on transformations in the global food system towards low-meat diets. The storage of CO_2 in BECCS and DACCS require substantial geological storage sites, and these are not always close enough to where the CO_2 is captured, for example at a power plant. Overall, (i) some CDR methods have been shown to be feasible, but there are doubts as to whether they can be deployed at scale without major negative side-effects; (ii) the remaining CDR methods are yet to be proven; (iii) nearly all CDR methods are expensive, at much greater than US$ 100 per tonne of CO_2, adding considerably to the full cost of burning fossil fuels.

Proven reserves of coal, oil and gas, and their combustion CO_2 emissions

Estimates of proven fossil fuel reserves vary widely between studies, due to different definitions of what constitutes proven, how such reserves are estimated, whether conventional or unconventional sources are considered, and which geographic regions are included (e.g., OPEC versus non-OPEC; Arctic included or excluded)[10]. Table 2 shows a range of estimates from different sources, summarised by McGlade and Ekins[10] and as well as other sources. The upper and lower ranges from these studies are 1,300-2,300 billion barrels of oil, 186-2,200 trillion cubic metres of gas, and 850-1,069 billion tons of coal, respectively.

The combustion emissions of CO_2 from different fossil fuel sources is dependent on several factors, including the characteristics of the raw resource (e.g., heavy versus light crude oil), the refining process and end product (e.g. gasoline versus diesel), and the efficiency of the eventual burning for energy. Estimates of future CO_2 emissions from fossil fuels are therefore dependent on assumptions about how these fuels are used. The most conservative estimates from the literature suggest that the *minimum* emissions from

[8] IPCC (2018): FAQ 4.2 What are Carbon Dioxide Removal and Negative Emissions? In: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* Eds: V. Masson-Delmotte, et al Cambridge, United Kingdom, and New York, NY, USA, Cambridge University Press. 1-32.

[9] Royal Society and Royal Academy of Engineering (2018): Greenhouse Gas Removal Policy briefing DES5563_1. https://royalsociety.org/topics-policy/projects/greenhouse-gas-removal.

[10] McGlade, C. and Ekins, P. (2015) The geographical distribution of fossil fuels unused when limiting global warming to 2 °C. *Nature*, 517, 187–190. https://doi.org/10.1038/nature14016.

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combustion of already discovered oil, gas and coal will be 543, 350 and 1,540 Gt CO_2 respectively (bold text in Table 2). If the reserves or emissions per unit fossil fuel are higher, then these values increase.

Table 2. Estimates of known global reserves of oil, gas and coal, and associated estimated emissions of CO_2 from their combustion (emission factors from McGlade and Ekins[4]). Gb = billions of barrels; Tcm = trillion cubic metres; Gt = billions tonnes.

Source	Oil (Gb)	Oil-CO_2 (Gt)	Gas (Tcm)	Gas-CO_2 (Gt)	Coal (Gt)	Coal-CO_2 (Gt)
BGR	1,600	661	195	388	1,000	1,756
IEA	1,700	700	190	379	1,000	1,756
GEA	1,500-2,300	621-936	670-2,000	1,229-3,584	858-1,000	1,540-1,755
ME	**1,300**	**543**	190	379	1,000	1,756
HO	1,688	626.9	**186**	**350.4**	892	1,756.9
BP (2020)	1,734	644*	199	376*	1,068	2,379*

BGR = Federal Institute for Geosciences and Natural Resources[11]; IEA = International Energy Agency[12]; GEA, Global Energy Assessment[13]; ME = McGlade and Ekins[10]; HO = Heede & Oreskes[14] using reserve data obtained from BP (2014)[15]; BP = Authors' own calculations for emissions based on reserve data from BP (2020)[16] using the methodology reported in Heede & Oreskes[14].

Comparison of Paris CO_2 budgets and emissions from proven reserves

Based on the IPCC estimates of oil and gas CO_2 emissions budgets consistent with the more ambitious 1.5°C Paris Agreement target, the least precautionary (maximum) budget (50% likelihood of meeting target) requires net CO_2 emissions of 380 Gt in total, and around 189 and 92 Gt for oil and gas, respectively. This compares to emissions from burning of the lowest estimates of proven oil and gas of 543 and 350 Gt CO_2, respectively. Therefore, there is already sufficient proven oil to supply nearly triple the emissions consistent with 1.5°C, while for gas, proven reserves are nearly over three times the 1.5°C CO_2 budget.

[11] Federal Institute for Geosciences and Natural Resources (BGR). Energy Study 2012. Reserves, Resources and Availability of Energy Resources. http://www.bgr.bund.de/DE/Gemeinsames/Produkte/Downloads/DERA_Rohstoffinformationen.

[12] International Energy Agency (IEA) (2013). World Energy Outlook. http://www.worldenergyoutlook.org/publications/weo-2013.

[13] Rogner, H.-H. et al. (2012). In: Global Energy Assessment—Towards a Sustainable Future. Ch. 7. 423–512, Cambridge University Press.

[14] Heede, R. and Oreskes, N. (2016). Potential emissions of CO2 and methane from proved reserves of fossil fuels: An alternative analysis. Global Environmental Change, 36, pp.12-20.

[15] BP (2014 & 2013). Statistical Review of World Energy. London. www.bp.com/statisticalreview.

[16] BP (2020). Statistical Review of World Energy. London. www.bp.com/statisticalreview.

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These broad figures are consistent with a similar analysis undertaken by Welsby et al (2021)[7] who estimate that nearly 60 per cent of oil and methane, and 90 per cent of coal must remain unextracted to keep within a 1.5 °C carbon budget, with a 50% likelihood.

Emissions budgets are more generous for the 2.0°C target. The least precautionary budget (2.0°C at 50% likelihood) allows for net emissions of 1300 Gt CO_2, of which oil and gas could make up 403-659 and 272-323 Gt (without significant CDR). However, many have argued that the Paris objective of keeping "well below 2.0°C" would require a more precautionary approach in setting these budgets, for example by choosing a 66% likelihood of keeping below 1.75°C[6]. In this case, the net emissions budget is 680 Gt CO_2 in total, of which oil comprises 297 Gt CO_2 and gas 146 Gt CO_2 (without significant CDR). Therefore, emissions of 543 and 350 Gt CO2 from burning proven oil and gas reserves would thus result in significantly exceeding this "well below 2 0°C" carbon budget for both oil and gas. It is only in the case of the least precautionary emissions scenarios, with a high risk of overshooting 2.0°C, that emissions from oil and gas are less than those from proven reserves.

[7] Welsby, D., J. Price, S. Pye and P. Ekins. 2021. Unextractable fossil fuels in a 1.5 °C world. *Nature*, 597(7875), 230-234. doi:10.1038/s41586-021-03821-8

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METHODOLOGY FOR ESTIMATING POSSIBLE PRODUCIBLE HYDROCARBON VOLUMES AS A BASIS FOR DETERMINING POTENTIAL GREENHOUSE GAS EMISSIONS FROM FUTURE COMMERCIAL OIL AND GAS DEVELOPMENTS

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Dr. Mark New (The University of Cape Town, South Africa)

October 2024

Summary

This report provides a methodology to transparently estimate hydrocarbon volumes that might possibly be produced by a series of commercially-viable projects in the future and the associated greenhouse gas (GHG) emissions from those projects. We also recommend a rigorous project-based classification and reporting framework that ensures these factors are considered, assessed and quantified across the life cycle of specific projects. The authors' contributions are based on their respective professional experiences with international petroleum and service companies, including reporting to several jurisdictional standards regarding opportunity and portfolio producible volume estimation.

Key messages

1. Information on GHG emissions from exploitation of future, yet to discovered, oil and gas reserves in South Africa can (and should) be used in support of development of the country's Nationally Determined Contribution for reducing greenhouse gas emissions, as required by the Paris Agreement of the UNFCCC.
2. Estimation of yet to be discovered, commercially viable, oil and gas reserves for South Africa are possible, using well established methodologies. These estimates carry large uncertainties, but can usefully be applied to determine likely upper and lower limits for these resources.
3. Well established emission factors, which determine the CO_2-equivalent greenhouse gas emissions from use of oil and gas for different purposes, can be used to calculate the emissions that would be emitted from exploitation and use of yet to be discovered oil and gas reserves.
4. The South African government should develop a system, using the methods described in this report, to estimate the CO_2-eq emissions from its national yet to be discovered reserves.
5. The South African government could include a requirement for oil/gas exploration and producing companies to provide reserve estimates and associated emissions as part of any exploration licensing process.

Introduction

In 2022, oil, gas, and flaring accounted for 54% of global emissions and 66% of African emissions, but only 15% in South Africa, where effectively no oil and gas is currently produced (emissions are from imported oil and gas).[1] However, the petroleum industry has growth aspirations[2] which could change the percentage of emissions in South Africa, and which should be adequately planned for.

[1] Our World in Data (n.d.). CO_2 Emissions by Fuel. Available at: https://ourworldindata.org/emissions-by-fuel
[2] Selley, R. & van der Spuy, D. (2016). The oil and gas basins of Africa. DOI: 10.18814/epiugs/2016/v39i2/95788. Available at https://pdfs.semanticscholar.org/5a6e/4c47d9960d6d1181bc0884e4a69b2f37c16b.pdf.

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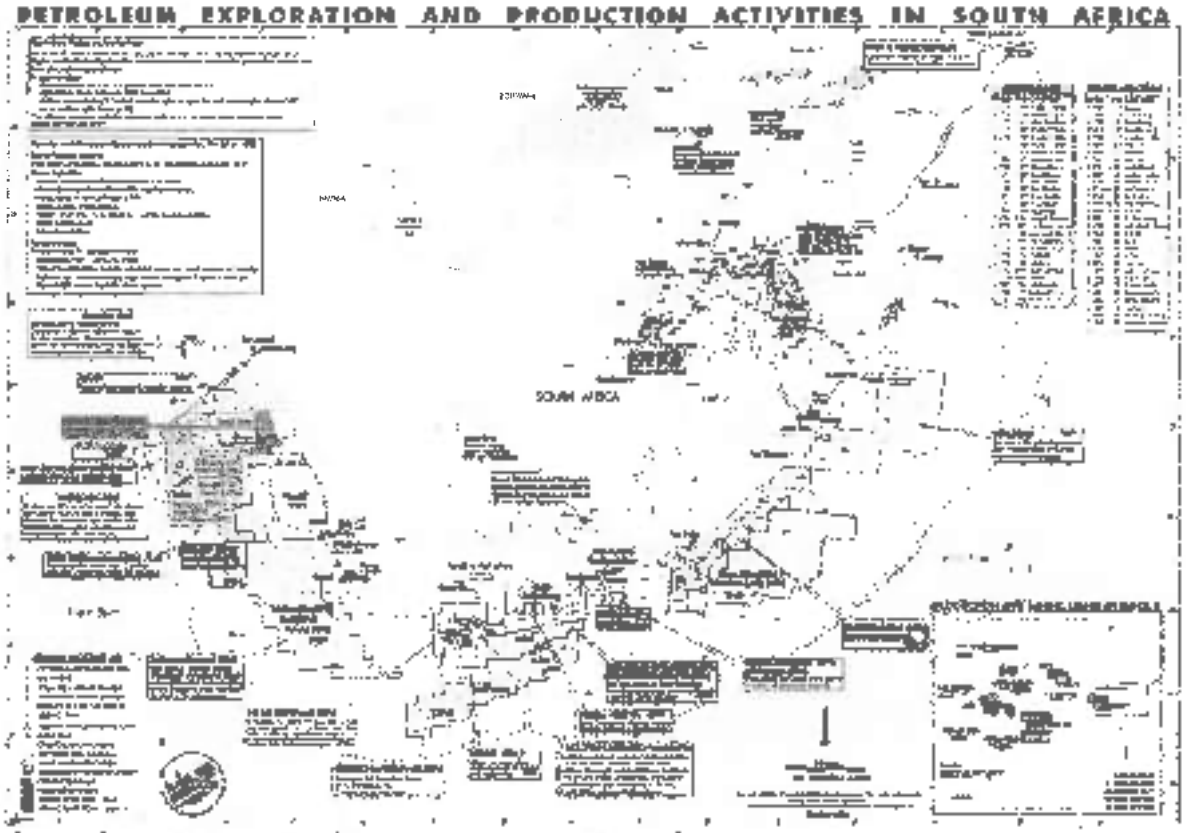

Figure 1. Petroleum exploration and production activities in South Africa.[3]

Given the lack of petroleum projects and the relative immaturity of the petroleum market in the South Africa, the Government is well positioned to develop (i) an *a priori* understanding of how much oil and gas might be expected to be produced in the future; (ii) an estimate of the expected quantity of Scope 1, Scope 2, and Scope 3 GHG emissions associated with that oil and gas production; and (iii) plans, policies, regulations, and laws to address these as-yet unquantified emissions in short- and long-term scenarios.

The reasons for the South African government to perform a quantified and transparent assessment of expected volumes of produced hydrocarbons and associated GHG emissions are as follows:

- To manage its resources effectively and sustainably, including to provide due diligence on companies' statements and reports;
- To develop coherent, holistic national policies, as part of a broad duty of care to the general public;
- To communicate the basis for these policies to all stakeholders;
- To estimate resource-related emissions adequately and realistically, in consideration of what is required to meet Nationally-Determined Contributions and "fair share" contributions to reducing global emissions (for which governments are expected to provide some justification of their proposed efforts); and
- To plan and budget future potential tax revenue effectively.

Similarly, the government has the opportunity to require companies operating in South Africa to report to a standard that facilitates the above criteria. If implemented, recoverable quantities associated with companies' projects would be described and categorized in a "manner that is consistent with scientific and socialeconomic information describing the economy as well as with the information describing the projects to recover them,"[4] consistent with industry Best Practice.

[3] Petroleum Agency of South Africa (10/2024): Petroleum Exploration and Production Activities in South Africa. Available at: https://petroleumagencysa.com/wp-content/uploads/2024/10/Hubmap10248.pdf.
[4] Ibid

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Methodology

A generally accepted Best Practice workflow for estimating petroleum resources and associated GHG emissions that could be applied at country or basin level in South Africa is as follows:

1. Establish a probabilistic range of Yet-to-Find (YTF) estimate of, technically-recoverable conventional and unconventional oil and gas resources, including a consideration of the chance of making a technically-recoverable discovery[5].
2. Multiply YTF by a reasonable range of Chance of Commercial Success (COCS) factors to generate a stochastic distribution of expected volumes at country level
3. Calculate the associated GHG emissions with the stochastically calculated range of oil and gas volumes using agreed emissions factors (either nationally or internationally defined).
4. Introduce a classification and reporting framework for resources and reserves that provides more granularity at the level of individual projects by explicitly considering environmental, social and economic viability; technical feasibility and maturity; and degree of confidence in estimates of the potential recoverability of the quantities.[6]

Yet-to-Find

YTF is an estimate of the remaining technically-recoverable hydrocarbons to be discovered in a petroleum province (typically a basin, assessment area, or country). Within the province, conventional and unconventional oil, gas, and natural gas liquids (NGL) resource estimates are typically reported separately, each as a ranges of possible outcomes, based on expert assessment of the associated geology. The range is presented as discrete volumetric values of low, mid, and high estimates of oil, gas, and NGL resources.

- "Low" is generally taken at the 95th, 90th, or 85th percentile, meaning that the reported YTF estimate is expected to exceed that value in 95%, 90%, or 85% of successful outcomes.
- "Mid" is generally taken at the 50th percentile, meaning that the reported YTF estimate is expected to exceed that value in 50% of successful outcomes.
- "High" is generally taken at the 5th, 10th, or 15th percentile, meaning that the reported YTF estimate is expected to exceed that value in 5%, 10%, or 15% of successful outcomes.

