

Your ref:

My ref: AP/GC/CGG EMP

To: **SLR Consulting (South Africa) (Pty) Limited**
5th Floor Letterstedt House
Newlands on Main Building
Newlands
7700

By Email: ecostandius@slrconsulting.com

29 November 2021

Re. THE GREEN CONNECTION - COMMENTS ON CGG Services SAS ENVIRONMENTAL MANGEMENT PLAN
PASA Reference: 12/1/037

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A. INTRODUCTION

These comments are submitted on behalf of the Green Connection, 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. 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.

According to the draft EMP, PASA accepted a Reconnaissance Permit application submitted by CGG Services SAS (CGG) in terms of section 74 of the Mineral and Petroleum Resources Development Act¹ (MPRDA). The application provides for the undertaking of a multi-client speculative three dimensional (3D) seismic survey in the Algoa, Gamtoos and Outeniqua Basins off the Southeast Coast of South Africa. CGG appointed SLR Consulting (South Africa) (Pty) Ltd (SLR) to compile the draft EMP and undertake a public participation process for the proposed project.²

The draft EMP indicates that the proposed survey area would be between 1 000 km² and 3 500km² in extent within a 15 428 km² identified 'area of interest'. This area of interest is indicated as being located between Gqeberha and a point approximately 120 km southeast of Plettenberg Bay, ranging between 30 km and 120 km from the coast in water depths between 150 m and 4,000 m. While the survey commencement would depend on a permit award date and the availability of a survey vessel, consultants SLR state that it is anticipated that the survey would take up to five (5) months to complete, and should the permit be awarded the proposed survey could commence in January 2022.³

The draft EMP states that the EMP process included an *Underwater Acoustics Modelling Study*, as well as *Biodiversity and Ecosystem Services (marine fauna) Impact Assessment* and a *Commercial Fisheries Impact Assessment*. This - and other relevant information - is indicated as having been integrated into the draft EMP.

B. POINT IN LIMINE 1 – Multiclient 3D Survey Application *ultra vires* MPRDA

The Green Connection submits that the acceptance of CGG's Reconnaissance Permit application was irregular and *ultra vires* the enabling provisions of the MPRDA, for the reasons set out below.

¹ Act 28 of 2002.

² CGG draft EMP, pi-ii

³ CGG draft EMP, pi.

The EMP indicates that on 06 April 2021 CGG submitted an application for a Reconnaissance Permit in terms of s74 of the MPRDA, and that the Petroleum Agency of South Africa (PASA) accepted the application on 4 May 2021.⁴

In terms of s74 of the MPRDA, 'any person' who wishes to apply to the Minister for a reconnaissance permit must lodge the application as indicated in subsection (1)(a) to (c), and PASA must within 14 days accept an application for a reconnaissance permit if, among other things, '**no other person holds a technical co-operation permit, exploration right or production right for petroleum over any part of the area**' (emphasis added).⁵

If the application does not comply with the requirements of this section, the designated agency must notify the applicant in writing within 14 days of the receipt of the application and provide reasons.⁶

The 'holder' in relation to *inter alia* a technical co-operation permit, reconnaissance permit or exploration right is defined as meaning '*the person to whom such right or permit has been granted or such person's successor in title*'.⁷

It is noted that the draft EMP states that the Reconnaissance Permit application area includes a number of blocks off the Southeast Coast of South Africa, and lists the block rights/permit holders within the Reconnaissance Permit application area in Table 6.1:⁸

Table 6-1: List of Right Holders in the Reconnaissance Permit Application area boundary

NO.	RIGHT HOLDER	Block
1.	New Age Algoa / RIFT Petroleum	Algoa Inshore – Exploration Right 201ER
2.	Impact Africa	Exploration Right 252ER
3.	Impact Africa / Silver Wave Energy	Area 2 – Exploration Right 276ER
4.	Total Energies	Block South Outeniqua – Exploration Right 231ER
5.	Total Energies / Qatar Petroleum / CNR / Main Street	Block 11B/12B – Exploration Right 067ER

The draft EMP states that:

⁴ 3 CGG EMP p19.

⁵ MPRDA, s74(2)(b).

⁶ S74(4).

⁷ MPRDA, s1.

⁸ 4 CGG EMP p32.

CGG is required to consult and obtain written consent from the existing right holders within the Reconnaissance Permit application area, giving PASA permission to continue to process its application over their acreage. PASA has no legal obligation to accept or to continue to process any applications if the requisite consent letters from existing right holders are not received. CGG is currently in the process of acquiring these consents which will be submitted directly to PASA.⁹

It is clear from the above that CGG did not have the existing rights holders' consents at the time of finalising this draft EMP, and that PASA's decision to accept CGG's Reconnaissance Permit application was made in the absence of such consents.

While the draft EMP suggests that PASA '*has no legal obligation to accept or to continue to process any applications if the requisite consent letters from existing right holders are not received*', it is submitted that the MPRDA does not empower PASA to accept and continue to process any application if consent letters from existing rights holders are received.

The relevant section requires PASA to accept the application if no other person holds (among other things) exploration rights for petroleum over any part of the area, and there are no enabling provisions in the MPRDA or its regulations empowering PASA to accept such applications where there are existing rights holders (with or without such rights holders' written consent).

In contrast to the absence of any enabling provisions relating to multi-client surveys in the MPRDA and its regulations, the Upstream Petroleum Resources Bill¹⁰ (which has not yet been enacted) specifically includes enabling provisions relating to multi-client speculative surveys:

- In terms of section 10(b) of the Bill, PASA must formulate [an] exploration strategy that includes acquisition of seismic data through non-exclusive multi-client speculative surveys in frontier or under explored areas ahead of licensing rounds;
- Section 16(1) of the Bill provides that the Minister may, by notice in the *Gazette*, invite applications for a reconnaissance permit from seismic companies to acquire data on a non-exclusive multi-client speculative business model in respect of a block or blocks, or in respect of a wide regional area comprising multiple blocks or areas as specified in the notice. Section 16(2) specifically provides that such a notice may be in relation to multiple blocks or areas which are encumbered by (among other things) exploration rights for purposes of enabling the State to assess the geological potential and establish prospectivity of a wider regional area. Section 16(4)

⁹ 4 CGG EMP p30.

¹⁰ B13-2021.

empowers the Minister to grant a reconnaissance permit over an area encumbered by (among other things) exploration rights subject to various conditions. Section 16(5) provides further that, notwithstanding the provisions of subsection 16(1), applications for reconnaissance permits may be lodged in terms of section 34 in the prescribed manner with the Petroleum Agency at any time;

- Furthermore, section 38(2)(b) of the Bill provides that PASA must accept an application for a reconnaissance permit if (among other things) no other person holds an exploration right over the same block or blocks. Section 38(3) of the Bill provides that PASA may accept an application for a reconnaissance permit over any part of an area subject to (among other things) an exploration right, subject to the applicant furnishing written consent from the holder of the exploration right giving PASA consent to accept and process the application, while section 38(4) provides that notwithstanding the provisions of subsections (2)(b) and (3), PASA may accept an process an application for a reconnaissance permit over an area encumbered by a permit or a right if the proposed seismic data acquisition will promote and facility the acquisition of petroleum geo-technical data as contemplated in section 2(l).

In the circumstances, it is submitted that the acceptance of CGG's Reconnaissance Permit application in the absence of enabling provisions in the MPRDA empowering PASA to accept such applications where there are existing rights holders (with or without such rights holders' written consent) was irregular and *ultra vires* the enabling provisions of the MPRDA, and falls to be set aside on appeal or review.

C. POINT IN LIMINE 2 – NEMA EIA Authorisation Required

It is submitted that the Minister /DMRE cannot lawfully issue a reconnaissance permit in the absence of an environmental authorisation, and that CGG cannot lawfully commence its proposed 3D seismic survey in the absence of a NEMA EIA authorisation.