Estimates may be made by governmental organizations to help plan long term energy policy, by consulting firms to provide commercial advice to clients in industry, finance, insurance, among others; by E&P companies to make proprietary portfolio decisions; and by other researchers for various reasons.

Methodologies for calculating YTF are long-established in the industry.

Halliburton and Schlumberger, the two largest oilfield services companies in the world, describe best practices, commonly-used methodologies, and their associated uncertainties [7,8]

- The **Areal Productivity** or **Areal Yield** method applies a bulk volume of oil, gas, and/or NGL that has been produced from a unit area in a well understood and suitably analogous province to the area being considered. For instance, if the area of interest "X", which has an area of 1000 km², is considered analogous to well-explored Area "Y", which has produced an average of 1 million barrels of oil per square kilometer, then the amount of petroleum that might be produced from Area "X" could be estimated as 1 billion barrels of oil (=1000 km² multiplied by 1000000 barrels of oil per square kilometer). Typically, a range of appropriate analogues is considered.
- The **Source Rock Yield** method "is mostly used in underexplored, frontier basins and is derived by calculating the volume of hydrocarbons likely generated and expelled from source rocks. This value is modified by estimating the losses that may have occurred [...], and the likely recovery factor [.]. An estimate for the YTF is derived once the volume of discovered recoverable hydrocarbons is subtracted from this value" (Simmons et al., 2021).

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[5] The chance of making a technically-recoverable discovery is typically referred to as the Geological Chance of Success (GCOS) or Geological Probability of Success (GCOS), expressed as a percentage, based on the state of knowledge about the presence and quality of relevant elements of the petroleum systems (charge & migration, reservoir, trap, seal).

[6] UNECE (2021). Supplementary Specifications for the Application of the United Nations Framework Classification for Resources to Petroleum. Available at: https://unece.org/fileadmin/files/2022-01/UNFC%20Petroleum%20Specifications%202021.pdf

[7] Simmons, M., Jewell, T., Sucsilla, C., & Heyburn, K. (2021). Assessing Yet-to-Find. In Exploration Handbook (R. Head & M. Simmons, eds.). Available at: https://www.researchgate.net/publication/349078014_Assessing_Yet_to_Find/link/601ee57d458515689088723b/download?_tp=eyJjb25uZXhpb24iOnsiaWQiOiJFbGVtZW50In0sInBhZ2UiOiJfZGlzayJ9

[8] Wygrala, B. & Norman, C. (2019). Best Practices in Petroleum Exploration – Assessment of Yet-to-Find (YTF) Petroleum Resources. DOI: https://doi.org/10.3997/2214-4609.201953057

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- **The Creaming Curve, ZIPF and Field Size Distribution** methods are only useful in provinces where a reasonably large number of discoveries has already been made, so are inappropriate for South Africa.
- **The Summing Prospect Inventory method** is relatively straightforward, provided the prospect inventory is sufficiently comprehensive. Each prospect will typically have low, medium, and high volumetric estimates and a Geological Probability of Success, which can be multiplied together and summed to get a total estimate. Although such an inventory does not currently exist for South Africa, there is no reason such an inventory could not be required to be provided by the operator of each lease.
- **The Feature Count Stochastic Prediction** method is based on probabilistically estimating the number of future discoveries based on three parameters. These are
    - The size range of existing discoveries or mapped prospects;
    - The chance of success — This is generally estimated as the number of discoveries in a play, divided by the number of wells targeted at a play. Chance of success improves with time as a play becomes better understood.
    - The number of prospects remaining to be drilled — This element is the hardest to estimate, as many prospects do not meet risk, volume, or economic thresholds and are unlikely to be drilled

Alan Fourn, a well-respected industry scientist with 35 years of experience, provides a synopsis for non-specialists of these techniques for estimating YTF.[5]

Table 1: Advantages and disadvantages of commonly used methods to calculate Yet-to-Find resources (Fourn, 2018)

Yet to find estimation method	Geological input	Ease of method	Limitations
Analogue field	Minimal	Easy and quick to do	Is it really an analogue? - limited scope for sensitivities – use only as a sense check
Source Rock Yield	High	Can be easy – spreadsheet or more complex - basin model	Need some data on the source rocks in the basin or make assumptions – can run multiple sensitivities - Number calibration in estimating migration losses and assigning charge volumes to different plays – BUT makes geologists think about what could be possible
Creaming Curves	Low	Easy and quick to do	Extrapolates from known plays only – how reliable is the resource volumes data? – using rear view mirror – cannot account for any new advances in technology or ideas – but can be a sense check
Zipf and Field Size Distribution plots	Low	Easy and quick to do	Are the fields really missing? – is the economic threshold applied? Are we missing plays? Is the field size distribution following Zipf's Law? - Avoid
Summing Prospect Inventory (as used by UKOGA)	High	Need to have a risked resource number for every prospect	Need to evaluate how likely is a prospect to be really drilled. Reliant on vaguely accurate estimates of prospect resource size and COS – are these overestimated? Need to apply thresholds. What about unmapped areas or plays?
Feature Count Stochastic Prediction (as used by USGS in World Petroleum Assessment)	Moderate	Easy to do, but need appropriate software	Where is the origin of the inputs? – can be a bit like the Drake Equation (SETI) – need to apply cut offs for economics. Very difficult to effectively run for new plays. – BUT can run many realisations and can run a "what would it take?" exercise

Numerous factors should be considered in YTF estimates, including:

- Analyses should be performed or audited by a competent independent expert
- Data, assumptions, and methodology should be transparent
- Any analogues considered should be checked for appropriateness and completeness
- Uncertainties, risks, and dependencies should be described and quantified
- Volumes should be presented as a range (Low/Mid-High)
- Reported volumes should be risked in terms of the likelihood of success
- Volume distributions should include a minimum field size threshold

[5] Fourn, A. (2018). Estimating Yet to Find in Petroleum Exploration. Available at: https://www.linkedin.com/pulse/estimating-yet-find-petroleum-exploration-alan-fourn/.

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Given the wide range of uncertainty in many of the input parameters, YTF estimates can vary widely (sometimes by orders of magnitude), depending on who does the analyses, and the assumptions, data, and analogues used. However, YTF estimates are considered sufficiently accurate to be useful for establishing broad expectations of future potential.

Even so, not all technically-recoverable volumes will eventually be determined to be commercially-viable to produce. As such, the actual volume of produced petroleum is expected to be less than the YTF, as a function of the Chance of Commercial Success.

Several 'Feature Count Stochastic Predictions' of YTF in South Africa are available from the United States Geological Survey (USGS) and US Energy Information Administration (EIA).[10,11,12,13,14] Commercial consultancies also provide estimates that are available to be purchased.[15]

Alternatively, the government of South Africa could compile independent volumetric ranges, chances of technical success, and other parameters from an inventory of Leads, Prospects, and Play Analysis, such as that implemented by the UK North Sea Transition Authority (NSTA, previously Oil & Gas Authority, OGA).[16]

Chance of Commercial Success

COCS is a risk-based representation of the likelihood that a specified volume of technically-recoverable hydrocarbons will be produced at a future point in time. All discovered volumes will not necessarily be produced, for any number of reasons, including:

- Unfavorable global or local commodity or contract prices
- Low-ranking value (e.g., Net Present Value) of a given project relative to other projects in portfolio
- Lack of infrastructure
- Cost of capital
- Lack of social 'license to operate'
- Lack of environmental or other regulatory approvals
- Corporate decarbonization targets or goals

The ratio of commercial success to technical success is the chance of commercial success (in the figure below, COCS = POSc/POSg). As a rule of thumb, slightly more than half of all technically successful discoveries in representative petroleum basins are potentially commercial (~65% for oil; ~60% for gas, with some scatter).[17,18] Other discoveries are too small to be developed (or are 'stranded' from a commercial perspective).

The impact of commerciality is recognized in common classification frameworks such as the widely-used Petroleum Resource Management System (PRMS), which differentiates volumes as Prospective Resources (undiscovered), Contingent Resources (discovered, but sub-commercial), Reserves (commercial), and Production (sold hydrocarbons that emit GHGs) on the basis of the chance of commerciality.

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[10] USGS (2012). Assessment of Undiscovered Oil and Gas Resources of the South Africa Coastal Province, Africa. Fact Sheet 2012-3030. Available at: https://pubs.usgs.gov/fs/2012/3030/fs2012-3030.pdf.

[11] Brownfield, M.E., Charpentier, R.R., Cook, T.A., Gautier, D.L., Higley, D.K., Kinscheburn, M.A., Klett, T.R., Pitman, J.K., Pollastro, R.M., Schenk, C.J., Tennyson, M.E., and Wandrey, C.J., 2016, Executive summary—Assessment of undiscovered oil and gas resources of the Sub-Saharan region, Africa, in Brownfield, M.E., compiler, Geologic assessment of undiscovered hydrocarbon resources of Sub-Saharan Africa: U.S. Geological Survey Digital Data Series 69–GG, chap. 1, 9 p., http://dx.doi.org/10.3133/ds69GG.

[12] USGS (2017). Assessment of Permian Coalbed Gas Resources of the Karoo Basin Province, South Africa and Lesotho, 2016. Fact Sheet 2016-3103. Available at: https://pubs.usgs.gov/fs/2016/3103/fs20163103.pdf.

[13] USGS (2016). Assessment of Shale-Gas Resources of the Karoo Province, South Africa and Lesotho, Africa, 2016. Fact Sheet 2016-3036. Available at: https://pubs.usgs.gov/fs/2016/3036/fs20163036.pdf.

[14] EIA (2013). Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States. Available at: https://www.eia.gov/analysis/studies/worldshalegas/pdf/overview.pdf.

[15] https://www.spglobal.com/commodityinsights/en/ci/research-analysis/decommissioning-commercial-value-for.html

[16] Cf. pp. 15-19 of NTSA (2023). UK Oil and Gas Reserves and Resources. Available at: https://www.nstauthority.co.uk/media/dkvlfvon/uk-reserves-and-resources-report-as-at-end-2023.pdf.

[17] Quirk, D. and Rudnall, R. (2008). Toward consistency in petroleum exploration: A systematic way of constraining uncertainty in prospect volumetrics. AAPG Bulletin 92(10), pp. 1283–1291.

[18] Rudnph, K. & Goulding, F. (2017). Benchmarking exploration predictions and performance using 20+ yr of drilling results: One company's experience. AAPG Bulletin 101(2), pp. 161–176.

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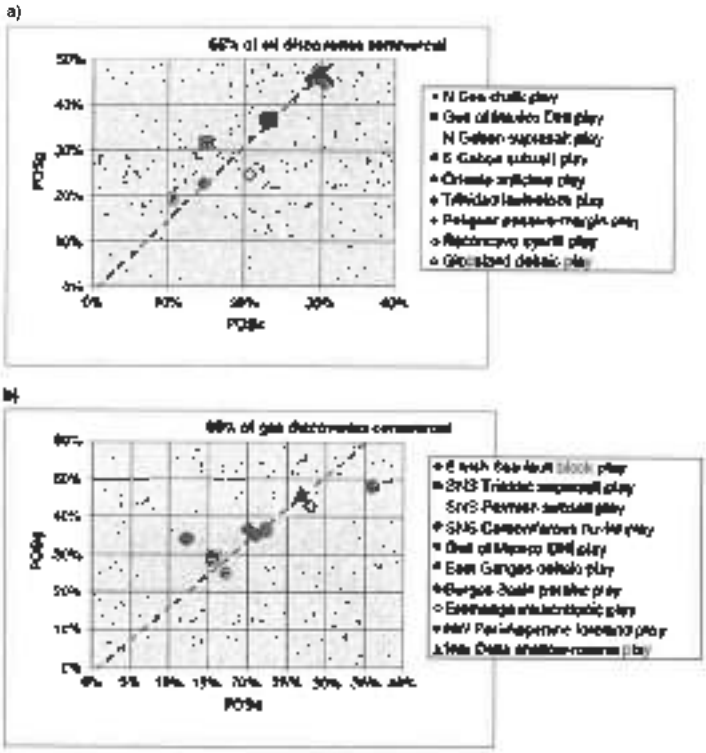

Figure 2: Historical chance of making a technical discovery (POSg) versus chance of making a commercial discovery (POSc) for a number of (a) oil plays and (b) gas plays. [Source: Quirk & Rutledge (2005).]

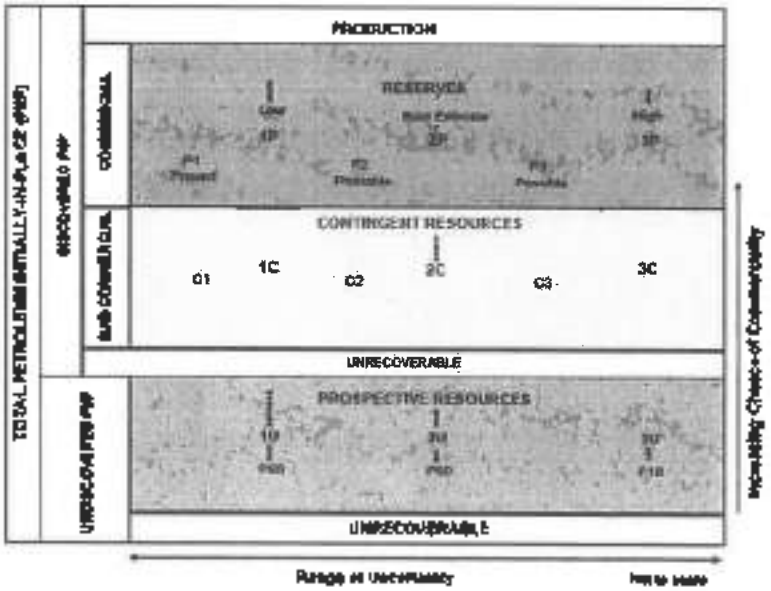

Figure 3: Resources classification framework (PRMS)[9]

[9] Society of Petroleum Engineers (2018). Petroleum Resources Management System. Available at: https://info.specommunications.com/633-LLT-087/images/PRMSmkSystem_V1.01%20Nov%2021.pdf

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Estimating the Range of Likely Produced Petroleum Volumes Given Uncertainties

Monte Carlo simulation is a robust method of estimation in which a series of significant input variables (x_1, x_2, x_3, ..., x_n) is randomly sampled in a statistically-meaningful number of trials to determine the resulting range of probable outcomes (y_n). In the simplistic case proposed here, a range of technically-recoverable petroleum volumes (YTF) would constitute input variable x_1, while a range of realistic chances of commercial success (COCS) would constitute input variable x_2. Multiplying a randomly selected single value of x_1 by a randomly selected single value of x_2 will generate a single outcome y_1 and doing this a predetermined number of times will provide the probabilistic range, y_n

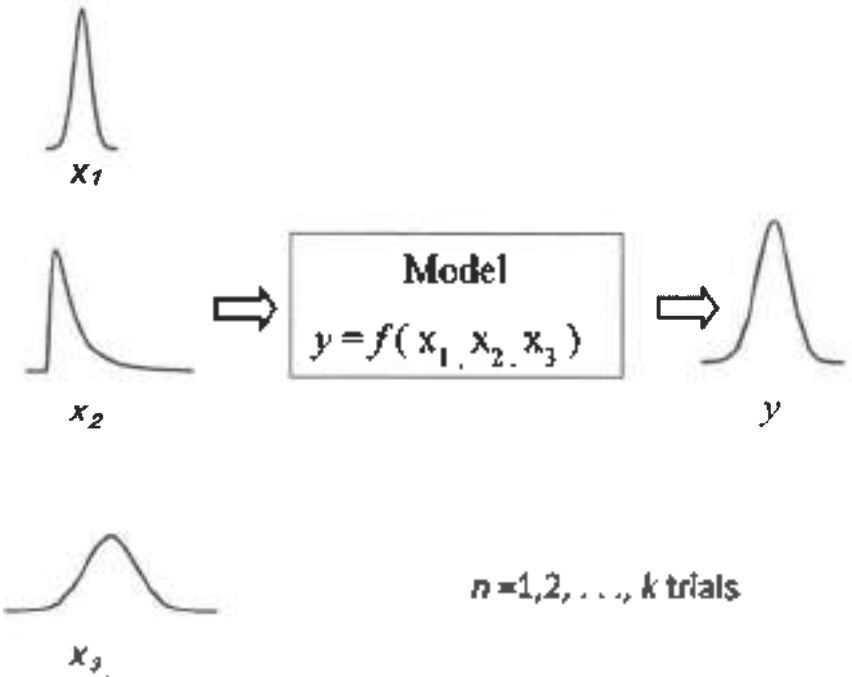

Figure 1. Generic example of stochastic combination of three input variables (x_1, x_2, x_3) to generate a distribution of outcomes (y) after a series of "k" trials [2]

As an example, if the YTF range were estimated at 826-3850 million barrels of oil (MMBO) and the COCS were estimated at 35-70%, then a random sampling of five equally-likely outcomes of each input variable might result in a range of petroleum volumes that are likely to be commercially viable of 400-2275 MMBO.