In terms of s5A of the MPRDA:

No person may... conduct...reconnaissance operations¹¹... or commence with any work incidental thereto on any area without:

¹¹ The MPRDA defines "**reconnaissance operation**" in s1 as meaning: *'...any operation carried out for or in connection with the search for a mineral or petroleum by geological, geophysical and photo geological surveys and includes any remote sensing techniques, but does not include any prospecting or exploration operation other than acquisition and processing of new seismic data'.*

- (a) **an environmental authorisation**;¹²
- (b) **a... reconnaissance permit...; and**
- (c) giving the landowner or lawful occupier of the land in question at least 21 days written notice. (emphasis added)

Section 38A(2) of the MPRDA provides also stipulates that:

- (2) An **environmental authorisation** issued by the Minister shall be a **condition prior to the issuing of a permit** or the granting of a right **in terms of this Act**. (emphasis added)

In terms of NEMA EIA Listing Notice 1,¹³ activities listed in Appendix 1 are identified as activities that may not commence without environmental authorisation from the competent authority, and the investigation, assessment and communication of potential impact of activities must follow the procedure as prescribed in regulations 19 and 20 of the Environmental Impact Assessment Regulations published in terms of section 24 (5) of the Act. Appendix 1 provides that the competent authority in respect of activities listed is the Minister responsible for mineral resources where the application is a mining application.¹⁴

As from 11 June 2021, NEMA EIA Listing Notice 1 listed activity 21B identifies the following as an activity that may not commence without environmental authorisation:

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. (emphasis added)

Read together, it is clear that:

- The MPRDA prohibits CGG from conducting a reconnaissance operation without both a NEMA

¹² The MPRDA stipulates that “**environmental authorisation**” has the meaning assigned to it in section 1 of the National Environmental Management Act, 1998 (Act No. 107 of 1998). Section 1 of NEMA in turn provides that “**environmental authorisation**”, when used in Chapter 5, means the authorisation by a competent authority of a listed activity or specified activity in terms of NEMA, and includes a similar authorisation contemplated in a specific environmental management Act. The definition does not refer to an ‘environmental authorisation’ issued under the MPRDA.

¹³ GNR983 of 4 December 2014 (as amended).

¹⁴ ‘Mining application’ is defined in GNR983 as meaning ‘*an application for an environmental authorisation for a permission, right, permit, or consent required in terms of the Mineral and Petroleum Resources Development Act*’.

environmental authorisation and an MPRDA Reconnaissance Permit, and that an environmental authorisation issued by the Minister shall be a condition prior to the issuing of a permit in terms of the MPRDA; and

- As from 11 June 2021, NEMA prohibits the commencement without NEMA environmental authorisation of any activity including the operation of that activity which requires a reconnaissance permit in terms of the MPRDA.

On this issue, the draft EMP indicates that:

At the time the Reconnaissance Permit Application was submitted to PASA, there was no, requirement in the Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) to apply for an Environmental Authorisation when applying for a Reconnaissance Permit, **and as such PASA requested** that CGG *'develop a plan for managing potential environmental impacts that may result from the proposed operations and notify and consult with affected parties'* and submit it to them for consideration by the Minister of Mineral Resources. For this application, the plan is referred to as an **"Environmental Management Plan (EMP)"**. Although the Department of Forestry, Fisheries and the Environment (DFFE) subsequently published amendments to the EIA Regulations 2014, which now requires Environmental Authorisation for Reconnaissance Permit Applications, **the transitional arrangements apply**. Thus, this Reconnaissance Permit Application will be dispensed with in terms of the previous Regulations that were in place at the time of application submission (refer to Section 2.2.3 for further detail in this regard).¹⁵ (emphasis added)

Section 2.2.3 of the EMP in turn states as follows:

'As noted in s1.1, at the time the Reconnaissance Permit application was submitted to PASA in 2020 [actually 4 May 2021 – see 2 CGG p1], there was no legislated process in NEMA or the EIA Regulations 2014 (as amended) prescribing the environmental approval procedure to be followed in order to obtain a Reconnaissance Permit. Thus, the procedure followed in this EMP process is based on PASA's acceptance of the Reconnaissance Permit application and as previously noted it was requested that CGG 'develop a plan for managing potential environmental impacts that may result from the proposed operations and notify and consult with the affected parties'.

Subsequent to PASA's acceptance of the Reconnaissance Permit Application, DFFE published amendments to the EIA Regulations 2014 in GN No. 517 (2021), which now includes *any activities (excluding any desktop study and any aerial survey) requiring a reconnaissance permit in terms of Section 74 of the MPRDA* as a listed activity (Activity 21B) in Listing Notice 1. Thus, **an application for a Reconnaissance Permit now also requires an application for Environmental Authorisation and the undertaking of a Basic Assessment**. However, GN No. 517 makes provision for transitional arrangements in order to accommodate applications submitted in terms of the previous Regulations and which are pending when the amendments took effect. Such applications must be dispensed with in terms of the previous Regulations that were in place at the time of application submission. Nevertheless, this EMP fulfils the requirements of a Basic Assessment Report, as specified in Appendix 1 of the EIA Regulations 2014 (as amended).¹⁶ (emphasis added)

¹⁵ 1 CGG pii.

¹⁶ 2 CGG, p7.

Where the EMP states that *'an application for a Reconnaissance Permit now also requires an application for an Environmental Authorisation and the undertaking of a Basic Assessment'*, it errs. The listed activity is triggered by the commencement of *'any activity including the operation of that activity that requires a Reconnaissance Permit'*. It is not the MPRDA Reconnaissance Permit application that triggers the requirement for a NEMA environmental authorisation in terms of NEMA Listing Notice 1, but the commencement of the activity and the operation thereof.

While the EMP is correct that the NEM Amendment Act (GN517 of 11 June 2021) makes provision for transitional arrangements in order to accommodate applications submitted in terms of the previous Regulations and which were pending when the amendments took effect (and stipulates that such applications must be dispensed with in terms of the previous Regulations that were in place at the time of the application submission), the EMP fails to point out that these transitional arrangements apply to NEMA EIA applications that were submitted and were pending (and not MPRDA permit applications):

An application submitted in terms of the Environmental Impact Assessment Regulations, 2014, published under [GN982 of 4 December 2014], or in terms of any amendments affected to these Regulations, which application was submitted on or after 8 December 2014, and which application is pending at the when these amendments take effect, must be finalised in terms of those Regulations that were in place at the time of submission of the application.¹⁷ (emphasis added)

These transitional arrangements clearly make reference to environmental authorisation applications submitted in terms of the NEMA EIA Regulations and which were still pending at the time when the NEMA amendments took effect, as distinguished from Reconnaissance Permit applications submitted in terms of s74 of the MPRDA that were still pending when the NEMA amendments took effect. The listing of this activity is a new legislative requirement that must be complied with prior to the commencement of an activity including the operation thereof requiring a reconnaissance permit in terms of the MPRDA. The transitional arrangements simply do not deal with a situation where, at the time of making an MPRDA permit application, the activity was not listed in the NEMA EIA listing notices. It is submitted that if this was intended, the NEM Amendment Act would have included a transitional arrangement stating to the effect that, where a permit or right was applied for under the MPRDA prior to the coming into effect of the NEM Amendment Act and which MPRDA application is still pending, and where such activity (and the operation thereof) was not a NEMA listed activity, the NEM listed activity does not apply.

¹⁷ GN517 of 11 June 2021, section 30(1).

It is noted that the EMP indicates that ‘the procedure followed in this EMP process is based on PASA’s acceptance of the Reconnaissance Permit application and as previously noted it was requested that CGG *‘develop a plan for managing potential environmental impacts that may result from the proposed operations and notify and consult with the affected parties’*’. It is submitted that there is no legislative basis for this request by PASA: the MPRDA (as amended) and MPRD Regulations (as amended) applicable at the time of CGG’s Reconnaissance Permit application did not include provisions (or procedures) for environmental impact assessment.

It is also noted that the EMP states further that ‘Nevertheless, this EMP fulfils the requirements for a Basic Assessment Report, as specified in Appendix 1 of the EIA Regulations 2014 (as amended)’. This does not however absolve CGG of the requirement to apply for and obtain environmental authorisation under NEMA, and prejudices the rights of interested and affected parties. For example, the MPRDA does not make provision for automatically providing a record of decision and reasons for the decision to interested and affected parties. In addition, while an appeal can be lodged against a Reconnaissance Permit decision, this appeal is made to the Director-General or the Minister responsible for mineral resources, and the appeal does not automatically suspend the Reconnaissance Permit (unless it is suspended by the Director-General or the Minister).¹⁸ In contrast, the NEMA EIA Regulations requires that all registered I&APs be provided with access to the decision and the reasons for such decision.¹⁹ In addition, NEMA provides that any person may appeal to the Minister responsible for environmental affairs against a decision made in terms of NEMA by the Minister responsible for mineral resources or any person acting under his or her delegated authority.²⁰ An appeal to the Minister responsible for environmental affairs provides an important ‘check and balance’ in the legislative regime, especially given that the MPRDA seeks to promote petroleum exploration and production. An appeal in terms of NEMA also automatically suspends an environmental authorisation.²¹

In the premises, it is submitted that in terms of the MPRDA, not only is CGG prohibited from conducting a reconnaissance operation without both a NEMA environmental authorisation and an MPRDA Reconnaissance Permit (s5A of the MPRDA), but an environmental authorisation issued by the Minister is a condition that must be met prior to the Minister or the DMRE issuing a permit in terms of the MPRDA (s38A). Furthermore, given that as from 11 June 2021 NEMA prohibits the

¹⁸ MPRDA s96, read with MPRD Regulations r74.