Trial #	826 MMBO < YTF < 3850 MMBO	35% < COCS < 70%	YTF*COCS
1	1000 MMBO	40%	400 MMBO
2	3500 MMBO	65%	2275 MMBO
3	2000 MMBO	60%	1200 MMBO
4	3000 MMBO	45%	1350 MMBO
5	2500 MMBO	50%	1250 MMBO

In practice, a much larger number of samples would need to be considered in order to be statistically meaningful. Additional input variables (risks) could also be considered in a more complex model. One such variable might be Chance of Regulatory Approval.

Greenhouse Gas Emissions

The greenhouse gas emissions from any oil or gas production can be calculated relatively easily, although there are a range of factors that influence these emissions, all of which have some uncertainty. To estimate such emissions, we need to use a formula, known as the emissions factor (EF), which calculates emissions as a function of the type of

[2] Benke, K., Norng, S., Robinson, N, Benke, L., & Peterson, T. (2015). Error propagation in computer models: analytic approaches, advantages, disadvantages and constraints. Stoch Environ Res Risk Assess 32, pp. 2971–2985

fossil fuel (oil, gas, coal), how the fuel is produced, and the way that the fossil fuel is used (such as for electricity generation, combustion in engines for transport, mineral beneficiation, and fertilizer production).

For ease of comparison, emissions of different gases are usually described in CO_2-eq, the effect of a given gas over 100 years compared to the effect of CO_2, the most abundant fossil fuel gas. CO_2-eq depends on two factors: the relative warming strength of a gas and how long it lasts in the atmosphere after being emitted. A gas with high GH warming strength that lasts longer in the atmosphere after being emitted has a higher CO_2-eq. For example, methane, which is 84 times more powerful than CO_2, only lasts about 20 years in the atmosphere, so has a CO_2-eq of 25.

For energy production, emissions come from two main sources: production and consumption (burning). During consumption, a given fuel, such as natural gas is burned, and CO_2 is the main gas emitted. During production, emissions are associated with the energy used in production, flaring at production sites, and fugitive emissions (leakages) during production and transport. Fugitive emissions can be a big proportion of total CO_2-eq of natural gas and oil production, because they occur as raw natural gas, with high CO_2-eq values.

Emission factors take into account the above production and use variations. For example, the average CO_2-eq for natural gas used to generate electricity in Europe is 0.244 kg CO_2-eq / kWh ICV (European mean) with 5% uncertainty. About 20% of this is from production and 80% is from combustion. A complication for use-related emissions calculations arises if the natural gas or oil is exported and refined and/or burned outside of its source country – that proportion used outside the country would not count for national greenhouse gas accounting under UNFCCC rules. However, companies involved in production and export should be including all downstream use in their Scope 3 emissions reporting, and may well be required to do under new laws in some jurisdictions (such as the EU and California). Apportioning emissions from gas and oil production and use into national and extra-territorial categories, and similarly into Scope 1, 2 and 3 categories for companies, is relatively simple.

To determine the likely emissions from a given commercially exploitable oil or natural resource, a median and upper/lower range can be easily calculated, for a given use, and with assumptions about the production emissions. Emissions factors used to do this can be nationally determined, or internationally available, such as those provided by the International Energy Association[21] South Africa has a comprehensive set of emissions factors for electricity production[22] but emissions factors for other uses tend are often drawn from international sources.

Examples of emissions factor ranges, and their application to estimate CO_2-eq emissions are shown in Table 2 and Table 3 below. Numbers such as these shown in Table 3 can be used in scenario planning for NDCs, to understand how YTF reserves, if exploited, affect NDC emission reduction pathways and associated policies to deliver them. One important factor for NDC considerations is that oil and gas produced and used domestically has higher CO_2-eq emissions that if it was imported, because of the production emission component of approximately 20% of total emissions.

Table 2. Example emission factors for natural gas for electricity generation and domestic heating (derived from various sources), assuming different levels of thermal (combustion) efficiency and diffuse emissions during production.

Use	Emissions Factor (tCO_2-eq / kcf)		
Thermal efficiency	High	Med	Low
Diffuse emissions	Low	Med	High
Electricity	0.048	0.086	0.147
Heating	0.033	0.059	0.117

Table 3. Illustrative range of CO_2-eq emissions from a given natural gas reserve size in Tcf (trillions of cubic feet), assuming an average EF across use for electricity and heating, and low, medium and high diffuse emissions

EF (tCO_2-eq / kcf)	0.043	0.077	0.133
Reserves of Gas (Tcf)	Emissions (Mt CO_2-eq)		
10	433	771	1926

[21] https://www.iea.org/data-and-statistics/data-product/emissions-factors-2023

[22] https://www.dffe.gov.za/sites/default/files/docs/publications/calculationofcountryspecificemissionfactors.pdf

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50	2163	3853	6530
100	4325	7706	13261

Project-Level Classifying and Reporting

In order to provide a consistent, auditable trail of how estimates of YTF hydrocarbon volumes and the associated emissions mature through time, many governments implement classification and reporting frameworks that require companies to provide an external assessment by a qualified expert of the estimated petroleum volumes associated with a specific project, as well as an assessment of the environmental impact. These assessments are then updated as the project matures towards commercial viability and during production.

A robust classification system is "a fundamental element to support a common language for communicating risk and uncertainty related to petroleum projects"[23] which the government can use to ensure common reporting standards among different companies.

The *United Nations Framework Classification (UNFC) for Petroleum Resources*[24] is currently the global Best Practice framework for sustainable management of energy and mineral resources. UNFC is designed to ensure harmonized decision-making on the technical feasibility, socio-environmental concerns, and commercial potential of projects to develop resources.

UNFC is "a universal system for classifying and reporting minerals, energy, and other resources. It provides a standardized approach to ensure consistency, transparency, and sustainability in resource management. By integrating environmental, social, and economic considerations, UNFC aligns with global sustainability goals, including the 2030 Agenda for Sustainable Development and the Paris Agreement. Its comprehensive framework supports decision-making processes across various sectors, facilitating efficient and responsible resource use globally. UNFC is essential for governments, industries, and stakeholders committed to sustainable resource management,"[25] insofar as resource volume, associated GHG emissions, and other socio-environmental factors are considered holistically, rather than independently.

UNFC aims to serve the following four principal needs[26]

1. The needs in international energy and mineral studies to formulate robust and long-sighted policies.
2. The needs of governments in managing their resources accordingly, allowing market prices to be transferred to the wellhead with as little loss as possible.
3. The industries' needs for information while deploying technology, management and finance to secure energy supplies and capture value efficiently within the established frameworks to serve its host countries, shareholders and stakeholders.
4. The financial community's need for information to allocate capital appropriately, providing reduced costs and improved long-sightedness through the application of lower risk-compensated discount factors.

In jurisdictions where UNFC is the regulatory reporting standard, such as the state of Queensland, Australia, the regulator is able to quantitatively review the emissions associated with a project to determine whether it meets legal standards to proceed.

[23] UNECE (2019). Global Resource Classification Systems for Oil and Gas: A Review and Comparison using SWOT Analysis. Available at https://unece.org/fileadmin/DAM/energy/se/pdfs/eqmv/egm10_apr2019/ECE-ENERGY-GE.M_EGRM_PWG_Petroleum_Report.pdf

[24] United Nations Framework Classification for Resources Update 2019 (ECE/ENERGY/125 and ECE Energy Series 61) and Supplementary Specifications for the Application of the United Nations Framework Classification for Resources to Petroleum (2021). Available at https://unece.org/sites/default/files/2022-01/UNFC%20Petroleum%20Specifications%202021.pdf

[25] https://unece.org/sustainable-energy/sustainable-resource-management/united-nations-framework-classification

[26] UNECE (n.d.). UNFC and Petroleum. Available at: https://unece.org/sustainable-energy/sustainable-resource-management/unfc-and-petroleum

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Dr Lawrence Meckel

Dr. Lawrence Meckel has more than 30 years of professional experience in energy and decarbonization projects on 6 continents, working within the frameworks of governmental and regulatory authorities, joint venture partners, environmental agencies and NGOs, and local communities.

Since 2021, Dr. Meckel has been involved in renewable energy, decarbonization, and energy transition activities. As Founder of Monteverde Energy, Dr Meckel provides sustainability consultancy for public and private international companies and local governments in Australia and USA. As Commercial Director for SolMax, he is responsible for commercializing industry-leading mining technology. With multiple geothermal start-ups, he has built portfolios of renewable energy assets. As Storage Program Manager for CO2CRC, he led technical services and R&D projects supporting international decarbonization projects. He is also a Tutor and energy industry SME for the University of Cambridge Institute for Sustainability Leadership.

From 1997-2021, Dr. Meckel worked in oil and gas, including senior leadership positions since 2008. He began his career with Shell and Woodside, where he developed high-level expertise across energy exploration and production and R&D, focused on developing and applying advanced technologies to provide science-based resource assessments. From 2016-2021, he was VP of Global Exploration and a member of the Risk Management Committee for Latin America's largest private E&P company

Dr Meckel holds a PhD from ETH-Zürich (Swiss Federal Institute of Technology), an MA in Geology from the University of Texas at Austin (USA) , and a BA with honours in Geology from Williams College (USA).

Dr Mark New

Mark New is a climate scientist with 30 years of research experience in climate change, including estimating the impacts of different future greenhouse gas emissions on global and regional climate. He holds a PhD in climate science from University of Cambridge, an MPhil in Environment and Development, also from Cambridge University, and a BSc in Geology from the University of Cape Town.

From 2011 to 2023 he was director of the African Climate and Development Initiative, a cross-faculty interdisciplinary research institute at the University of Cape Town. He is also Director of the ARUA (African Research Universities Alliance) Centre of Excellence for Climate and Development, in which UCT partners with the University of Ghana and Nairobi University, to drive pan-African research and teaching on climate change in Africa. Mark is internationally recognised as a leading researcher in climate change detection, attribution, impacts and adaptation.

He is a recipient of the 2023 Frontiers Planet Prize, which recognises research the offers solutions to planetary environmental challenges and the 2020 Piers Sellers Prize for exceptional climate change research. He has served on several international bodies, most recently as a member of the World Adaptation Science Programme Scientific Committee, as Coordinating Lead Author for the IPCC 6th Assessment Report, and as a member of the World Climate Research Programme Working Group on Event Attribution.

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IN THE HIGH COURT OF SOUTH AFRICA
(WESTERN CAPE DIVISION, CAPE TOWN)

Case No ...../2024

In the matter between

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	**First Applicant**
THE GREEN CONNECTION	**Second Applicant**
NATURAL JUSTICE	**Third Applicant**

And

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	**First Respondent**
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	**Second Respondent**
TGS GEOPHYSICAL COMPANY (UK) LTD	**Third Respondent**
MINISTER OF MINERAL AND PETORLEUM RESOURCES	**Fourth Respondent**

EXPERT AFFIDAVIT: JEAN HARRIS

I, the undersigned,

JEAN MARY HARRIS

do hereby make oath and say:

1. I am an adult female marine scientist, and am currently the Executive Director of WILDOCEANS, the marine programme of the Wildlands Conservation Trust

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(WILDTRUST), and NGO focused on biodiversity protection and building socio-ecological resilience in the Southern Africa and western Indian Ocean.

2. The facts contained in this affidavit fall within my personal knowledge, except where I indicate otherwise and are, to the best of my knowledge, true and correct. To the extent that I rely on information supplied by others, I believe that such information is true and correct.

3. Together with Dr Jennifer Olbers and Dr Kendyl Wright, I have prepared the report annexed hereto marked "JH1".

4. My qualifications and experience are set out in a copy of my *curriculum vitae*, attached to this affidavit marked "JH2". I respectfully submit that I am qualified by my qualifications, training and experience to express the expert opinions which are set out in the report referred to above.

5. I further confirm that the report is to the best of my knowledge and belief true and correct.

JEAN MARY HARRIS

I hereby certify that on the 13 day of NOVEMBER 2024 in my presence at DURBAN the Deponent signed this Affidavit and I administered the oath/affirmation in full compliance of the provisions of Act 16 of

1963 and Regulations promulgated thereunder (GN R1258 in GG 3619 of 21 July 1972, as amended).

COMMISSIONER OF OATHS

Name: [illegible]

Designation: Constable

Date: 2024-11-13

2024 -11- 13

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"JH1"

ADDITIONAL COMMENTS ON THE TGS ORANGE BASIN BASIC ASSESSMENT REPORT FOR RECONNAISSANCE, LOCATED OFFSHORE THE WEST COAST, SOUTH AFRICA.

Dr JM Harris, Dr JM Olbers and Dr K Wright

10 November 2024

These comments were prepared by WILDTRUST marine scientists, namely Dr JM Harris, Dr JM Olbers and Dr K Wright, as requested by Natural Justice, and relate to an Appeal Decision of an Environmental Authorisation (EA) granted (26 April 2023; Ref: EIMS 1520). This document provides additional comments on the Basic Assessment Report (BAR), dated 6 October 2022, on the TGS Orange Basin Basic Assessment Report for reconnaissance, located offshore the west coast, South Africa.

Having reviewed the BAR and associated specialist reports, it is our opinion that the implications to marine fauna are not being sufficiently acknowledged in the EA to ease/allay fears around the impact of seismic survey (reconnaissance) activities. Comments on the ecological and biological components are given below, but by no means are comprehensive and are intended to highlight key concerns.

General impacts

Historically, the focus of seismic survey impacts and sound has been on cetaceans, with decades of effort and literature published globally to obtain a better understanding of the consequences to these animals which rely on sound for survival, including for communication using sound mainly for social interactions such as mating, mother-calf recognition, predator avoidance and locating food (see reviews of Gordon et al 2003, Weilgart 2007, Weilgart 2013, Kavanagh, 2019). Notwithstanding this, it has been well documented that various other animals also require and use sound critical to ensure functional life cycles (see Jasny et al, 2005). Sound is used by many species, by actively producing sound (Tyack 1981), by listening to sounds emitted by other living organisms (Clark et al. 2009; Van Opzeeland 2010), and taking cues from physical or non-living factors producing sounds, contributing to the ambient background noise, such as wind; waves, swell, bubbles, currents, turbulence, earthquakes, rainfall, ice cracking or breaking (Hildebrand 2005). Apart from cetaceans, many marine animals rely on producing a sound that is heard, and also having the ability to hear a sound and interpreting the sound for their survival (Hildebrand 2005).

Cetaceans

The BAR highlights that occurrences and encounters with various cetacean species are inevitable, all of which are protected in South African waters. Information supplied on cetaceans is largely based on observational data, i.e. Marine Mammal Observer (MMO) surveys (Figures 29a &b, and 30; Biodiversity and Ecosystem Services Assessment). These data are somewhat outdated and do not account for the population dynamics of the cetaceans present in the reconnaissance area or area of interest (AOI). To understand the risk of seismic surveys on cetaceans, the population status of species of concern needs to be established. This requires many years of research and depends on the temporal trends for each marine mammal species (Nowacek et al., 2015) specific to the AOI. Considering this, developing other metrics for cetacean population status, such as current distribution, ranging patterns, population structure, and body condition, should be a priority (Nowacek et al., 2015). Furthermore, without a proper understanding of the ecosystem within and surrounding the AOI, as

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highlighted in the BAR, it is impossible to assess the impacts of seismic noise on prey distribution, which ultimately influences the predator populations and distributions, such as with cetaceans (Nowacek et al., 2015).

Behavioural responses to noise are dependent on various factors, such as age, sex, presence of offspring, location and an individual animals' previous encounter with a specific sound or noise. Behavioural responses may include modification of vocal behaviour, displacement from important habitats, and other subtle responses, including increased breathing rates, change in dive duration, time spent at the surface, and rapid or erratic movements (Bowles et al. 1994; Lesage et al. 1999; Williams et al. 2002; Ng and Leung 2003; Aguilar de Soto et al. 2006). These all with potentially high energetic costs (Williams et al. 2006; Koper and Plön 2012). The time period, frequency and magnitude of a behaviour modification caused by anthropogenic disturbance, with its associated long-term implications, at a population level, remains unknown, and there remains no evidence to suggest that the change in behaviour is not detrimental.

Stress caused by disturbance is associated with a change in body chemistry (Jasny et al. 2005) and can be equally disruptive as physical damage. Stress has implications on sexual maturation, inhibits growth, reproduction and general survival ability (Pickering 1992; McCormick 1999; Consten et al. 2001). Perceptual effects can occur when there is an interference of sounds of interest to a specific animal but are being drowned out or masked by anthropogenic noise. The impact of this in the long term could have implications on breeding populations, thus on reproduction within a population (Erbe 2001). Many animals may have the ability to counteract this and make minor changes to their vocalisations and behaviour; however, these modifications may come at a cost in terms of energy expenditure (Tyack 2008) and are likely to reduce breeding productivity of the population. This is of particular concern for species that are already threatened.

Barendse et al. (2010), Best & Allison (2010), and Elwen et al. (2014) highlighted that there is no existing evidence of a clear 'corridor' of migration and humpback whales appear to be spread out widely across the shelf and into deeper pelagic waters, especially during the southward migration, in the Benguela ecosystem. Despite various species being recorded frequently on the coasts and within the Exclusive Economic Zone, the location of breeding grounds of Sei (*Balaenoptera borealis*) and Fin whales (*Balaenoptera physalus*) are unknown, the seasonality of pygmy (*Kogia breviceps*) and dwarf (*Kogia sima*) sperm whales are unknown and the abundance and occurrence of the offshore common dolphin (*Delphinus delphis*) is also unknown, highlighting that encounters with these animals cannot be predicted and the generic mitigation measures may be insufficient.

In 2020, Vermeulen *et al.* warned that there is an observed decrease in Southern Right Whale calving success (i.e. low numbers of unaccompanied adults) of the South African population, with a strong link to foraging success (Vermeulen *et al.* 2023). It was highlighted that reduced maternal body condition, could contribute to a decreased reproductive rate and potentially have serious consequences for cow-calf pairs in relation to South Africa's whale-watching industry in the future. Germishuizen (2024) and Vermeulen *et al.* (2023) show that Southern Right Whales are responding to changing climate conditions by modifying foraging behaviours within their high-latitude foraging grounds. These adaptive strategies, which include altering migratory behaviours, are associated with energetic costs (Vermeulen *et al.* 2023). The consequences of these changes in energetic costs, at a population level, remain unknown.

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South Africa's south and west coasts are hosts to eight species of beaked whales (Ziphiidae) (Best 2007), including a new species described in 2021 (*Mesoplodon eueu;* Carroll et al. 2021), which are globally recognised as being sensitive to anthropogenic noise, and having raised conservation concerns. New et al. (2013) found that adult female beaked whales could survive but not reproduce in times or areas of lower habitat quality. They may extend the duration of lactation in mediocre conditions to increase their chance of survival, while still reproducing. New et al. (2013) found that some beaked whale species require high-quality habitat to meet their requirements for reproduction and survival. They suggested that even minor, non-lethal disturbances resulting in changes in behaviour, such as displacement from preferred habitats and stress (discussed above), could impact a population

Sea Turtles

Adult sea turtles may be less vulnerable to sound damage than cetaceans as the air spaces in their cochlear are smaller than those in cetaceans, making them less sensitive to sound shockwaves (Popper et al. 2014). However, while studies have shown that adult sea turtles have a moderate ability to move from an area being surveyed (Lenhardt 1994, O'Hara and Wilcox 1990), they are prone to Temporary Threshold Shift (TTS) after exposure to sound within 1 km of a sound source, with signs of recovery only two weeks after injury (Lenhardt 1994).

There are five resident sea turtle species that migrate around the South African coastline: Endangered green turtles (*Chelonia mydas*); Critically Endangered hawksbills (*Eretmochelys imbricata*); regionally Near Threatened loggerheads (*Caretta caretta*); regionally Critically Endangered leatherbacks (*Dermochelys coriacea*); and vagrant Vulnerable olive ridleys (*Lepidochelys olivacea*) (Le Gouvello et al., 2024).

In our opinion there is cause for concern of harm to these threatened species of sea turtles both at the population as well as the species level. Sea turtles employ nest site fidelity, essentially returning to the beach where they were born to lay eggs. In South Africa, the leatherback and loggerhead nesting trends have been monitored since 1965, within their rookeries in northern KwaZulu-Natal (KZN), giving clear indications of local population levels. Both species are already under significant pressure offshore including being caught as bycatch in fishing gear and having to contend with increasing plastic pollution. Current estimates of loggerhead turtles are low, with an estimated 801 and 615 adults nesting in the KZN rookery during the 2021/2022 and 2022/2023 seasons, respectively (Figure 1; Bachoo, 2022; Bachoo, 2024). Of more concern is the leatherback turtle, in which only 96 identified individual adults nested during the 2021/2022 season and declined to 46 individuals in 2022/2023 (Figure 2; Bachoo, 2022; Bachoo, 2024). Both populations have shown extremely slow recovery since conservation measures in South Africa were implemented, and further anthropogenic loss could, in our opinion, constitute irreparable harm.

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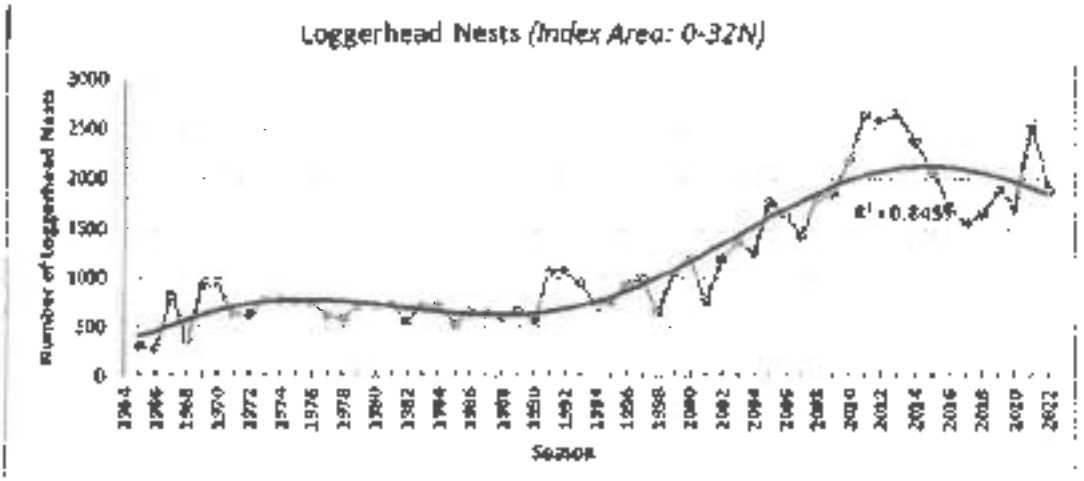

Figure 1. Number of loggerhead turtle nests in the index area (0 – 32 N) from the 1965/1966 nesting season to the 2019/2020 nesting season. From Bachoo (2022) and Bachoo (2024).

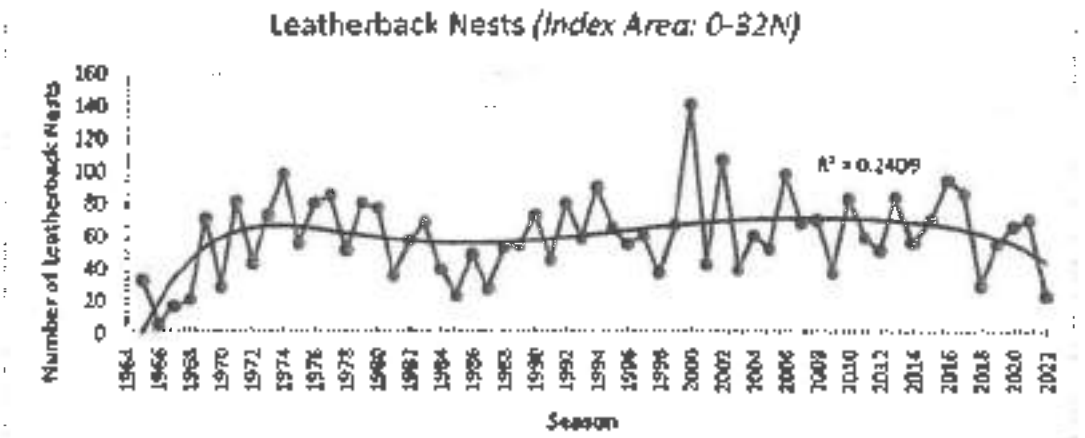

Figure 2. Number of leatherback turtle nests in the index area (0 – 32 N) from the 1965/1966 nesting season to the 2019/2020 nesting season. From Bachoo (2022) and Bachoo (2024).

The migratory lifestyle of sea turtles is mostly attributed to its complex life-cycle and their innate nature to return to their natal areas for nesting (Pendoley, 1997). Nesting of both leatherback and loggerhead turtles, on the beaches of the iSimangaliso Marine Protected Area (KwaZulu-Natal, South Africa) and Ponta do Ouro (southern Mozambique), occurs between October and March, with a peak from December to January (Table 1; Nel et al., 2013; Le Gouvello et al., 2020). Turtle hatchlings are likely to enter the ocean during the first quarter of the year, where they feed off plankton and remain in the open ocean currents until their development is complete (Luschi et al., 2003; Le Gouvello et al., 2024). It is almost impossible to track these 'tennis ball sized' hatchlings, in addition to their high mortality rates and rapid growth, further complicating the attachment of tracking devices. The result, is termed the "lost years", where it remains unclear where sea turtles <10 years old occur before returning to their shallow water foraging grounds (Musick and Limpus, 1997; Luschi et al., 2003). The movement of sea turtle hatchlings and early juveniles from coastal waters into the open pelagic ocean is strongly

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influenced by currents, which aid in moving them away from inshore predatory waters and prevents them from being cast higher ashore (Luschi et al., 2003). The current systems serve as the optimal environment for hatchlings and juveniles where their passive dispersal movement is a consequence of drifting (Luschi et al., 2003).

A recent scientific investigation by Le Gouvello et al. (2024) employed modelling techniques to examine the trajectory of neonate (<1 year old) turtles from hatching to one years old, using high-resolution ocean models in conjunction with particle tracking simulations. Juvenile sea turtles, both loggerhead and leatherback, leaving the iSimangaliso Marine Protected Area and Ponta do Ouro, take approximately 200-365 days to reach the west coast region (Figure 3a & 3b; Le Gouvello et al., 2024). Considering the loggerhead and leatherback movements and duration from the east coast to the west coast, raises the question of whether this can be considered a migration behaviour (Luschi et al., 2003). This means that due to the annual introduction of new hatchlings between January and March, and their movement around the coastline from east to west, it is indicative of a high likelihood that juvenile sea turtles will occur throughout the year (Table 1; Figure 3a & 3b; Le Gouvello et al., 2024).

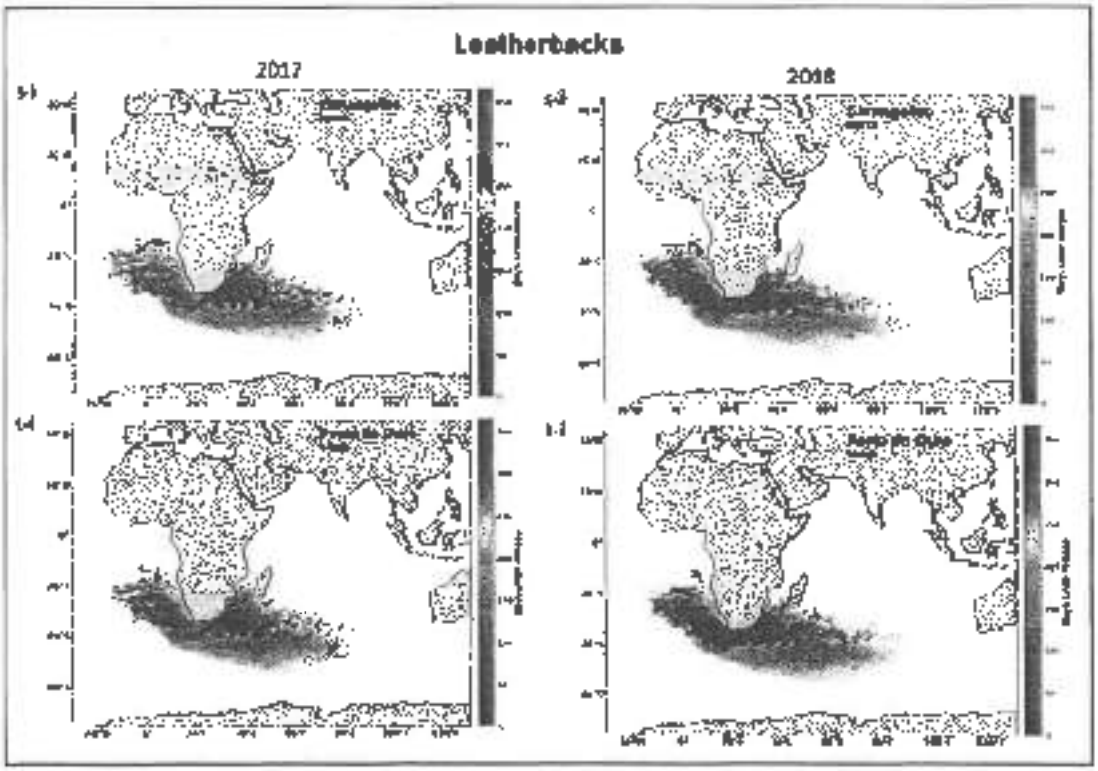

Figure 3a: Dispersal maps showing 12 month trajectories of 5000 particles released from the respective nesting sites (white circles) of leatherbacks in 2017 (-i) and 2018 (-ii) from two rookeries (iSimangaliso MPA and Ponta do Ouro). Colours (blue to red) indicate the number of days since release, and grey text gives the month of release. From Le Gouvello et al. 2024.