¹⁹ NEMA EIA Regulations GN982 of 4 December 2014 (as amended), r4.

²⁰ NEMA s43(1A).

²¹ NEMA s24(7).

commencement without NEMA environmental authorisation of any activity including the operation of that activity which requires a reconnaissance permit in terms of the MPRDA, it would be unlawful for CGG to commence the 3D seismic survey in the absence of a NEMA environmental authorisation for NEMA Listing Notice 1 Activity 21B. As explained above, the transitional arrangements contained in the NEM Amendment Act do not apply given that (on available information) CGG did not submit an application for environmental authorisation in terms of the NEMA EIA Regulations that was pending when the NEMA amendments took effect (namely 11 June 2021).

D. 3D SEISMIC SURVEY WILL RESULT IN UNACCEPTABLE ECOLOGICAL DEGRADATION OR DAMAGE TO THE ENVIRONMENT

The Green Connection submits that the proposed 3D seismic survey will result in unacceptable ecological degradation and damage to the environment, that the proposed mitigation measures are not adequate to achieve the mitigation claimed in the EMP, and that accordingly CGG's Reconnaissance Permit application should be refused by the Minister / DMRE.²²

The CGG EMP acknowledges that the 3D seismic will increase the underwater ambient noise levels (i.e. create noise pollution) through the firing of the seismic airguns,²³ and that these elevated noise levels could impact marine fauna by:

- Causing direct physical injury to hearing or other organs (direct negative impact), including permanent (PTS) or temporary threshold shifts (TTS);
- Causing disturbance to the receptor resulting in behavioural changes or displacement from important feeding or breeding / spawning areas (direct negative impact);
- Masking or interfering with other biologically important sounds (e.g. communication, echolocation, signals and sounds produced by predators or prey) (indirect negative impact).²⁴

3D seismic surveys blast the water column with a multiple array of high-volume airguns to detect oil and gas reserves beneath the ocean floor, generating some of the loudest sounds that humans produce in the ocean that disrupt acoustic habitats across a wide geographic scale.²⁵ Airguns are fired

²² In terms of section 75 of the MPRDA, the Minister must issue a Reconnaissance Permit if (among other things):

(c) the reconnaissance **will not result in unacceptable** pollution, **ecological degradation or damage to the environment** and that the environmental authorisation is issued.

²³ CGG EMP Ch8, p170.

²⁴ Ibid, p171.

²⁵ Pichegru *et al* 'Avoidance of seismic survey activities by penguins', 7 Sci Rep 16305 (2017), <http://www.nature.com/articles/s41598-017-16569-x>

as often as every ten seconds, twenty-four hours a day, for months at a time. Each blast can produce effective sound levels in excess of 260 decibels that are powerful enough to be heard underwater for hundreds²⁶, or even thousands, of kilometres.²⁷ The main seismic airgun frequencies overlap with the frequencies of greatest sensitivity for many fishes and invertebrates,²⁸ while all of the airgun frequencies interfere with marine mammal communication.²⁹ Noise from these blasts can disturb, injure, or even kill animals across the entire marine ecosystem, from the smallest zooplankton to the largest whales.³⁰ For example, airguns have even been shown to disrupt use of reefs by fish³¹ and kill off zooplankton, critical for sustaining the larger food web.³² They also have been shown to disrupt whale migrations and feeding.³³

According to an analysis of the CGG EMP Underwater Acoustics Modelling report³⁴ carried out by Machoy Mackenzie Consulting Acoustics and Wind Engineers (Machoy), *'all fish and mammals within 220m of the survey vessel and to a depth of 100m will die as a result of the survey'*. Machoy states further that *'[d]epending on the duration of the survey, there is potential to cause the deaths of many fish in the annual sardine run, to kill many whales, dolphins, seals and other mammals. Since new hatched fish will be most easily killed, the fish population as a whole will be greatly affected'* (see **Annexure B** to these comments). This impact cannot be mitigated.

²⁶ Estabrook et al 'Widespread spatial and temporal extent of anthropogenic noise across the northeastern Gulf of Mexico shelf ecosystem'. *Endangered Species Research*, 30:267-382, (2016); Guerra et al (2016) 'High-resolution analysis of seismic air gun impulses and their reverberant field as contributors to an acoustic environment'. In A.M. Popper and A. Hawkins, eds. *The Effects of Noise on Aquatic Life II*, at 371-379. New York, N.Y.: Springer.

²⁷ Nieuwkirk et al (2012) 'Sounds from Airguns and fin whales recorded in the mid-Atlantic Ocean'. 1999-2009. *Journal of the Acoustical Society of America*, 131: 1102-1112.

²⁸ Popper et al 'Acoustic detection and communication by decapod crustaceans', 187 *J Comp Physiol A* 83-89 (2001), <https://link.springer.com/article/10.1007/s003590100184>. Popper et al 'Anthropogenic Sound: Effects on the Behaviour and Physiology of Fishes', 37 *Marine Technology Society Journal* 35-40 (2003).

²⁹ Gomez et al 'A systematic review on the behavioral responses of wild marine mammals to noise: The disparity between science and policy'. *Canadian Journal of Zoology* 94: 801-819, (2016); Cerchio et al 'Seismic surveys negatively affect humpback whale singing activity off Northern Angola'. *PLoS ONE* 9(3): e86464 (2014).

³⁰ Miller et al, 'Using at-sea experiments to study the effects of airguns on the foraging behavior of sperm whales in the Gulf of Mexico', 56 *Deep Sea Research Part I: Oceanographic Research Papers* 1168-1181 (2009), <https://www.sciencedirect.com/science/article/pii/S0967063709000508>; Richardson et al 'Displacement of migrating bowhead whales by sounds from seismic surveys in shallow waters of the Beaufort Sea', 106 *The Journal of the Acoustical Society of America* 2281-2281 (1999), <https://asa.scitation.org/doi/10.1121/1.427801>; DeRuiter et al, 'First direct measurements of behavioural responses by Cuvier's beaked whales to mid-frequency active sonar', 9 *Biology Letters* 20130223 (2013), <https://royalsocietypublishing.org/doi/10.1098/rsbl.2013.0223>

³¹ Paxton et al 'Seismic survey noise disrupted fish use of a temperate reef', 78 *Marine Policy* 68-73 (2017), <https://linkinghub.elsevier.com/retrieve/pii/S0308597X16307382>

³² McCauley et al 'Widely used marine seismic survey air gun operations negatively impact zooplankton', 1 *Nat Ecol Evol* 1-8 (2017), <https://www.nature.com/articles/s41559-017-0195>

³³ Acknowledgement: this paragraph and references are sourced from Cullinan & Associates (letter to the DMRE & others dated 23 November 2021).

³⁴ CGG EMP, Appendix 4.

CGG's EMP states that *'leatherback and loggerhead turtles that occur in the offshore waters around South 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 NEMA'*.³⁵ The CGG EMP also shows that juvenile turtles migrate down the coast between February and April of each year, coinciding with the proposed timing of the 3D seismic survey. The EMP proposes no mitigation in respect of juvenile turtles.

While the CGG EMP sets out some of the key impacts of the proposed 3D seismic survey, much of the mitigation proposed fails to mitigate, alternatively fails to adequately mitigate, these impacts. See **Appendix A** for the Green Connection's further detailed submissions on some of these issues.

For the reasons set out above, the Green Connection disputes the recommendation made in the draft EMP, namely that:

All residual impacts related to normal operations, are **NEGLIBLE** to **LOW** significance with the implementation of the recommended mitigation measures. Based on the nature, duration (short-term) and extent (regional, although generally localised at any one time) of the proposed seismic survey and the findings of the specialist studies, SLR is of the opinion that there is no reason why the proposed project should not, with the implementation of the project controls and proposed mitigation measures, receive a favourable decision and the issuing of a Reconnaissance Permit.

It is submitted that the EMP is flawed in a number of respects, and does not provide an adequate basis for the Minister (or the DMRE in terms of the delegation made by the Minister) to conclude that the reconnaissance operation will not result in unacceptable ecological degradation or damage to the environment. Having regard to these flaws it is submitted that the DMRE must apply a risk averse and cautious approach and refuse the reconnaissance permit application.

E. ACOUSTIC MODELLING FLAWED

According to an analysis of the CGG EMP Underwater Acoustics Modelling report³⁶ carried out by Machoy (see **Appendix B** to these comments), the CGG EMP Underwater Acoustics Modelling report is flawed for the following reasons:

- The noise predication calculations have been done in respect of two locations on the border

³⁵ CGG EMP Appendix 5, p105.

³⁶ CGG EMP, Appendix 4.

of the seismic survey area, 200 km apart. Machoy expresses the view that the use of only two locations so far part renders the acoustic model meaningless;

- No impact prediction of the effect on fishing grounds;
- No impact prediction of effect on sea birds.
- No impact prediction of effect on crustaceans.
- No underwater mapping study.
- No prediction of noise transmission via the Sofar underwater channel; and
- The NIA is written in an obscure and confusing manner with meaningless references. It is rushed and fatally flawed.

For these reasons, the Green Connection submits that CGG EMP Underwater Acoustics Modelling report cannot serve as a reliable basis for granting a Reconnaissance Permit to CGG, and accordingly the application should be refused.

F. INFORMATION GAPS AND SCIENTIFIC UNCERTAINTY

The draft EMP indicates that specialist studies and other relevant information / assessments have been integrated into the report, and acknowledges that:

Many of the issues associated with seismic surveys are generic in nature and have been assessed based on previous seismic surgery programmes off the coast of South Africa and the Generic EMP prepared for seismic surveys in South Africa. Recommendations proposed are based on specialist input and are in line with the Generic EMP and the general principles of the Joint Nature Conservation Committee (JNCC) seismic guidelines.³⁷

The footnote indicates that the Generic EMP dates back to 1999, while the JNCC guidelines referred to were developed in 1995 by the United Kingdom's JNCC in 1995. These guidelines were the first national guidelines to be developed, and have subsequently become the basis of international mitigation measures for noise pollution during seismic surveys. However, the shortcomings in these guidelines were criticised as far back as 2009:

... relatively few aspects of these measures have a firm scientific basis or proven efficacy. Existing guidelines do not offer adequate protection to marine mammals, given the complex propagation of airgun pulses; the difficulty of monitoring in particular the smaller, cryptic, and/or deep-diving species, such as beaked whales and porpoises; limitations in monitoring requirements; lack of baseline data; and other biological and acoustical complications or unknowns. Current guidelines offer a 'common sense' approach to noise mitigation, but in light of recent research and ongoing concerns, they should be updated, with broader measures needed to ensure adequate species

³⁷ 3 CGG EMP p20.

protection and to address data gaps.³⁸

A 2015 article by Hawkins *et al* identifies a number of information gaps relating to understanding the effects of noise on fishes and invertebrates.³⁹ This study notes that the expansion of shipping and aquatic industrial activities has led to growing concerns about the effects of anthropogenic sounds on aquatic life, including sound from offshore oil exploration and production.⁴⁰ Among other things, the study makes the following relevant observations:

- There are *'very substantial gaps in our understanding of the effects of these sounds, especially for fishes and invertebrates. Currently, it is almost impossible to come to clear conclusions on the nature and level of man-made sound that have the potential to cause effects upon these animals'*.⁴¹
- While direct physiological impacts (such as mortality) of seismic impulses are likely limited to species close to seismic airgun arrays, *'research into the effects of acoustic noise exposure has examined only a fraction of fishes or invertebrates'*.⁴²
- Furthermore, *'[m]any fishes, and at least some invertebrates, depend on sound to communicate with each other, detect prey and predators, navigate from one place to another, avoid hazards, and generally respond to the world around them'*.⁴³
- While there is limited data on the effects of sound on mortality of fish, *'[t]he greater likelihood is that fishes and invertebrates will be injured by high intensity impulsive sounds with rapid rise times, and that some of these injuries could result in fatalities over the short term or over a longer term if animal fitness is compromised.... If an animal is injured it may be more susceptible to infection because of open wounds or a compromised immune system. Even if the animal is not compromised in some way, it is possible that the damage will result in lowering fitness, reducing the animal's ability to find food or make it more subject to predation'*.⁴⁴
- Concerns include how anthropogenic sound can alter the general behaviour of fish and invertebrates given that they are *'likely to show behavioural responses to sounds at much*

³⁸ Parsons *et al* 'A critique of the UK's JNCC seismic survey guidelines for minimising acoustic disturbance to marine mammals: Best practise?', Marine Pollution Bulletin 58 (2009) 643-651. Available online at: https://www.academia.edu/12955376/A_critique_of_the_UK_s_JNCC_seismic_survey_guidelines_for_minimising_acoustic_disturbance_to_marine_mammals_Best_practise?pop_sutd=false

³⁹ Hawkins *et al* 'Information gaps in understanding the effects of noise on fishes and invertebrates', Rev Fish Biol Fisheries (2015).

⁴⁰ Ibid, 39-64.

⁴¹ Ibid, p39.

⁴² Ibid, p49.

⁴³ Ibid, p52.

⁴⁴ Ibid, p54.

*greater distances from the sources than those that will result in physical injury. Changes in behaviour could have population level effects as a consequence of keeping animals away from preferred habitats, diverting them from migratory routes..., or interfering with reproductive behaviour’.*⁴⁵

- In their review of studies on the behaviour of wild fishes in response to sounds, Hawkins *et al* point out that *‘[s]uch studies have been confined to very few species and the data are often contradictory. There is a lack of information not only for immediate effects on fish that are close to a source but also on fish that are more distant’.*⁴⁶
- There *‘is a particular need to investigate the propagation of sound and vibration through the seabed, as this is especially relevant to benthic fishes and invertebrates and for exposure to.... seismic airguns’*,⁴⁷ with many fish and invertebrates sensitive to particle motion rather than sound pressure.

An assessment of the impact of seismic surveys on South African Fisheries was also conducted by Russell⁴⁸ (this report also does not appear to have been considered in the specialist studies conducted for the EIA). Russell points out that:

Seismic air gun arrays output a rather broadband low-frequency sound (i.e. not a single “tone” or “chord”, but rather a noise composed of an undifferentiated range of tones). Peak output is generally in the range of 50Hz, with a secondary peak appearing in the 150-200Hz range, and continuing decreasing peaks up to almost 1kHz. **The end result of all this is that, given the relatively extreme source levels of airgun sound, even creatures whose hearing is not centred on the lower frequencies can hear and are affected by the sound of seismic surveys.**⁴⁹ (emphasis added)

Russell goes on to point out that:

- Fish hearing via the inner ear is typically restricted to low frequencies, but that fish also receive low-frequency sound through their lateral lines to detect water movement relative to the fish. It is thought that the lateral lines functions in a variety of behavioural contexts, *‘including prey localization, predator avoidance, communication during spawning, and navigation around*

⁴⁵ Ibid, p54.

⁴⁶ Ibid, p54-56

⁴⁷ Ibid, p57.

⁴⁸ Russell, D. ‘Assessing the Impact of Seismic Surveys on South African Fisheries’ (5 April 2018). Available online at: www.rfalliance.org.za/wp-content/uploads/2018/10/Assessing-Impact-of-Seismic-Surveys-on-South-African-Fisheries-April-2018.pdf (last accessed 31 August 2021).

⁴⁹ Russell, p4.