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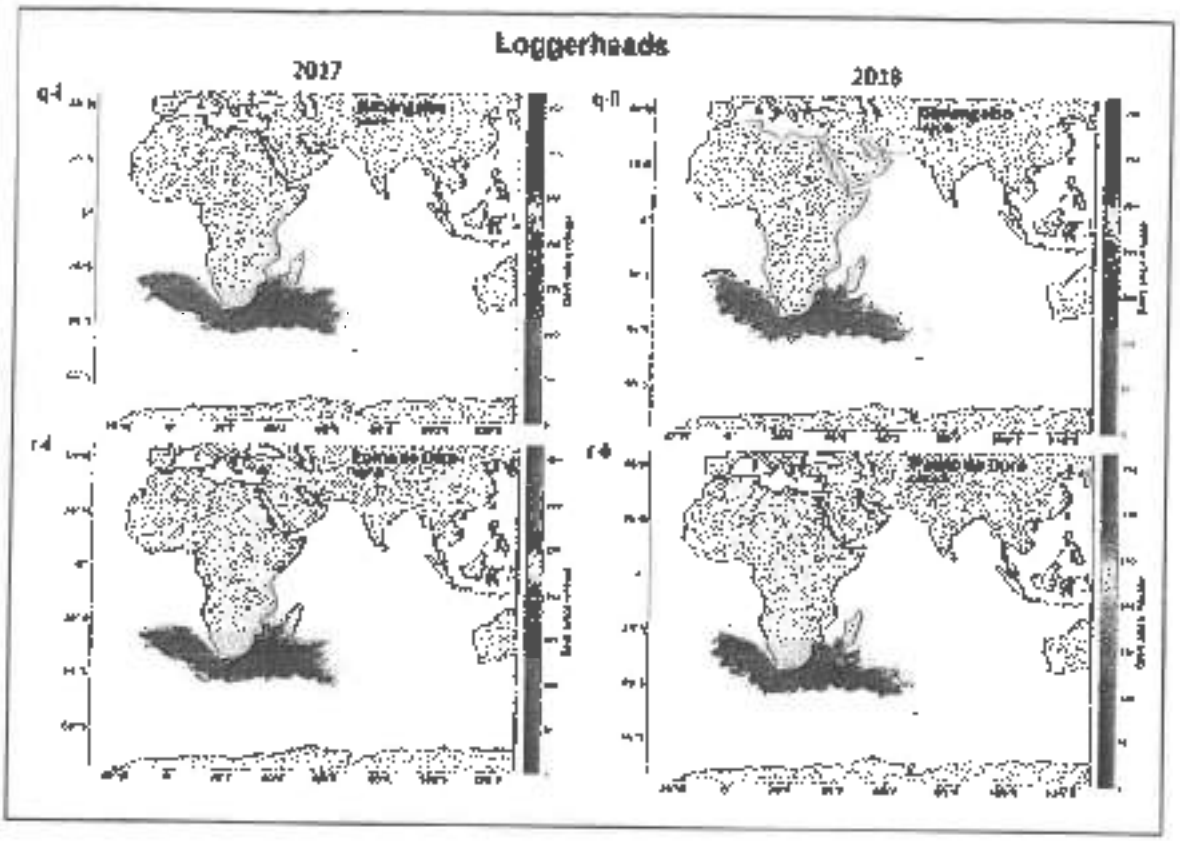

Figure 3b: Dispersal maps showing 12-month trajectories of 5000 particles released from the respective nesting sites (white circles) of loggerheads in 2017 (-I) and 2018 (-II), from two rookeries (iSimangaliso MPA and Ponta do Ouro). Colours (blue to red) indicate the number of days since release, and grey text gives the month of release. From Le Gouvello et al. 2024.

Satellite tracking data of stranded, rehabilitated and released sea turtles of various species (loggerhead, green, olive ridley) and sizes (juvenile to sub-adult) further confirms their presence on the west coast year-round (Two Oceans Aquarium Foundation, Bayworld, Port Elizabeth and South African Association for Marine Biological Research, unpublished data; Figure 4a, 4b, 4c). The routes of sea turtles from satellite tracking often show direct paths to their destination, but individual turtles may only arrive at their destination after a long detour, making their movements unpredictable.

A.V

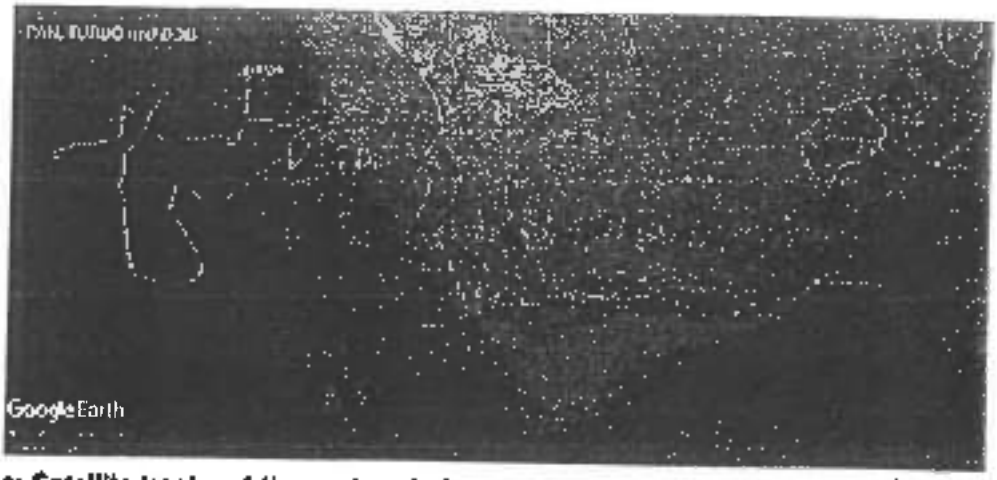

Figure 4a: Satellite tracks of three stranded, rehabilitated and released sea turtles (green and loggerhead), indicating overlap with AOI on the west coast of South Africa. Images from Two Oceans Aquarium Foundation, Bayworld, Port Elizabeth and South African Association for Marine Biological Research, unpublished data; Talitha Noble-Trull, Pers. comm.).

Figure 4b: Satellite tracks of two stranded, rehabilitated and released sea turtles (loggerhead and olive ridley), showing overlap with AOI. Images from Two Oceans Aquarium Foundation, Bayworld, Port Elizabeth and South African Association for Marine Biological Research, unpublished data; Talitha Noble-Trull, Pers. comm.).

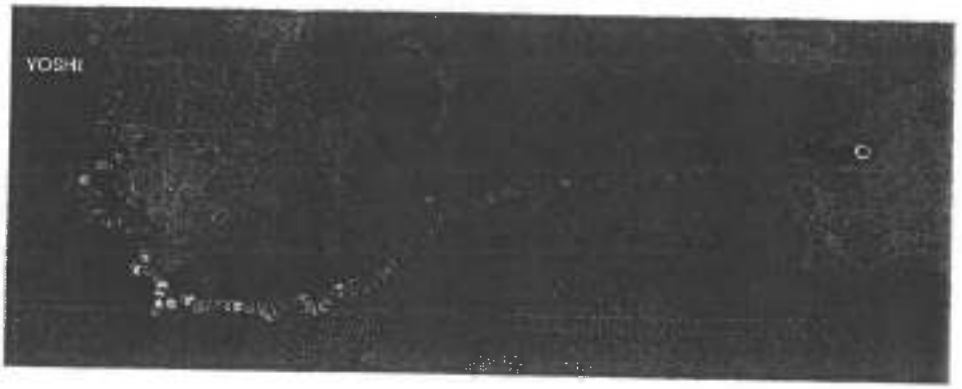

Figure 4c: Satellite tracks of one stranded, rehabilitated and released sea turtle (loggerhead), showing overlap with AOI. Images from Two Oceans Aquarium Foundation, Bayworld, Port Elizabeth and South African Association for Marine Biological Research, unpublished data; Talitha Noble-Trull, Pers. comm.).

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The presence of sea turtles at different stages in their life history, are present throughout the year along the west coast and likely within the AOI. (Table 1; Le Gouvello et al. 2024; Satellite tracking data, Bayworld, Port Elizabeth and South African Association for Marine Biological Research, unpublished data).

Table 1. Presence and location of sea turtles each month occurring on the southern African nesting beaches and in the area of interest (AOI) throughout the year based on local literature.

	J	F	M	A	M	J	J	A	S	O	N	D
Nesting period												
Hatchling period												
Presence of post-hatchling & immature sea turtles within the AOI (based on Le Gouvello et al, 2024)												

These sea turtles live out their early years on and close to the surface, only being able to dive to depths of 2-3 m. These juveniles and hatchlings cannot swim effectively or fast enough away if in close proximity to the sound source. Up to now, there are no effective mitigation measures which can be offered to mitigate the impact of sound/airgun blasts on the smaller turtles, and this is of extreme concern, not only due to their inability to evade the radius of blasts, but also since they will not be readily visible to visual observers due to their small size and behaviour in the water. Given that the success rate of visual observations by MMOs for large species such as humpback whales is only 44% of the time (Wilkinson, 2021), it renders this method of mitigation ineffective for smaller animals such as sea turtles, but especially for post-hatchling (palm-sized) and juvenile (dinner plate-sized) turtles. The difficulty in visually detecting these animals in the offshore environment is further corroborated by turtle researchers (Musick and Limpus 1997).

A further potential physical impact for sea turtles from seismic surveys is entanglement and/or entrapment in equipment (Nelms et al., 2016). It was noted by Weir et al. (2007) that off the west coast of Africa prior to the turtle nesting season, an influx of sea turtles are observed during seismic surveys, as well as in the vicinity of seismic vessels and its towed equipment (Ketos Ecology (2009). Turtles tend to bask on the ocean surface to slow down metabolic processes and conserve energy during hot and favourable weather conditions (Ketos Ecology, 2009). Therefore, turtle startle dive responses to seismic vessels and equipment may be delayed and occur only after visual detection of approaching objects at close range (< 1 m) (Ketos Ecology, 2009). This basking behaviour of turtles can leave them vulnerable to collisions with dik floats and tail buoys, which are usually located several kilometres astern the ship and pose a challenge of observing and monitoring for turtle entrapments (Ketos Ecology, 2009). In addition, loggerhead, olive ridley and Kemp's ridley (*Lepidochelys kempii*) are likely species falling victim to tail buoy entrapments while foraging alongside a seismic cable, inevitably causing the fatality of trapped turtles (Ketos Ecology, 2009).

Their presence, coupled with an inability to mitigate the risk of seismic surveys on sea turtles, means that post-hatchling and juvenile sea turtles are at significant risk of harm. Furthermore, with their limited ability to swim and avoid obstacles, pelagic loggerhead and leatherback juvenile turtles are highly vulnerable to seismic surveys because of direct injury or mortality from the towed hydrophone

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streamers (Le Gouvello et al., 2024). In 2020, Le Gouvello et al. reported that female loggerhead turtle size is declining in South Africa, even though their nesting grounds are protected. Therefore, population growth is not always guaranteed if survival is not ensured at other life stages at sea (Crouse et al. 1987; Crowder et al. 1994; Chaloupka and Limpus 2001; Bjorndal et al. 2005; Margaritoulis 2005; Mazaris et al. 2006), and although coastal marine protected areas do work in protecting sea turtles (Nel et al., 2013, Le Gouvello et al., 2020) there is a need for integrated management strategies (Le Gouvello et al., 2020), to protect threatened species.

CONCLUSION

For the reasons outlined above, it is our opinion that the proposed seismic surveys for reconnaissance pose an unacceptable acoustic and ecological risk to the marine ecosystems and species in South African waters. In point 3.2 of the EA, seismic surveys are described as "*generally regarded as non-intrusive in nature*", and although states that "*the technology poses potential impacts on fisheries and marine fauna,…..the majority of the impacts were assessed to range between low to very low significance with mitigation*". In our opinion, the acute anthropogenic noise over a prolonged period of time, and the extensive survey gear in the water is an ecological risk to threatened and protected marine fauna that primarily use sound to survive and/or are unable to avoid the area of impact. We therefore disagree with the finding of the BAR and Reasons for Decision in the EA, that seismic surveys are regarded as 'non-intrusive', especially when the report clearly acknowledges the presence of impacts, before assessing their significance as low despite the impacts being largely unknown.

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Curriculum Vitae

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EDUCATION

1993 PhD (Zoology), University of Cape Town. Focus: Trophic ecology in estuarine and intertidal systems.
1984 B.Sc. Hons. (Marine Biology), University of Cape Town, First Class
1982 B.Sc. (Zoology), University of Cape Town
1979 Matriculated, A-grade, Clarendon Girls High School, East London

AWARDS:

- PEW Fellowship in Marine Conservation, 2000
- Purcell Memorial Prize for best Zoology PhD thesis, 1993
- FRD Special Merit Doctoral Award, 1990

SELECTION OF PROFESSIONAL OFFICES HELD

Pew Fellow in Marine Conservation, Pew Fellows Program in Marine Conservation, 2000 - present
Trustee: South African Association for Marine Biological Research, 2016- July 2017
Member: Programme Steering Committee for the Marine Science for Management Association (MASMA), Western Indian Ocean Marine Science Association (WIOMSA) 2004-2015.
Chair: Subsistence Fisheries Task Group 1999-2000.
Chair: SA Network for Coastal and Oceanographic Research (SANCOR) National Steering Committee 1997-2001.
Member: IUCN Species Survival Commission – Marine Conservation Committee, 2018-present
Member: IUCN SSC Red List Committee, 2018-2021
Executive Trustee: Wildlands Conservation Trust, 2015- April 2017
Member: Scientific Authority 2014-2017. Advises the SA Minister of Environment on biodiversity matters
Chair: Symposium of Contemporary Conservation Practice (SCCP) 2012- July 2017.
Member: East African Marine EcoRegion Programme Committee (EAME) 2004-2010

EMPLOYMENT RECORD

Strategic Ocean Lead, WILDOCEANS, Wildlands Conservation Trust, August 2017 - current
Research Associate, Institute for Coastal and Marine Research, **Nelson Mandela University**, 2016-present
Senior General Manager: Scientific Services, Ezemvelo KZN Wildlife, October 2006 – July 2017
Ecological Advice Co-ordinator, Coast Region, Ezemvelo KZN Wildlife, 2002- September 2006
Regional Ecologist Marine/Scientist, Scientific Services, KZN Nature Conservation Service, 1995 – 2002
Senior Scientific Officer, Terrestrial Antarctic Biology Research Programme, Ornithology, UCT, 1991-1994