*obstacles. The relationship between the lateral line and the auditory system of fish is not fully understood and continues to be investigated’.*⁵⁰

- Fish also respond to pressure gradients with their lateral lines and swim bladders, and have particle motion sensors. These systems are used to respond to subtle phase differences (for example to instantly join in schooling movements or to respond to disturbances caused by a food source). While all sound diminishes with distance, *‘low-frequency sounds diminish more slowly, meaning their impact can last over longer distances than those of high-frequency sounds. Energy at low frequencies can travel great distances. Thus, there can be a larger potential range of impact to organisms whose hearing is tuned to lower frequencies, or who use low frequencies to communicate’.*⁵¹
- Fish use sound to communicate, and sound may be related to reproduction and used as an escape response, while sound interception is used respond to the sounds of prey or predators: *‘It is possible that man-made sound could mask or otherwise interfere with fish communication. The consequences of interruption of communication between fishes are essentially unknown’.*⁵² Furthermore, *‘[s]tudies indicate that behavioural and physiological reactions to seismic sounds may vary between fish species (for example, according to whether they are territorial or pelagic) and also according to the seismic equipment used. Because of the complexity of marine ecosystems, and because sea species respond to sound in ways well beyond current human understanding, ongoing research is required, and a common sense precautionary approach is needed’.*⁵³
- Frequency ranges are also important, with larger whales *‘likely the most susceptible to direct impact by relatively low frequency output of airguns, since they make the most use of low frequency bands themselves’.*⁵⁴

Russell summarises the potential impacts on South African fisheries as follows, with the following negative impacts identified:

- Hake – seismic surveys appear not to impact hake long term. With hake there is temporary behavioral disruption, Namibian hake longliners saying that after a seismic vessel goes past, the hake disappears for around three days before they are able to start catching again.
- Small pelagic fishery – seismic surveys may have a significant impact, long surveys of around 6 months, and multiple survey cumulative impact particularly in 2013, may have cost the industry a lot of money.

⁵⁰ Russell, p4.

⁵¹ Russell, p5.

⁵² Russell, p5.

⁵³ Russell, p5.

⁵⁴ Russell, p5.

- West coast tuna pole and line fishery – impacts appear to be localized, disrupting fast swimming tunas migration flow by forcing them to move on. But where 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....
- Squid – serious scientific concerns about the impact of low frequency seismic sound on squid. Appears to be a drop in squid jig catches with seismic surveys.
- Rock lobster – no significant drop in catches, but need research on different life history stages, which have different levels of sensitivity to airgun sound. Findings among related species show that egg development among specific crustaceans may be retarded, metabolic rates increased and internal organs damaged following exposure to high amplitude anthropogenic sound.⁵⁵

The Green Connection submits that in light of the data and information gaps and lack of certainty, insufficient data is available to draw credible conclusions regarding the significance of seismic survey impacts on marine fauna and fisheries. Accordingly, the Green Connection submits that the proposed 3D seismic survey should not be authorised in the absence of adequate and up-to-date baseline data relating to the proposed 3D seismic survey area, and until such time as the various uncertainties relating to the significance of impacts of 3D seismic surveys on marine fauna have been clarified and information gaps filled.

G. MPAs and EBSAs

The proposed seismic survey area straddles one Marine Protected Area (MPA) and is located in relatively close proximity to several other MPAs, provides habitat or migratory routes to a number of critically endangered, endangered or threatened species, and also includes Ecologically or Biologically Significant Areas (EBSAs).

The draft EMP acknowledges several coastal MPAs and ‘other recently identified sensitive marine areas’⁵⁶ in the vicinity of the survey area of interest along the southeast coast:

⁵⁵ Russell, p6.

⁵⁶ CGG EMP Ch7, p109.



- The Tsitsikamma MPA, located 80 to 110km inshore of the area of interest;
- The Robberg MPA, located about 100km inshore and to the west of the survey area of interest;
- The Sardinia Bay MPA, located about 30 to 40km inshore of the survey area of interest;
- The Addo Elephant MPA, which is located about 50km north of the northeastern corner of the survey area of interest.⁵⁷

The EMP also indicates that the Reconnaissance Permit area and area of interest overlaps with the Kingklip Corals EBSA and the Algoa to Amatohole EBSA, while the Tsitsikamma-Robberg EBSA is

⁵⁸ CGG EMP Ch7, p112.

located inshore of the area of interest.⁵⁹

The EMP states that as *part of a regional Marine Spatial Management and Governance Programme (MARISMA) the Benguela Current Commission (BCC) and its member states have identified a number of EBSAs, including along the South and East Coasts, with the intention of implementing improved conservation and protection measures within these sites.* The EMP states further that the principal objective of these EBSAs is identification of features of higher ecological value that may require enhanced consideration and management measures, and that they ‘currently carry no legal status’.⁶⁰

It is submitted that EBSAs merit special consideration, and that adverse impacts (including acoustic impacts) on such areas and ecosystems should be avoided. Among other things, it is relevant to note that the National Environmental Management: Biodiversity Act (NEMBA)⁶¹ requires the State, in fulfilling the rights contained in section 24 of the Constitution, to manage, conserve and sustain South Africa’s biodiversity and its components and genetic resources, and to implement NEMBA to achieve the progressive realisation of those rights.⁶² Exercising powers contained in section 38 of NEMBA, the Minister responsible for environmental affairs published a National Biodiversity Framework (NPF).⁶³ The NBF indicates that its purpose is (among other things) to provide a framework for conservation and development, and that there is need to achieve economic growth in a way that allows for the continued functioning of ecosystems and persistence of the natural resource base. The NBF indicates that sustainable development depends on where and how development takes place, and states that development is not sustainable if it results in (among other things) ‘*loss and degradation of habitat in threatened ecosystems and critical biodiversity areas*’.⁶⁴ Consideration of the sustainability of a proposed activity thus requires consideration of the risk of loss or degradation in such threatened ecosystems and critical biodiversity areas.

The Green Connection submits that the presence of the Port Elizabeth Corals MPA and EBSAs within the seismic area of interest, and the relatively close proximity of coastal MPAs and other EBSAs to the proposed seismic survey area are relevant factors that have to be taken into account by the competent authority when making its decision on whether or not to grant a Reconnaissance Permit, and that it must do so in a manner that meets its duty to fulfil the rights contained in section 24 of the

⁵⁹ CGG EMP Ch7, p113.

⁶⁰ CGG EMP Ch7, p113.

⁶¹ 10 of 2004.

⁶² Section 3.

⁶³ GN 813 of 3 August 2009: National Biodiversity Framework.

⁶⁴ Section 1.1.

Constitution by managing, conserving and sustaining South Africa's biodiversity and its components and genetic resources. The Green Connection submits further that it is inappropriate to authorise 3D seismic surveys in close proximity to the Port Elizabeth Corals MPA and EBSAs, and in relatively close proximity of coastal MPAs and other EBSAs (which surveys could result in subsequent invasive exploration and production drilling activities, with additional significant risks to these areas). Accordingly, it is submitted that the Reconnaissance Permit application should be refused.

H. NEED AND DESIRABILITY

The NEMA EIA Regulations indicate that the objective of the EIA process is to (among other things) describe the need and desirability for the proposed activity in the context of the development footprint on the approved site as contemplated in the accepted scoping report,⁶⁵ and an EIA report must 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 development footprint within the approved site as contemplated in the accepted scoping report.⁶⁶

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:

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.⁶⁷ (emphasis added)

⁶⁵ NEMA EIA Regulations, Appendix 3, section 2(1)(b).

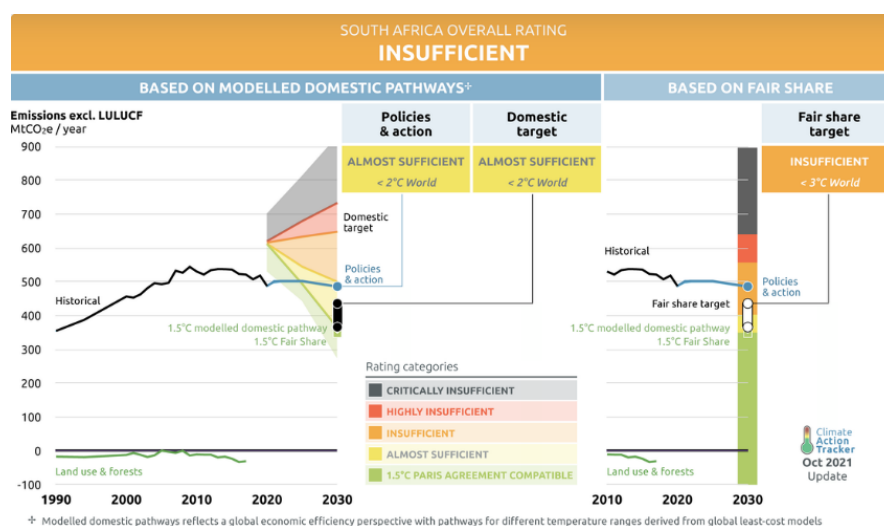
⁶⁶ NEMA EIA Regulations, Appendix 3, section 3(f).