SELECTION OF RESEARCH AND MANAGEMENT EXPERIENCE

Project Leader Blue Action Fund uThukela MPA Ecosystem-based Adaptation Project (2023-current): This project is aimed at the protection and restoration of important ecosystems in new uThukela Banks Marine Protected Area, and associated estuarine functional zones, reducing climate-related socio-ecological risk.
Project Leader Blue Action Fund "Oceans Alive" iSimangaliso MPA Project (2019-current): This project has 3 main objectives 1) Build knowledge of the biodiversity and socio-economics of the MPA and its communities, 2) Support effective management of the iSimangaliso MPA, and 3) Ensure benefits and improved livelihoods for rural communities living alongside the iSimangaliso MPA.
Directs the following WILDOCEANS projects for the WILDTRUST (2017-current): Ocean Stewards, WhaleTime, MPA Expansion Project, Shark and Ray Conservation Project, Comoros Fish and Benthic Biodiversity Project, iSimangaliso Oceans Alive (MPA expansion, effective management and benefits to communities) Project, Blue Crew project in the Durban bay estuarine environment (plastic pollution action), Oil spill modelling and risk assessment projects, inshore bottom-trawling assessment project, small-scale fisheries support project..
Principle Investigator and Co-ordinator for NRF-funded African Coelacanth Ecosystem Programme research projects: uThukela MPA SmartZone (2020-2023), Biodiversity Surrogacy (2014-2017), Spatial Solutions (2016-2018) and Canyon Connections (2018-2020). Offshore biodiversity survey and sampling to test validity of modelled biozones, to refine conservation planning, and to support marine protected area expansion and the National Biodiversity Assessment (CBD).
Project leader for WWF-SA, NRF and ACEP funded project: SeaPLAN – development of a systematic conservation plan for the east coast of south Africa (2004-2012). Integrates shoreline biodiversity mapping, reef biodiversity surveys and key species and processes.
Project leader Wildlands Trust funded project: Rare and Endangered Species of the Greater St Lucia Wetland Park (2002-2006). This project aims to update the records of these species in the park and provide a management handbook. It is focussed on terrestrial and freshwater wetland species and employs a full-time researcher. This project has become entrenched and is ongoing.
Project leader for NRF funded project: KwaZulu-Natal and Transkei indigenous knowledge of subsistence harvesters (2002-2006): Aims to document traditional knowledge and management systems of rural subsistence harvesters, compare regional differences, and integrate into current management practices.
Chairperson of Subsistence Fisheries Task Team, on behalf of Marine and Coastal Management (DEAT), managed a national programme for coast-wise identification of and consultation with subsistence fishers (1999-2000). Acted as Program manager and supervisor of 8 Regional Fieldworkers (Northern Cape, West Cape (x2), South coast, Eastern Cape (x2), KwaZulu-Natal (x2), and a National Co-ordinator and project researcher. – Project leader and finance vote-holder (ca R1 mill)
Project executant (co-ordinator & researcher, and supervisor of 2 project staff) for 5-year project funded by The Green Trust, WWF-SA: The development of sustainable utilization of mussels by artisanal and subsistence gatherers along the northern KwaZulu-Natal coast – Sokhulu community alongside iSimangaliso 1995-2000.

POST-GRADUATE STUDENT SUPERVISION:
6 MSc and 2 PhD students

PUBLICATION SUMMARY:

Papers in refereed journals:	37
Book/ book chapter	9

PUBLICATIONS AND REPORTS

Owabe W, Samai T, Harris JM, Palmer RM, Kerwath SE (2023)First mesophotic Ecklonia radiata (Maninariales) records within the iSimangaliso Wetland Park marine protected area, east coast, South Africa. Journal of the Marine Biological Association of the United Kingdom 103, e91, 1-8

Spalding AK, Grorud-Colvert K, Allison EH, Arnon, DJ, Collin R, de Vos A, Friedlander AM, Mana'oakamai Johnson S, Mayorga J, Paris CB, Scott C, Suman DO, Cisneros-Montemayor AM, Estradivari, Giron-Nava A, Gurney GG, Harris JM, Hicks C, Mangubhai S, Michell F, Naggea J, Obura D, Palacios-Abrante, Pouponneau A, Thurber BV (2023) Engaging the Tropical Majority to Make Ocean Governance and Science more Equitable and Effective. Tropical Science. Npg Ocean Sustainability 2:8

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Book Chapters

Harris JM & AT Lombard (2023) Marine Protected Areas. The Ocean and Us. In: The Ocean and Us. Part IV. How we Manage the Oceans. F. Obaidullah (ed.) pp 229-238

Lombard A, Durbach I, Harris JM, Mann-Lang J, Mann B, Branch GM & Attwood C. (2019) South Africa's Tsitsikamma Marine Protected Area winners and losers. In: MARINE PROTECTED AREAS - SCIENCE, POLICY AND MANAGEMENT. Elsevier DOI: 10.1016/B978-0-08-102698-4.00013-7

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Selected Conference Presentations

Harris JM (2017) Contribution of MPAs to building ecological and social resilience. In Session: The role of MPAs in Achieving Ocean Health and Sustainable Blue Economies, 4th International Protected Areas Conference, Chile. September 2017. Invited oral presentation.

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Harris JM, Lombard AT (2017) Why we need more Marine Protected Areas – tossing red-herrings off the table. South African Marine Science Symposium. July 2017. Port Elizabeth. Oral presentation.

Harris JM (2017) Marine Protected Area Expansion in South Africa. 10x20 Symposium. Ocean Conference New York, USA. June 2017. Invited oral presentation.

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https://www.linkedin.com/in/jennifer-olbers-52302587/

SKILLS

- Class IV Commercial Diver,
- SAMSA Skipper - Category C (Surf Launch)
- SAMSA Short Range VHF Radio Operators Certificate
- First aid - Level 3 (in-date).
- Quantum GIS (2015)

Profile

I have practised as a marine conservation biologist for over 20 years with a keen interest in marine biodiversity, policy development and law enforcement. While conducting applied research that identifies anthropogenic threats and risks to species, I aim to provide solutions to reduce habitat degradation, biodiversity loss and illegal trade risk. I possess essential scientific, technical and reporting skills with two decades of experience in project development, data collection, statistical analyses and reporting in multidisciplinary projects, in both the government and NGO sectors. Projects I have worked on have required coordination and facilitation with various stakeholders, government entities and the public. This resume validates my excellent work ethic and personal attributes, including sound organizing, time management and planning skills, together with the ability to work independently or in a team. I obtain a great deal of satisfaction in that there is rarely a dull moment in conservation, and very little remains static from day to day.

Education

PhD (Zoology) - 2016
University of Cape Town, South Africa.
Taxonomy, biodiversity and biogeography of the brittle stars (Echinodermata: Ophiuroidea) of South Africa.

MSc (Biological Sciences) - 2007
University of KwaZulu-Natal, Oceanographic Research Institute.
Zonation of the benthic communities on Aliwal Shoal, KZN, South Africa.

BSc Hons (Marine Ecology) - 2003
University of Natal, Durban.
Age, growth and stock assessment of Otolithes ruber from KwaZulu-Natal, South Africa.

BSc degree (Natural and Environmental Sciences) - 2002
Rand Afrikaans University.

Certificate in Environmental Law and Liabilities for the Regulated Community - 2019
University of South Africa.

Certificate in Environmental Law & Environmental Management Legal Enforcement - 2023
University of South Africa.

Employment History

WILDOCEANS, a programme of the WILDTRUST | Senior Marine Scientist | August 2022 - Present
Provide scientific oversight in shark and ray conservation-based projects, while contributing to overall scientific support and mentorship in several marine projects within WILDOCEANS.

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Duties: the focus of my duties within the shark and ray projects, namely, *Securing protection for sharks and rays in South African waters* (funded by the Shark Conservation Fund) and the *Sanctuary for Sharks and Rays Project* (funded by the Rainforest Trust), was to ensure scientific rigor and oversight in the information provided by the project to the Department of Forestry, Fisheries and the Environment, while creating information and collating existing knowledge to increase the statutory protection for sharks and rays, with emphasis on threatened and endemic species. Some aspects of the projects are policy-focused, where modifying current legislation and regulations for further protection of shark and ray species is required while increasing spatial protection (through the formation of new no-take marine protected areas within South Africa's mainland Exclusive Economic Zone. The projects also required content creation for awareness and education via their campaigns, namely *Sharks Under Attack* and *On the Brink*, with a focus on changing the public's perception of sharks as dangerous, to a better understanding of this imperilled species globally.

Additional components of these projects is to achieve effective implementation and enforcement of adopted conservation and management measures, through training and support of law enforcement officials within various aquatic units and ports of entry (i.e. SAPS, Metro Police, SARS Customs and conservation agencies including Ezemvelo KZN Wildlife, Cape Nature, SANParks and Border Management Agency), specifically in environmental law, illegal gill-netting, use of drones, and the shark fin trade.

Further to this, during my time at WILDTRUST, I have supervised students academically (4x MSc; 1x BSc Hons), while managing and mentoring several interns (x2) and junior staff (x3).

Ezemvelo KZN Wildlife | Marine Ecologist | 2007 - 2020.

While at Ezemvelo, I was required to provide ecological advice and decision support to conservation managers on priority biodiversity information needs in the province of KwaZulu-Natal (KZN). Develop and implement long-term monitoring programmes for several marine ecosystems and resources, including subtidal reefs, rocky shores, sandy beaches, nesting turtles, humpback whale migration, marine stranded animals, shark diving and non-consumptive resource use. I also contributed to policy development and legislation tackling marine conservation concerns, while providing training to field staff on aspects of marine protected areas, threatened and protected species and various marine resources. I also liaised with several external organisations and government departments on issues relating to marine research and the marine environment, while representing the province of KZN in marine conservation on several National working groups, i.e. Top Predator Working Group and Marine Alien Invasive Working Group.

During my tenure at Ezemvelo, I created, implemented and coordinated a marine animal stranding Network for KZN, where all stranded animals, including turtles, cetaceans (whales and dolphins), pinnipeds (seals), and sea- and coastal birds, were managed through rescue, rehabilitation and/or disposal. The KZN Marine Stranding Network continues to be supported by over 25 affiliates and organisations.

Oceanographic Research Institute | Research Assistant | 2006.

Sort, process and identify benthic samples, including data capture and maintain a benthic reference collection database.

Oceanographic Research Institute | MSc Fellowship | 2004 - 2005.

In addition to completing an MSc, maintain the Oceanographic Research Institute research aquarium, capture data for the east coast reef survey project and assist with oyster, crayfish and mud prawn surveys.

IUCN Shark Specialist Group | Workshop assistant

Batoid Workshop - September 2003.

Sub-Equatorial Africa Workshop - September 2004.

General and administrative assistance for the duration of the workshop, and aid in documenting elasmobranchs for IUCN red data list criteria.

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Peer-Reviewed Publications

2024 Tree, B., **Olbers, J.M.**, Seyboth, E., Seakamela, S.M., Cockcroft, V.G., Vermeulen, E. and K.P. Findlay (2024) Migratory movement of photo-identified humpback whales *Megaptera novaeangliae* along the southeastern coast of Africa, African Journal of Marine Science, 46 (3): 191-203, DOI: 10.2989/1814232X.2024.2380882.

2023 Plön, S., Norman, S., Adam, F-A., Andrianarivelo, N., Bachoo, S., Braulik, G., Collins, T., Estrade, V., Griffiths, O., Inteca, G., Khan, N., Marinesque, S., **Mederic, E., Mwang'ombe, M., Olbers, J.**, Ramoelintsalama, L., Reeve-arnold, K., Rocha, D., Guilan, A.D., **Saloma, A., Vermeulen, E., Vitry, H.**, Wilkinson, C., and V. Dulau. 2023. Spatio-temporal trends in cetacean strandings and response in the south-western Indian Ocean: 2000-2020. *Journal of Cetacean Research and Management*, 24(1):95-119. https://journal.iwc.int/index.php/jcrm/article/view/396.

2023 Wilkinson, C., Seyboth, E., **Olbers, J.**, Vermeulen, E., Kramer, R. and K. Findlay (2023): Estimating population changes in humpback whales *Megaptera novaeangliae* migrating past Cape Vidal, South Africa, *African Journal of Marine Science*, 45(1): 1–12. DOI: 10.2989/1814232X.2023.2193591

2023 Faure-Beaulieu, N., Lombard, A.T., **Olbers, J.M.**, Goodall, V., Da Silva, C., Daly, R., Jordaan, G., Kerwath, S.E., Kock, A., Mann, B.M., Murray, T., Albano, P., Cliff, G., Dos Santos, N.A., van der Merwe, A.E., Gennari, E., Hammerschlag, N., Watson, R., Andreotti, S., Bernard, A.T.F., Cowley, P.D., De Vos, L., Drobniewska, N., Elston, C., Fallows, C., Rogers, T.D., Smith, G., Van Staden, M., De Villiers, P., Paulet, T.G. and Harris, J.M. (2023). A systematic conservation plan to identify critical areas for improved chondrichthyan protection in South Africa. *Biological Conservation*, 284: 110163. DOI: https://doi.org/10.1016/j.biocon.2023.110163.

2022 Cortelazzi, P., Paulet, T.G., **Olbers, J.M., Harris, J.M. and Bernard, A.** 2022. Conservation Benefits of a Marine Protected Area on South African Chondrichthyans. *Journal of Environmental Management*, 319: 115691. https://doi.org/10.1016/j.jenvman.2022.115691.

2022 Pfaff, M.C., Biccard, A., Mvula, P.E., **Olbers, J.M.**, Mushanganyisi, K., Macdonald, A. and Samaai, T. 2022. Giants and titans: first records of the invasive acorn barnacles *Megabalanus tintinnabulum* (Linnaeus, 1758) and *Megabalanus coccopoma* (Darwin, 1854) on intertidal rocky shores of South Africa. *BioInvasions Records* 11(3): 721-737. https://doi.org/10.3391/bir.2022.11.3.14.

2021 Daly, R., Le Noury, P., Hempson, T.N., Zlembicki, M., **Olbers, J.M.**, Brokensha, G.M. and Mann, B.Q. (2021). Bull shark, Carcharhinus leucas, recruitment into the St Lucia Estuary, South Africa, after prolonged mouth closure, and the first observation of a neonate bull shark preyed on by a Nile crocodile, *Crocodylus niloticus*. *African Journal of Marine Science*, DOI: 10.2989/1814232X.2021.1964594

2020 Plön, S., Andrianarivelo, N., Braulik, G., Bunbury, N., Collins, T., Duffaud, M.-H., Estrade, V., Griffiths, O., Inteca, G., Hofmeyr, G., Marteau, C., Mwangombe, M. Norman, S., **Olbers, J.M.**, Rocha, D., Seakamela, S., Vermeulen, E. (2020). IndoCet Stranding Network - Report on Strandings for the Western Indian Ocean Region.

2020 Dames, V., Bernard, A., Floros, C., Mann, B., Speed, C., Maggs, J., Laing, S., Meakan, M., **Olbers, J.M.** 2020. Zonation and reef size significantly influence fish population structure in an established marine protected area, iSimangaliso Wetland Park, South Africa. *Ocean and Coastal Management*, 185: 105040.

2019 **Olbers, J.M.**, Griffiths, C.L., O'Hara, T.D. & Samyn, Y. 2019. Field guide to the brittle and basket stars (Echinodermata: Ophiuroidea) of South Africa. *Abc Taxa* 19: 1-346.

2018 Atkinson L.J., Mah C., Filander Z., **Olbers J.** and Thandar A. 2018. Phylum Echinodermata In: Atkinson L.J. and Sink K.J. (eds) *Field Guide to the Offshore Marine Invertebrates of South Africa*, Malachite Marketing and Media, Pretoria, pp. 393-476. DOI: 10.15493/SAEON.

2015 **Olbers, J.M.**, Samyn, Y. and Griffiths, C.L. 2015. New or notable records of brittle stars (Ophiuroidea: Echinodermata) from South Africa. *African Natural History* 11:83-116.

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2014 **Olbers, J.M.**, Rowe, F.W.E., Griffiths, C.L. and Samyn, Y. 2014. The rediscovery of a collection of echinoderms including two holotypes in the Durban Natural Science Museum, South Africa. *Novitates*: 36: 1-13.

2013 Smit, A.J., Roberts, M., Anderson, R.J., Du Fois, F., Dudley, S.F.J., Bornman, T.G., **Olbers, J.M.** and Bolton, J.J. 2013. A coastal Seawater Temperature dataset for biogeographical studies: Large biases between in-situ and remotely-sensed datasets around the coast of South Africa. *PLoS ONE*, 8(12): e81944. Doi: 10.1371/journal.pone.0081944.

2013 Okanishi, M. **Olbers, J.M.** and Fujita, T. 2013. A taxonomic review of the genus *Asteromorphe* Litken (Echinodermata: Ophiuroidea: Euryalidae). *The Raffles Bulletin* 61(2): 461-480.

2012 **Olbers, J.M.** and Samyn, Y. 2012. The *Ophiocoma* species (Ophiurida: Ophiocomidae) of South Africa. *Western Indian Ocean Journal of Marine Science*, 10(2): 137-154.

2009 **Olbers, J.M.**, Celliers, L. and Schleyer, M.H. 2009. Zonation of benthic communities on the subtropical Aliwal Shoal, Durban, KwaZulu-Natal, South Africa. *African Zoology* 44(1): 8-23.

2007 **Olbers, J.M.** and Fennessy, S.T. 2007. A retrospective assessment of the stock status of *Otolithes ruber* (Pisces: Sciaenidae) as bycatch on prawn trawlers from KwaZulu-Natal, South Africa. *African Journal of Marine Science*, 29(2): 247-252.

2005 **Brush, J.M.** and Fennessy, S.T. 2005. Age and growth of *Otolithes ruber* of KwaZulu-Natal, South Africa. *Western Indian Ocean Journal of Marine Science*, 4(1): 21-28.

References

Dr Camilla Flores
Africa Foundation
Camilla.flores@gmail.com
082 893 6919

Mr Santosh Bachoo
Ezemvelo KZN Wildlife
santosh.bachoo@kznwildlife.com
089 783 9612

Mr Omar Parak
Department of KZN Department of Economic Development, Tourism and Environmental Affairs
Omar.Parak@kznedtea.gov.za
082 330 2136

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KENDYL ANDREA WRIGHT

SYNOPSIS

Dr. Kendyl Wright is a dedicated marine biologist committed to marine conservation. Currently, she holds the position of Marine Protected Area Scientist at WILDTRUST, WildOceans Programme. Dr. Wright is a passionate advocate for expanding marine protection, actively contributing to the discourse on the need for safeguarding the marine environment. Having earned her Ph.D. in Benthic Ecology, Dr. Wright has diverse experience in both the private and non-governmental organization sectors. Initially specializing in coastal ecology and nearshore benthic habitat research, she has transitioned into the realm of Marine Protected Area science, policy, and planning. Currently, Dr. Wright is engaged in various Marine Protected Area (MPA) projects spanning South Africa and the Western Indian Ocean. Her focus extends to community and small-scale fisher engagement, reflecting her keen interest in fostering inclusive conservation efforts. A competent passionate ocean enthusiast, she has experience diving, power boating, sailing and surfing.

Personal Info

Address
13 Rockview Road

Amanzimtoti 4126

Phone
0844701932

Email
kendylir@gmail.com

ID Number
8707240045080

Gender
Female

Education

PhD Marine Biology	University of KwaZulu-Natal	2020
MSc Environmental Consultancy	University of Plymouth United Kingdom	2011
BSc (Honours) Marine Biology	University of KwaZulu-Natal	2009
BSc Marine Biology and Geography	University of KwaZulu-Natal	2008

Employment

WILDTRUST	2021 – current	MPA Scientist
Oceanographic Research Institute	2018 - 2021	Assistant Scientist
University of KwaZulu-Natal, Westville	2016 - 2017	Contractual Lecturer
Anchor Environmental	2014 - 2015	Contractual Consultant
GCS Water and Environmental Consultants	2014 - 2015	Contractual Consultant
WSP Environment and Energy	2014 - 2015	Contractual Consultant
WSP Environment and Energy	2012 - 2014	Consultant
Oceanographic Research Institute	2011	Laboratory Assistant

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KENDYL ANDREA WRIGHT

Selected Project Related Experience

Marine

2021-Current: Sanctuary Project for Sharks and Rays – MPA Scientific Lead

Following the development of a Systematic Conservation Plan identifying priority areas for South Africa's MPA network, led the implementation of spatial protection measures for sharks, rays, skates, and chimaeras, with a focus on threatened and endemic species. Contributing to the future expansion of MPA's in South Africa and addressing the vulnerability of these species due to slow growth, late maturity, and dependence on critical habitats.

2023-Current: Small-scale Fishers and Marine Protected Areas – Scientific Lead

Currently providing the scientific and strategic support for a project aimed at improving the management and sustainability of small-scale fisheries in South Africa, fostering positive relationships between marine protected areas (MPAs) and rural fishers dependent on natural resources for livelihoods and food security. Focused on iSimangaliso and uThukela MPAs, the project, funded by the Blue Action Fund, is attempting to establish co-management systems between MPA managers and fishers, with community-based monitoring in defined co-management zones. Targeting rural subsistence fishing communities, providing practical support for improved fisheries management and sustainable resource use.

2023-Current: Sustainable Finance in Support of 30x30 – Scientific Lead

Providing marine expertise in support of a large team exploring the financial sustainability of marine protected and conserved areas (PCAs) within South Africa. This has included supporting a Finance Needs Assessment of current financial needs and future requirements related to 30x30 conservation targets. In addition, more focused work is being undertaken within the iSimangaliso MPA to develop sustainable financing strategies, supporting the long-term viability of PCAs.

2018-2022: The South Africa MPA Expansion Project – Scientific Lead

A project funded by Oceans 5 aimed at unlocking the MPA expansion process in South Africa by way of a high-profile, intensive, and multi-faceted Campaign to increase MPA coverage of the mainland EEZ from 0.4% to 5% and to pave the way towards 10%. This campaign was based on the best available science and succeeded in supporting active expansion of MPAs and by advocating for the South African government to commit to ambitious international targets including the Kunming-Montreal Global Biodiversity Frameworks, and most pertinently target 3 or 30x30.

2014-2019: Identification of macrozoobenthic zonation and ecosystem linkages in the iSimangaliso Wetland Park – Phd Dissertation

Dr. Wright spent a year sampling the nearshore macrobenthos inshore of 2-Mile Reef in Sodwana Bay, KwaZulu-Natal. An area that is not well studied, she hoped to provide improved insight into biodiversity in the region. She is currently compiling two scientific papers for publication from her doctoral thesis, allowing for improved management in the region.

2016: KwaZulu-Natal Environmental Outlook Report – Marine Specialist Component

In order to align with government legislation, a specialist report assessing the current state and pressures experienced by the KZN coastal environment was compiled. Indicators to assess the impact of these pressures

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KENDYL ANDREA WRIGHT

were outlined for monitoring purposes. The specialist report provided improved decision-making capabilities at all levels of government.

2013-2014: Richards Bay Oil Spill and Subsequent Mangrove Monitoring, Contractual Consultant

Following a crude oil spill within Richards Bay harbour, assistance and advice were sought for the implementation of a clean-up strategy and a monitoring plan. Dr. Wright spent time in the field, assisting in the management of staff tasked with the clean-up. She also undertook the post-clean-up monitoring of the mangroves.

2015: Mhlanga Estuarine Assessment, KwaZulu-Natal, Contractual Consultant Anchor Environmental:

An estuarine assessment was undertaken for a Water Use License Application to permit discharge from a Waste Water Treatment Facility. Dr. Wright undertook the identification of the invertebrates and compiled the specialist report.

Environmental Impact Assessment

2013 – 2014: BrightSource Kalahari Solar Energy Power Project, Assistant Consultant:

Scoping and Environmental Impact Assessment for the installation of a Solar Power Plant in Upington, Northern Cape.

2012 - 2014: Illovo Sugar South Africa (Pty) Ltd, Proposed Green Boiler Project, Assistant Consultant.

Scoping and environmental impact assessment for the construction of boilers at Eston and Noodsberg to convert bagasse to energy for export to the national grid. Assistant consultant in stakeholder engagement and report writing

Environmental Screenings

2012 – Africa Sun Oil, Environmental Screening of a Proposed Shopping Centre, Reservoir Hills, Consultant.

Environmental Screening of the proposed new Reservoir Hills Shopping Centre based on virgin land, including the identification of potential impacts or areas of concern.

References: *additional references on request

Dr Jennifer Olbers
+27659066541
jennifer@wildtrust.co.za

Fiona Mackay
+27829277890
fmackay@ori.org.za

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2406

IN THE HIGH COURT OF SOUTH AFRICA
(WESTERN CAPE DIVISION, CAPE TOWN)

Case No ...../2024

In the matter between

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	**First Applicant**
THE GREEN CONNECTION	**Second Applicant**
NATURAL JUSTICE	**Third Applicant**

And

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	**First Respondent**
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	**Second Respondent**
TGS GEOPHYSICAL COMPANY (UK) LTD	**Third Respondent**
MINISTER OF MINERAL AND PETORLEUM RESOURCES	**Fourth Respondent**

CONFIRMATORY AFFIDAVIT

I, the undersigned,

CARMELITA JOAN MOSTERT

do hereby make oath and say:

1 I am an adult female fisher woman residing at 141 Whipping Street, Diazville, Saldana.

C.J.M.

2 The facts contained in this affidavit fall within my personal knowledge, except where I indicate otherwise and are, to the best of my knowledge, true and correct. To the extent that I rely on information supplied by others, I believe that such information is true and correct.

3 I confirm that I had submitted a letter to the appeals authority opposing the TGS seismic survey and how these processes exclude my community from participating. I attach hereto a copy of the letter submitted by myself as Annexure "**CJM1**".

4 I further confirm that I attended a meeting at the Hoedjies Bay Hotel in Saldanha Bay on 31 August 2022 and my name appears on the Attendance Register. I attach hereto an extract from the Attendance Register as Annexure "**CJM2**".

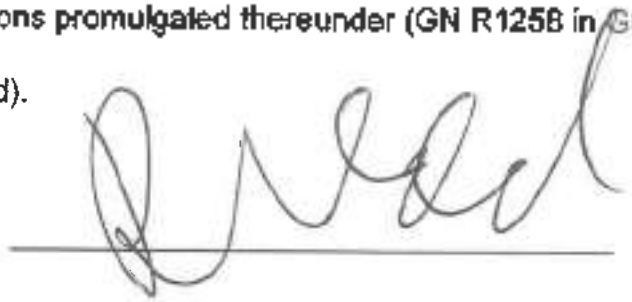
5 Further, I confirm that I have read the affidavit of Johannes Walter Steenkamp and confirm the contents insofar as it relates to me.

C. J. Mostert

CARMELITA JOAN MOSTERT

I hereby certify that on the 13 day of NOVEMBER 2024 in my presence at CAPE TOWN the Deponent signed this Affidavit and I administered the oath/affirmation in full compliance of the provisions of Act 16 of 1963 and

Regulations promulgated thereunder (GN R1258 in GG 3619 of 21 July 1972, as amended).



COMMISSIONER OF OATHS

Name: **RICHARD ALLAN LIDDLE**
COMMISSIONER OF OATHS (RSA)
Designation: PRACTISING ATTORNEY & CONVEYANCER (RSA)
RICHARD LIDDLE ATTORNEYS
13 BELGRAVIA ROAD, ATHLONE
Date: TEL: 021 697 9610

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ANNEX B5

"CJM 1"

Saldanha TGS interaksie

18 May 2023

Ons as die vissers van Saldanha het n vergadering met EIMS by hoedjies baai Hotel vir TGS bygewoon en ons het die volgende met hulle gedeel. Ons as visser is gekant teen alle forms van Olie en Gas in oseane vir die volgende redes. Die vis species wat tans folop is sal uitgeroei word en ons ervaring is dat hierdie vis spesies al reeds skaars as gevolg van klimaats verandering. Olie/Gas Drilling is n bedreiging vir alle marine spesies in die oseane. Dit gaan ons vissers voortbestaan verder in armoed dompel. Ons will dit pertinent stel van Noord tot Wes, Suid en Oos,ons is bank vas gekant teen Olie en Gas en ons weier om ons oseane beskikbaar te stell vir enige Olie en Gas. Hierdie vergadering was nie goed bygewoon die deur die bree gemeenskap nie en ons wonder was daar nog soort gelyke opvolg vergaderings gehou

Opvolg verslae:

Ons as die vissers, en Ek spesifiek wat by die vergadering was van TGS het geen terugvoering ontvang vanaf TGS tot kennisgewing 26 April 2023. Ons as Visser drae nie kennis van verslae wat in biblioteek of ander plekke was nie.Ons het nie geleenheid gehad om seker te maak dat ons kommentaar well akuraat opgeteken was nie en dra nie kennis hoe hulle ons kometaar beantwoord het nie.

Baie Dankie

Carmerlita Mostert

Coastal links Saldanha

C. J.M.

EIMS

Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Saldanha Bay - Hoedjies Bay Hotel	Date and Time	31 August 2022 - 16:00- 18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Camelite Mkeled	141 Whipping	Tel: 084 756 2203 Cell: Email: c.jmcsteelpoppie@gmail.com	C.Mkeled	Coastal Links
ANDREW APRIL	5 ANGEL ST	Tel: Cell: — Email:		
WARICK FOURIE	906 BOLGARGA AVE ST. PRETORIA	Tel: 082 851 3575. Cell: Email:		PGS HSE/ENVS.
DAVID HARPER	CAPE TOWN	Tel: Cell 076 808 8839 Email:		SLR AFRIFORUM ENV - AFFAIRS

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IN THE HIGH COURT OF SOUTH AFRICA
(WESTERN CAPE DIVISION, CAPE TOWN)

Case No ...../2024

In the matter between

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	**First Applicant**
THE GREEN CONNECTION	**Second Applicant**
NATURAL JUSTICE	**Third Applicant**

And

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	**First Respondent**
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	**Second Respondent**
TGS GEOPHYSICAL COMPANY (UK) LTD	**Third Respondent**
MINISTER OF MINERAL AND PETORLEUM RESOURCES	**Fourth Respondent**

CONFIRMATORY AFFIDAVIT

I, the undersigned,

JOHN C ADAMS

do hereby make oath and say:

1. I am an adult male residing at 76 Dolphin Street, Hondeklip Bay, Northern Cape.

2. The facts contained in this affidavit fall within my personal knowledge, except where I indicate otherwise and are, to the best of my knowledge, true and correct. To the extent that I rely on information supplied by others, I believe that such information is true and correct.

3. I confirm that I attended the TGS public participation meeting on 2 September 2022 at Eric Baker Hall in Hondeklip Bay and the reference to "John Adams" in the meeting minutes is in reference to myself. I attach hereto an extract of the Attendance Register as Annexure "JA1".

4. Further, I have read the Founding Affidavit of Johannes Walter Steenkamp and confirm the contents insofar as it relates to me.

JOHN C ADAMS

I hereby certify that on the 13th day of November **2024** in my presence at Kleinvlei Jaws the Deponent signed this Affidavit and I administered the oath/affirmation in full compliance of the provisions of Act 16 of 1963 and Regulations promulgated thereunder (GN R1258 in GG 3619 of 21 July 1972, as amended).