⁶⁷ DEA (2017) *Guideline on Need and Desirability*, Department of Environmental Affairs, at p 10.

Given that reconnaissance operations are intended to identify hydrocarbons below the seabed, and which in turn would likely lead to further petroleum exploration and production operations should commercially exploitable hydrocarbon resources be discovered, the Green Connection is of the view that addressing the need and desirability within the context of ecologically sustainable development requires at the very least an initial assessment and consideration of the environmental health and safety consequences of the project, including an assessment of need and desirability, throughout its life cycle⁶⁸ (rather than ring-fencing the assessment of impacts and the consideration of need and desirability to the reprocessing of seismic data and acquisition of new seismic data).

This will necessarily entail a consideration of (among other things):

- Climate change impacts associated with future exploration, production and use of hydrocarbons discovered in the area of interest, including: its impact on South Africa's ability to meet its international responsibilities to address climate change; whether the proposed project promotes increased dependency on non-renewable hydrocarbon resources or reduces such resource dependency; and whether the exploration for and subsequent discovery of new hydrocarbon resources will impact positively or negatively on future generations of South Africans. According to Climate Action Tracker, South Africa's predicted GHG emissions exceed the upper end of South Africa's updated 2030 emissions reduction target submitted to the UNFCCC in September 2021, as illustrated below:⁶⁹



⁶⁸ Section 2(4)(e) of NEMA stipulates that responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.

⁶⁹ <https://climateactiontracker.org/countries/south-africa/> (29 October 2021 update).

The above graph indicates that further action will be needed in order for South Africa to meet its upper emissions target threshold, which target is not yet consistent with the Paris Agreement's 1.5° C temperature limit. The Green Connection submits that the government's outdated energy policy (developed prior to climate change being acknowledged as a 'climate crisis' by the UNFCCC), the implementation thereof through Operation Phakisa (which seeks to discover and commercially exploit as yet undiscovered oil and gas resources), and the promotion of oil and gas exploration and production by the DMRE and PASA, are incompatible with South Africa's international commitments to reduce GHG to between 350 and 420 MtCO₂e by 2030. It is submitted further that further oil and gas exploration and production is not needed, nor is it desirable. The State has a constitutional duty to protect the environment, for the benefit of present and future generations, through reasonable legislative and other measures that (among other things) prevent pollution and ecological degradation, including GHG pollution and ecological degradation arising from the adverse impacts of climate change. Furthermore, in accordance with a risk averse and cautious approach,⁷⁰ in the absence of information in the EMP demonstrating that the discovery and exploitation of oil and gas as a result of its 3D seismic exploration programme will not impact negatively on South Africa's GHG emission reduction targets, CGG's Reconnaissance Permit application;

- Ecological and socio-economic impacts associated with a major oil spill (such as an uncontrolled wellhead blowout) during likely future exploration well drilling and testing and/or production activities, including potential impacts on small-scale fishers and coastal communities that depend on the ocean for their livelihoods; and
- The presence of the Port Elizabeth Corals MPA and EBSAs within the seismic area of interest, and the relatively close proximity of coastal MPAs and other EBSAs to the proposed seismic survey area.

The EMP indicates that South African government policy currently supports exploration for indigenous hydrocarbon resources, and currently promotes the use of hydrocarbons as part of the energy mix up to 2030, citing the IRP2019 as the reference. The EMP goes on to acknowledge that the promotion of the oil and gas sector is not aligned with other national plans and policies, which identify the need to reduce the reliance on fossil fuels and shift to lower-carbon electricity generation options in order for South Africa to reduce its GHG emissions and meet commitments in this regard. The EMP states that notwithstanding this, the current limitation of renewable energy technologies are such that there is

⁷⁰ NEMA section 2(4)(a)(vii) stipulates that sustainable development requires the consideration of all relevant factors, including 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.

still a need (per the IRP2019) to include fossil fuels (and notably natural gas) within the energy mix of the country at least in the short- to medium-term (up to 2030) to ‘serve as a bridge’ on the path to a carbon-neutral goal (as per the Paris Agreement). The EMP claims that the proposed exploration would result in the generation of information on petroleum resources and not in the production of petroleum, and *‘[t]hus, the need and desirability does not consider the benefits, or risks, of any possible future petroleum production’*.⁷¹ The EMP also claims that while there is general consensus that the world, including South Africa, must move towards a carbon-neutral society, *‘the proposed exploration has no direct influence on South Africa’s reliance on hydrocarbons and whether consumers use more or less oil or gas’*.⁷²

The approach taken in the EMP artificially removes potentially significant life cycle impacts (in this context potential impacts associated with the exploration for and production of oil and gas resources) from consideration, notwithstanding that the proposed exploration is aimed at identifying oil and gas resources to be used in (among other things) energy production, and notwithstanding that that future exploration drilling and ultimately production activities are likely to follow.

The Green Connection submits that the EMP fails to provide an adequate description of and motivation for the need and desirability of the proposed development in the broader sustainable development context or in the context of the preferred development footprint within the proposed 3D survey area. In particular the EMP fails to address need and desirability within the broader context of the global climate emergency (and South Africa’s responsibilities to contribute towards global efforts to minimise greenhouse gas emissions), and fails to consider whether it is necessary and desirable to pursue additional oil and gas exploration having regard to significant gas discoveries made off the South Cape Coast (the Brulpadda exploration well was completed in 2018/2019, which was reported in the TEPSA draft Scoping Report as having been successful in yielding a significant gas condensate discovery⁷³). The EMP also fails to address need and desirability within the context of project’s overall intention of identify oil and gas resources (a non-renewable natural resource) which would inevitably lead to invasive well drilling and production activities should commercially exploitable oil and gas resources be identified – adding to the 200 wells that have been already been drilled on the Agulhas Bank to date.⁷⁴ Should additional oil and gas resources be identified through CGG’s 3D seismic survey, the subsequent extraction and production of oil and gas resources will, in

⁷¹ CGG EMP piii.

⁷² Ibid.

⁷³ TEPSA draft Scoping Report, p1.

⁷⁴ CGG EMP Ch7, p142

the Green Connection's view, exacerbate the increased dependency on the use of natural resources to maintain economic growth, and will in no way reduce resource dependency (i.e. de-materialised growth).

It is also relevant to note that during or about July 2021, the IEA published its *Net Zero by 2050 – A Roadmap for the Global Energy Sector* report. While South Africa is not an IEA member country, it is indicated as an IEA association country.

This report acknowledges the 'climate crisis', as well as the need for action and 'total transformation' of energy systems based on fossil fuels.

In its foreword, the Executive Director of the IEA states as follows (selected excerpts):

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...⁷⁵(emphasis added).

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'.⁷⁶

The IEA's report is a clear indication that there is no need for investment in new fossil fuel supply in its net zero pathway, and that no new oil and gas fields should be approved. This is a compelling factor that the Minister / DMRE should take into account as a relevant consideration when considering CGG's Reconnaissance Permit application which will (if new commercially exploitable oil and gas fields are identified) inevitably lead to new investment in oil and gas exploration and probable extraction and production from oil and gas fields that will require future authorisation approvals.

For the reasons set out above, the Green Connection submits that the need and desirability has not been adequately assessed, that the proposed and/or likely future exploration and production activities are not needed or desirable, and that the Reconnaissance Permit application should accordingly be refused.

I. NO GO OPTION

With regard to the 'no go alternative', the EMP again seeks to sidestep the lifecycle impacts associated with the likely future extraction and production of oil and gas that would inevitably follow the identification of commercially exploitable oil and gas reserves, asserting that the no-go alternative would result in avoidance of the impacts predicted to occur from the proposed seismic survey activities (which the EMP assesses as ranging from negligible to medium significance in the short term).⁷⁷ The EMP goes on to admit that exploration *'is an essential stage in the industries' development cycle, which might lead to the production of oil and gas resources'*.⁷⁸ The EMP states that the risks and benefits of future production development are distinct and considered separately in the South African regulatory framework, and the EMP does not include consideration of the risks or benefits of possible production, and similarly *'reasonable consideration of the No-Go alternative is limited to the exploration viewpoint'*.⁷⁹

⁷⁵ IEA Net Zero Report, p3-4.

⁷⁶ IEA Net Zero Report, p21.

⁷⁷ CGG EMP Ch 8, p229.

⁷⁸ Ibid.

⁷⁹ Ibid, p230.