COMMISSIONER OF OATHS

Name: Florina Minnie
Designation: Constable
Address: Albert Luthuli Road, Kleinvlei, 7570

SUID-AFRIKAANSE POLISIEDIENS
Community Service Centre
13 NOV 2024
KLEINVLEI

EIMS

Attendance Register

EIMS Ref	1520	Project Name	Proposed YGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Call to Register Public Meeting		
Meeting Venue	Hondeklip Bay - Eric Baker Hall	Date and Time	2 September 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Maria Papiel	Hondeklipbaai	Tel: Cell: 0795453563 Email: maria.papiel7@gmail.com Papiel		
Johan C Adams Hondeklipbay		Tel: Cell: 076 034 6173 Email: boyadams1965@gmail.com		
Diana Mentoor Hondeklipbay		Tel: Cell: 0166880414 Email: dianamentoor@gmail.com Dentoor		
Sam-Mare Arends Palaai		Tel: Cell: 082 963 9687 Email: sammarep@yahoo.com		

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PO Box 1082, Pinegowrie, 2123, South Africa

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T (011) 789-7170 | F (086) 513-0067

A Right Business Centre, 14 Stewart Drive, Beest, East London
PO Box 10131, Beacon, 5241 South Africa

1.
2.

IN THE HIGH COURT OF SOUTH AFRICA
(WESTERN CAPE DIVISION, CAPE TOWN)

Case No ...../2024

In the matter between

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	**First Applicant**
THE GREEN CONNECTION	**Second Applicant**
NATURAL JUSTICE	**Third Applicant**

And

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	**First Respondent**
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	**Second Respondent**
TGS GEOPHYSICAL COMPANY (UK) LTD	**Third Respondent**
MINISTER OF MINERAL AND PETORLEUM RESOURCES	**Fourth Respondent**

CONFIRMATORY AFFIDAVIT

I, the undersigned,

JACQUELINE SUNDE

do hereby make oath and say:

1 I am an adult female residing at 38 Peak Road, Fish Hoek, Cape Town.

JS PH

2 I hold a Phd from the University of Cape Town and I am a senior researcher in the Department of Environmental and Geographical Sciences, working on the One Ocean Hub Small-Scale Fisheries Research Team, based at the University of Cape Town.

3 The facts contained in this affidavit fall within my personal knowledge, except where I indicate otherwise and are, to the best of my knowledge, true and correct. To the extent that I rely on information supplied by others, I believe that such information is true and correct.

4 I confirm that I submitted comments on the TGS draft BAR and my comments were not meaningfully engaged with. I also confirm that two of my publications were favourably cited in the Fisheries Impact Assessment. I attach a copy of my CV as annexure "JS1" which lists a number of my publications.

5 Further, I have read the Founding Affidavit of Johannes Walter Steenkamp and confirm the contents insofar as it relates to me.

J Sunde.

JACQUELINE SUNDE

I hereby certify that on the 13 day of November 2024 in my presence at Walmer SAPS the Deponent signed this Affidavit and I administered the oath/affirmation in full compliance of the provisions of Act 16 of

JS P.H

1963 and Regulations promulgated thereunder (GN R1258 in GG 3619 of 21 July 1972, as amended).

COMMISSIONER OF OATHS

Name:

Designation:

Date:

SUID-AFRIKAANSE POLISIEDIENS
P. O. BOX 3018, WALMER 6065
2024 -11- 13
WALMER
SOUTH AFRICAN POLICE SERVICE

I CERTIFY that the above statement was taken by me and that the deponent has acknowledged that he/she knows and understands the contents of this statement. He/she has no objection to taking the prescribed oath and considers the oath binding on his/her conscience.

SA POLICE SERVICE

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CURRICULUM VITAE

Jackie Sunde

Current Bio

I am a researcher and activist in South Africa working with small-scale fishing communities. I undertake research and training on marine and fisheries governance and work closely with fishers in all four provinces in South Africa and have a particular interest in supporting fishing communities in their struggle for the recognition of their customary fishing rights and in highlighting the intersection of human rights and marine biodiversity protection.

Personal details

Name: Dr Jacqueline Sunde (Jackie)
Address: 38 Peak Rd, Fish Hoek, Cape Town 7975
Telephone: Mobile: 072 262 7444
Email: jacklesunde25@gmail.com
Date of Birth: 25 April 1963 Born in South Africa

Relevant Educational Qualifications

2014 PhD. University of Cape Town, South Africa
1990 Master of Arts (Women's Studies), University of York, UK

Relevant Employment

Current – Independent Researcher
Dec 2019 to June 2024 – Senior Researcher, One Ocean Hub Research Team, Dept of Environmental and Geographical Science, University of Cape Town
July 2018 – July 2019 – Gender and Learning Advisor, ABALOBI Fisheries Organisation
2017 – 2018 Independent researcher and consultant on Small-scale Fisheries and Marine and Coastal Governance
2010-2017 Part-time contract researcher and Phd. candidate, Dept Environmental and Geographical Science, University of Cape Town
Sept 2008 - 2010 Research and Advocacy Coordinator, Masifundise Development Trust
2002 - Sep 2003 Program Manager Masifundise Development Trust
2001 Social Development and Gender Consultant contracted to the Human Rights and Poverty Directorate, Provincial Administration of the Western Cape.
2000 Contract Lecturer Department of Social Development University of Cape Town
1995 – 1999 Researcher, Centre for Rural Legal Studies,
1994 - 1995 Assistant Lecturer University of Cape Town, South Africa
1991-1993 Social Worker – Child Protection Department, Child Welfare Society

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Publications of relevance to Small-scale Fisheries Governance

Sunde, J. 2003 *Access and Rights to the Marine Commons in South Africa: Perspectives, Lessons and Possibilities for Future Action.* Masifundise Development Trust.

Jaffer, M. and Sunde, J. 2006. Fishing Rights versus Human Rights in *SAMUDRA* Report No.44, July 2006. ICSF, India.

Sunde, J and Isaacs, M. 2008. *Marine Conservation and Coastal Communities: Who Carries the Costs?* A Study of Marine Protected Areas and Their Impact on Traditional Small-Scale Fishing Communities in South Africa. International Collective in Support of Fishworkers (ICSF), Chennai, India.

Sunde, J. 2008. Resilience or Transformation? *SAMUDRA Report* No.51, November 2008. International Collective in Support of Fishworkers, (ICSF), Chennai, India.

Sowman M. Hauck M, Van Sittert L, Sunde J. 2010. Marine protected areas management in South Africa: New policies, old paradigms. *Environmental Management* 47(4): 573-583.

Sunde, J. 2010. A New Sense of Urgency: Biodiversity Report. *SAMUDRA Report* No. 56, July 2010. International Collective in Support of Fishworkers (ICSF). India.

Sunde, J. 2010. Seeking Protection. *SAMUDRA Report* No. 56, July 2010. International Collective in Support of Fishworkers (ICSF). India.

Sowman M, Hauck M, Sunde J, Raemaekers S. 2011. *Conceptual framework for identifying and addressing human dimensions of marine protected areas* (MPAs). Unpublished report. Cape Town: Environmental Evaluation Unit, UCT.

Sowman M, Sunde J, Raemaekers S, Schultz O. 2012. *Fishing for equality: Policy for poverty alleviation for South Africa's small-scale fisheries.* Unpublished Conference Proceedings, Conference on Strategies to Overcome Poverty and Inequality. Towards Carnegie III conference, UCT, South Africa. 3-7 September 2012.

Sowman, M., Hauck, M., Van Sittert, L and Sunde, J. 2011. Marine protected areas management in South Africa: New policies, old paradigms. *Environmental Management* 47(4): 573-583.

Sunde, J. 2013. *Living customary law along the South African coastline: securing the rights of small-scale fishing communities.* Unpublished Research Report. Legal Resources Centre, Cape Town.

Sunde, J., Sowman, M., Smith, H., Wicomb, W. 2013. Emerging proposals for tenure governance in small-scale fisheries in South Africa. *Land Tenure Journal*, 1-13, July 2013. Food and Agricultural Organisation. Rome, Italy. Pages 117-146.

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Sowman, M., Raemaekers, S and Sunde, J. 2014a. Shifting Gear: A New Governance Framework for Small-Scale Fisheries in South Africa. In Sowman M. and Wynberg, R. (eds.). *Governance for Justice and Environmental Sustainability. Lessons across Natural Resources Sectors in Sub-Saharan Africa*. Earthscan/Taylor and Francis, London.

Sunde, J. 2014. *Marine Protected Areas and small-scale fisheries in South Africa: promoting governance, participation, equity, and benefit-sharing*. SAMUDRA Monograph. International Collective in Support of Fishworkers (ICSF), Chennai, India.

Sunde, J. 2014. *Customary governance and expressions of living customary law at Dwesa-Cwebe: Contributions to small-scale fisheries governance in South Africa*. Unpublished Phd. *University of Cape Town. Cape Town*.

Sunde, J. 2015. *Reincorporating the excluded: Recognising and integrating customary fishing rights and practices in small-scale fisheries governance and management in South Africa*. Policy Brief: Reincorpfish.

Sunde, J. 2016. *Social relations and dynamics shaping the implementation of the Voluntary Guidelines on Small-scale Fisheries (SSF Guidelines)*. SAMUDRA Monograph. International Collective in Support of Fishworkers (ICSF). Chennai, India.

Sunde J. 2016. Conservation, conflict and claiming collective rights to marine commons in Dwesa-Cwebe, South Africa. Case study on customary tenure for publication in Governing Tenure Rights to Commons: *A Technical Guide to support the implementation of the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security*. Prepared by the Institute for Advanced Sustainability Studies (IASS) for the Food and Agriculture Organization of the United Nations (FAO).

Sunde, J. 2017. Expressions of Tenure in South Africa in the context of the Small-scale Fisheries Guidelines. In Jentoft, Chuenpagdee, R, Barragan-Paladines, M and Franz, N. (eds). *The Small-scale Fisheries Guidelines Global implementation*. Mare Publication Series 14. Springer

Sowman, M. and Sunde, J. 2018. Social impacts of marine protected areas in South Africa on coastal fishing communities. *Ocean and Coastal Management*. 157. (2018). 168-179.

Jentoft, J., Stacey, N., Sunde, J., and Gonzalez, M. 2019. The Small-scale Fisheries of Indigenous Peoples: A Struggle for Secure Tenure Rights. In Chuepagdee, R. and Jentoft, S. (Eds) Transdisciplinarity for Small-scale Fisheries Governance. Mare Publication Series 21. Springer.

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Sowman. M and Sunde, J. 2021. A just transition? Navigating the process of policy implementation in small-scale fisheries in South Africa. *Marine Policy* 132 (2021) 104683. DI. 10.1016/j.marpol.2021.104683

Sowman, M., Sunde., J. Pereira, T. Snow., B. Mbatha, P and James, A. 2021. Unmasking governance failures: The impact of COVID-19 on small-scale fishing communities in South Africa. *Marine Policy* (2021). Doi: 10.1016/j.marpol.2021.104713ast out: The

Sunde, J and Erwin, K. 2020. *Cost Out: The systematic exclusion of the KwaZulu Natal Subsistence Fishers from the Policy for Small-scale Fisheries in South Africa*. South Durban Community Environmental Alliance (SDCEA). Durban, South Africa.

Christoffels-Du Plessis, A. Erinosho, B., Major, L., Morgera, E., Sunde., J and Vermeylen, S. 2022. Navigating a sea of laws: small-scale fishing communities and customary rights in Ghana and South Africa. In Boswell R. and O'Keene, D and Hills, J (Eds). *The Palgrave Book of Blue Heritages*. Palgrave Macmillan Ltd. Cham, Switzerland.

Relevant organisational experience

2006 -2010 Member of the Animation Team of the International Collective in Support of Fishworkers (ICSF)

2010 – 2014 Chairperson of the Coordinating Committee of the International Collective in Support of Fishworkers (ICSF).

2018-2022 Board Member, Trust for Community Outreach and Education (TCOE), South Africa

2020- Member of the Coastal Justice Network, South Africa

Relevant policy related work

Member of the National Policy Task Team for the Policy for Small-scale Fisheries South Africa, 2007-2010.

Input on High Level Panel on *Governance* at the World Parks Congress, Sydney, 15 November 2014;

Presentation on *Customary Marine Tenure* at the South African National Conference on Tenure co-hosted by FAO-FIAN-Masifundise attended by 70 representatives from all four coastal provinces and two government departments, June 2015;

Presentation on *Customary Tenure and a Human Rights Based Approach to Small-scale Fisheries*: FAO Workshop on a Human Rights Based Approach to Small-scale Fisheries, FAO, Rome, Italy, 23-27 October 2016;

Presentation on *Extractivism and Fisheries* at the People's Dialogue workshop on Extractivism, AIDC and Women in Mining, Cape Town, March 2017.

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IN THE HIGH COURT OF SOUTH AFRICA

(WESTERN CAPE DIVISION, CAPE TOWN)

CASE NO.: ...../2024

In the matter between:

AUKOTOWA FISHERIES PRIMARY CO-OPERATIVE LIMITED	First Applicant
THE GREEN CONNECTION NPC	Second Applicant
NATURAL JUSTICE	Third Applicant

and

DIRECTOR-GENERAL: DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES	First Respondent
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	Second Respondent
TGS GEOPHYSICAL COMPANY (UK) LIMITED	Third Respondent
MINISTER OF MINERAL AND PETROLEUM RESOURCES	Fourth Respondent

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CONFIRMATORY AFFIDAVIT

I, the undersigned,

REGAN JAMES

do hereby make oath and state as follows:

1. I am an adult male, residing at 34 Kingfisher Lane, Hangberg, Hout Bay, Cape Town.

R. J

2. The facts contained in this affidavit fall within my personal knowledge, except where I indicate otherwise, and are, to the best of my knowledge and belief, both true and correct. To the extent that I rely on information supplied by others, I believe that such information is true and correct.

3. I am a small-scale fisher from Hout Bay and the Chief of the Katz Koranna Royal House of the Koranna Khoi Poeples. I confirm that I attended the TGS Public Participation meeting at the Lamberts Bay Community Hall on 2 November 2022. I attach hereto an extract from the Attendance Register as Annexure "**RJ1**".

4. Further, I confirm that I have read the founding affidavit of Johannes Walter Steenkamp and confirm the contents insofar as it relates to me.

R. J

REGAN JAMES

I hereby certify that the deponent knows and understands the contents of this affidavit and that it is to the best of the deponent's knowledge both true and correct. This affidavit was signed and sworn to before me at Hout Bay on this the 13 day of November 2024, and that the Regulations contained in Government Notice R.1258 of 21 July 1972, as amended by R1648 of 19 August 1977, and as further amended by R1428 of 11 July 1989, having been complied with.

SUID-AFRIKAANSE POLISIEDIENS
13 NOV 2024
GEMEENSKAPSDIENSTE

COMMISSIONER OF OATHS
Full names: Mahaol
Address: Main Road Hout Bay
Capacity: Constable

R. J

Attendance Register

EIMS Ref	1520	Project Name	Proposed TGS Orange Basin Reconnaissance Permit Basic Assessment
Meeting	Draft Basic Assessment Report Review Meeting		
Meeting Venue	Lamberts Bay - Community Hall	Date and Time	02 November 2022 - 16:00-18:00

Name and Surname	Address	Contact Details	Signature	Organisation / Property Details
Ms NAMPSHA JAMES	BAZNABASSTR. 5	Tel: Cell: 0783184585 Email: nabashae@eagle.co.za		KAIZ KEKANA Royal House
CHIEF KEKANA JAMES	BAZNABASSTR. 5	Tel: Cell: 0765416407 Email: [illegible]	R.J	KAIZ KEKANA Royal House
DESMOND SIMON	SARAHSTR. 9	Tel: Cell: Email		GIRVAG FARM
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