The Green Connection submits that the potential positive impacts of the 'no go alternative' have not been adequately identified or assessed. Notwithstanding the subjective significance assessment conducted in the EMP (the adequacy of which Green Connection contests) which downplays the environmental impacts of seismic surveys, the proposed 3D seismic survey will cause unacceptable ecological degradation and environmental damage for the duration of the reconnaissance operation: 3D seismic surveys cause significant noise pollution, result in harm to a wide range of marine species, and ecological damage through both direct harm and behavioural disturbances that disrupt sensitive and interdependent marine ecosystems. While the MPRDA and NEMA have different permitting and authorisation stages for reconnaissance, exploration and production activities, it does not follow that reasonably foreseeable future impacts should be ignored at the reconnaissance stage.

The Green Connection submits that selecting the 'no go' option would be consistent with the NEMA sustainable development principles that emphasise the need to avoid the disturbance of ecosystems, and to prevent negative impacts on the environment and people's rights.⁸⁰ It would also ensure that marine ecosystems in the area of interest would be protected, including the interdependence of these marine ecosystems. Selection of the 'no go' option would result in the avoidance of (for example, but not limited to):

- The negative impacts associated with 3D seismic surveys (such as noise impacts on marine species and ecosystems, as well as impacts on small-scale fishers whose livelihoods would be negatively impacted should the 3D seismic survey result in reduced catches); and
- The negative consequences that would arise should commercially exploitable oil and gas resources be discovered in the area, which consequences have not been assessed (such as climate change impacts associated with extraction and production of fossil fuels identified in the 3D seismic survey, and the catastrophic environmental and ecological impacts that would result from a catastrophic, uncontrolled wellhead blowout during exploration drilling or production drilling).

The Green Connection persists with its view that the potential ecological and socio-economic risks associated with the proposed 3D seismic survey and likely future exploration drilling and petroleum production activities (having regard to the global climate emergency and the potentially devastating impacts of a catastrophic oil spill) require a proper assessment and consideration of the benefits of

⁸⁰ NEMA, s2(4)(a)(i) and (vii).

selection of the “no go option”. The draft EMP fails to do so, and as a result does not contain the information that is necessary for the competent authority to consider and come to a decision on the application. Accordingly, the Green Connection submits that the Reconnaissance Permit application should be refused.

J. FAILURE TO CONDUCT CLIMATE CHANGE ASSESSMENT

It is noted that the draft EIA report does not address climate change impacts associated with the exploration for and production of oil and gas in the area of interest (i.e. the extraction and use of GHG-emitting fossil fuels), nor does it address how climate change may impact on such exploration and production activities.

The UN Framework Convention on Climate Change enjoins State Parties to take precautionary measures to anticipate, prevent or minimize the causes of climate change.⁸¹

As a party to the UNFCCC that ratified the Kyoto Protocol and adopted the Paris Agreement, South Africa 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*’⁸² by reducing GHG emissions. 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.⁸³ South Africa revised its NDCs in 2021.⁸⁴

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

These NDCs are based on (among other things) South Africa's national GHG emissions inventory. South

⁸¹ Article 3.3. Available online at: <http://unfccc.int/resource/docs/convkp/conveng.pdf>

⁸² 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>

⁸³ Available online at: https://unfccc.int/sites/default/files/resource/cma2018_03a01E.pdf and https://unfccc.int/sites/default/files/resource/CMA2018_03a02E.pdf

⁸⁴ <https://www.dffe.gov.za/sites/default/files/docs/southafricasINDCupdated2021sept.pdf>, at p15.

Africa's energy sector is estimated at contributing about 84% percent to the country's overall GHG emissions,⁸⁵ and increased fossil fuel production will inevitably add to GHG emissions (although emissions from old coal-fired plants will be phased out).

In August 2021, the IPCC released its 6th Assessment Report (AR6).⁸⁶ In its summary for policymakers,⁸⁷ 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;⁸⁸
- 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;⁸⁹
- 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;⁹⁰
- 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 CO₂ and other greenhouse gas emissions occur in the coming decades;⁹¹
- 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;⁹²
- Continued global warming is projected to further intensify the global water cycle, including its

⁸⁵ <https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-south-africa>

⁸⁶ Climate Change 2021: The Physical Science Basis, available online at: <https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/>

⁸⁷ https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf

⁸⁸ Para A.1

⁸⁹ Para A.2

⁹⁰ Para A.3

⁹¹ Para B.1

⁹² Para B.2

variability, global monsoon precipitation and the severity of wet and dry events;⁹³

- Many changes due to past and future greenhouse gas emissions are irreversible for centuries to millennia, especially changes in the ocean, ice sheets and global sea level;⁹⁴
- From a physical science perspective, limiting human-induced global warming to a specific level requires limiting cumulative CO₂ emissions, reaching at least net zero CO₂ emissions, along with strong reductions in other GHG emissions. Strong, rapid and sustained reductions in CH₄ emissions would also limit the warming effect resulting from declining aerosol pollution and would improve air quality.⁹⁵

On 9 August 2021 the IPCC issued a press release relating to its 6th Report, which 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 greenhouse gas emissions, limiting warming to close to 1.5°C or even 2°C will be beyond reach.**⁹⁶

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*".⁹⁷ 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. The UN chief 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, Guterres stated that all nations - especially the advanced G20 economies – 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.

Having regard to the global 'Climate Emergency'⁹⁸ and South Africa's international commitment⁹⁹ to

⁹³ Para B.3

⁹⁴ Para B.5

⁹⁵ Para D.1

⁹⁶ <https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/>

⁹⁷ <https://news.un.org/en/story/2021/08/1097362>

⁹⁸ <https://www.unenvironment.org/explore-topics/climate-change/facts-about-climate-emergency>

⁹⁹ As a party to the United Nations Framework Convention on Climate Change (UNFCCC) that ratified the Kyoto Protocol and adopted the Paris Agreement.

‘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’¹⁰⁰ by reducing GHG emissions, CGG’s proposed 3D seismic survey would, if additional commercially viable offshore oil and gas resources are found and developed to production phase, inevitably add to the South Africa’s overall GHG emissions (South Africa’s energy sector currently contributes an estimated 84% percent to the country’s overall GHG emissions).¹⁰¹

The Green Connection submits that as reasonably foreseeable future impacts that may become more significant when added to the existing and reasonably foreseeable GHG impacts arising from similar offshore oil and gas exploration and production activities in South Africa’s exclusive economic zone, the impacts (including cumulative impacts¹⁰²) of such GHG emissions should have been identified in the EMP and the impact thereof assessed. CGG should not be permitted to side-step such an assessment by limiting its assessment of GHG impacts to the reconnaissance operation only. It is submitted that it is relevant for the Minister / DMRE to consider these impacts in the EMP, given that if the climate change impacts are found to be unacceptable there is no reason for CGG to be permitted to continue with the 3D seismic survey.

It is submitted further that including an assessment of the reasonably foreseeable climate change impacts of CGG’s reconnaissance operation to probable future exploration drilling and production activities would also be consistent with the NEMA environmental management principles that emphasise the need to avoid the disturbance of ecosystems, and to prevent negative impacts (including climate change impacts) on the environment and people’s rights.¹⁰³ It would also be consistent with section 2(4)(e) of NEMA, which stipulates that responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.

Such an approach would also be consistent with the approach taken by High Court in *Earthlife Africa Johannesburg v Minister of Environmental Affairs* 2017 (2) SA 519 GP, which - in relation to the issue of whether or not a climate change impact was necessary for a proposed coal-fired power station -

¹⁰⁰ 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>

¹⁰¹ <https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-south-africa>

¹⁰² ‘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.’

¹⁰³ NEMA, s2(4)(a)(i) and (vii).

stated that *'a climate change impact assessment is necessary and relevant to ensuring that the proposed coal-fired power station fits South Africa's peak, plateau and decline trajectory as outlined in the [NDC] and its commitment to build cleaner and more efficient than existing power stations'*.¹⁰⁴

Following this reasoning, the Green Connection submits that is equally necessary and relevant to ensure that proposed the reconnaissance operation (including reasonably foreseeable future exploration well drilling and oil and gas production activities) fit South Africa's peak, plateau and decline trajectory as outlined in South Africa's updated Nationally Determined Contributions (NDCs).¹⁰⁵ The State has a Constitutional duty to protect the environment, for the benefit of present and future generations, through reasonable legislative and other measures that (among other things) prevent pollution and ecological degradation, including GHG pollution and ecological degradation arising from the adverse impacts of climate change. Furthermore, in accordance with a risk averse and cautious approach,¹⁰⁶ in the absence of information in the EMP demonstrating that the discovery and exploitation of oil and gas as a result of its 3D seismic exploration programme will not impact negatively on South Africa's GHG emission reduction targets, CGG's Reconnaissance Permit application should be refused.

The Green Connection submits that the EMP should address the implications of climate change on oceans. The IPCC¹⁰⁷ has identified that coastal systems will experience climate change-related impacts due to sea level rise and associated storm swells. In addition, there is medium agreement that the Benguela system will experience changes in upwelling intensity as a result of climate change. The Green Connection submits that the EIA should therefore include a study on the potential impacts that changes in ocean currents, increased severity of storms etc. could have on future exploration and production drilling activities.

For the reasons set out above, the Green Connection submits that as a consequence of the EMP failing to address climate change impacts associated with the likely future production of oil and gas in the

¹⁰⁴ At para 90.

¹⁰⁵ It is relevant to note that in 2021 South Africa published an update of its First NDC under the Paris Agreement for public comment, informed by the Talanoa Dialogue and IPCC special report on global warming of 1.5°C above pre-industrial levels. In terms of this update, South Africa commits to reducing the upper range of its 2025 and 2030 targets by 17% and 28% respectively. Among other things, the update indicates that South Africa will be finalising its Just Transition Plan, including pathways compatible with pursuing efforts to limit temperature increase to 1.5°C. South Africa's update of its first NDC is available online at: https://www.environment.gov.za/sites/default/files/reports/draftnationallydeterminedcontributions_2021updated.pdf

¹⁰⁶ NEMA section 2(4)(a)(vii) stipulates that sustainable development requires the consideration of all relevant factors, including 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.

¹⁰⁷ https://www.ipcc.ch/site/assets/uploads/2018/02/WGIAR5-Chap22_FINAL.pdf

area of interest (i.e. the extraction and use of GHG-emitting fossil fuels) or the potential impacts of climate change on such exploration and production activities, and in the absence of information in the EMP demonstrating that the discovery and exploitation of oil and gas as a result of its 3D seismic exploration programme will not impact negatively on South Africa's GHG emission reduction targets, the EMP does not contain the information that is necessary for the competent authority to consider and come to a decision on the application. Accordingly, the Green Connection submits that Reconnaissance Permit application should be refused.

K. FAILURE TO ADEQUATELY ASSESS CUMULATIVE IMPACTS

At the time of drafting these comments, Shell were about to commence 3D seismic survey operations in the Transkei Exploration Area to the north east of the proposed CGG area of interest.

The draft EMP fails to mention this 3D seismic survey, and fails to assess the potential cumulative impacts should the proposed CGG 3D seismic survey and the Shell 3D seismic survey overlap (as is likely should Shell commence on or about 1 December 2021 as indicated, and should CGG commence its 3D seismic survey in January 2022 as anticipated¹⁰⁸).

Russell points out the following regarding cumulative impacts of seismic surveys:

Controls also need to be put in place to reduce cumulative impacts – **in recent years off the South African coast multiple surveys were occurring at the same time, creating greater pressure on South African fisheries. It is important to ensure that an intensive period of seismic surveys is limited. Particularly if there is a risk of the sound source displacing a species from an important feeding or breeding area for a prolonged period, as impacts at the population level interrupting life functions such as spawning or migration patterns, could be significant.** Norway as an example has established management actions against seismic surveys on and close to spawning grounds and over well-established migration routes to spawning grounds.

Building up in 2011 (13 months of seismic surveys), during 2012 (11 months of surveys), 2013 (29 months of surveys), and tailing off in 2014 (6 months of surveys), these were an abnormally large number of seismic surveys that occurred off the South African coast. These impacted mainly the West and South Coasts, which is where the bulk of South Africa's commercial fisheries sectors operate. **Single surveys generally seem to have limited impact, disturbing fish, and perhaps disrupting fishing for a few days, but cumulative impacts from so many surveys need assessment, and better management going forward so that they are spread to reduce negative impacts on sea life.**¹⁰⁹ (emphasis added)

It is also noted that the EMP indicates that:

¹⁰⁸ CGG EMP Exec Summary, page i.

¹⁰⁹ Russell, p6.

Oil and gas exploration and production is currently undertaken in a number of license blocks off the West, South and East coasts of South Africa. **Some 200 well have been drilled on the Agulhas Bank to date:**¹¹⁰ (emphasis added)

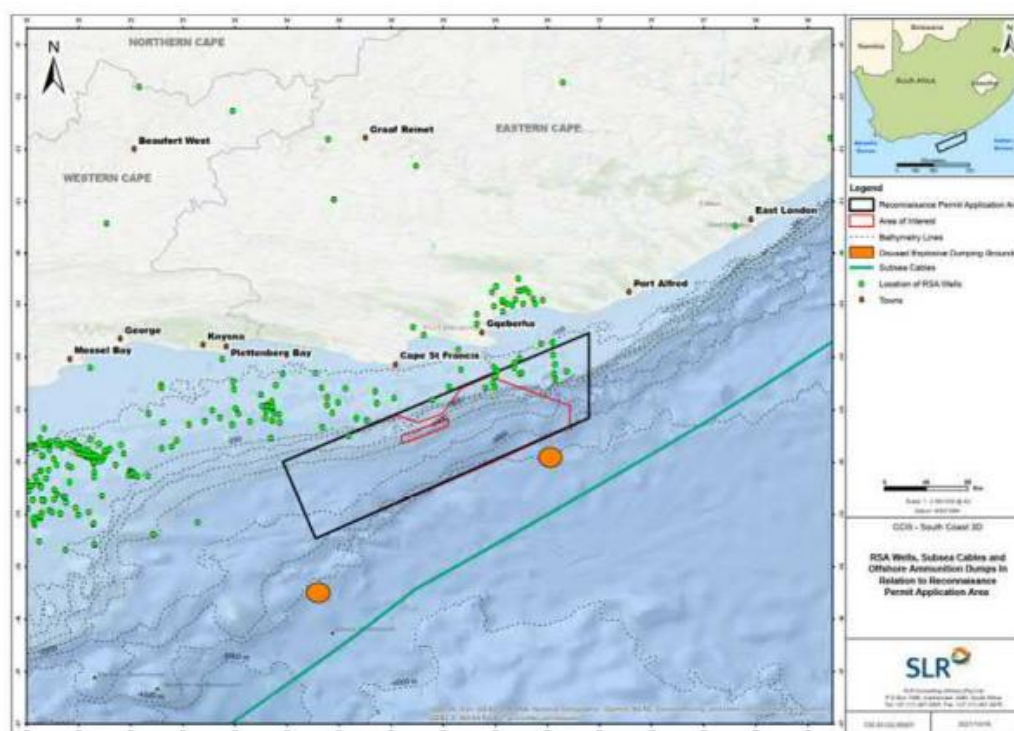


Figure 7-68: Distribution of anthropogenic marine hazards on the seafloor in relation to the proposed survey area of interest

The potential cumulative impacts of these existing exploration and production activities off the south east coast in relation to potential future exploration wells that are likely to be drilled should CGG's reconnaissance operation identify commercially exploitable oil and gas resources, have not been assessed in the EMP.

The Green Connection submits that in the absence of the EMP addressing the cumulative impacts of seismic surveys being conducted, as well as the cumulative impact of more exploration and production activities on the Agulhas Bank, the draft EMP report is flawed and does not contain the information that is necessary for the Minister / DMRE to consider and come to a decision on the application. Accordingly, the Green Connection submits that the Reconnaissance Permit application should be refused.

¹¹⁰ CGG EMP Ch 7, p142.

L. SUBMARINE INSTABILITY¹¹¹

The entire 3D seismic survey area falls within the area of the Agulhas Slump (Dingle 1997). The slump represents the largest known submarine and terrestrial slump feature on the planet and covers an area of almost 80 000km² and is situated along the east coast of South Africa, extending from Plettenberg Bay in the south to north of East London. (Figure 1.).

The post-Pliocene feature lies on two major fault zones that are known to be active, namely the Cape Fold Belt and the Agulhas marginal fracture zone. Diagnostic features of the Agulhas Slump include a wide fissured zone, a prominent glide plane scar, tensional depressions in the head region and compressional features in the distal toe region. All of these features are thought to be a result of its structural setting along a sheared continental margin (Dingle 1977).

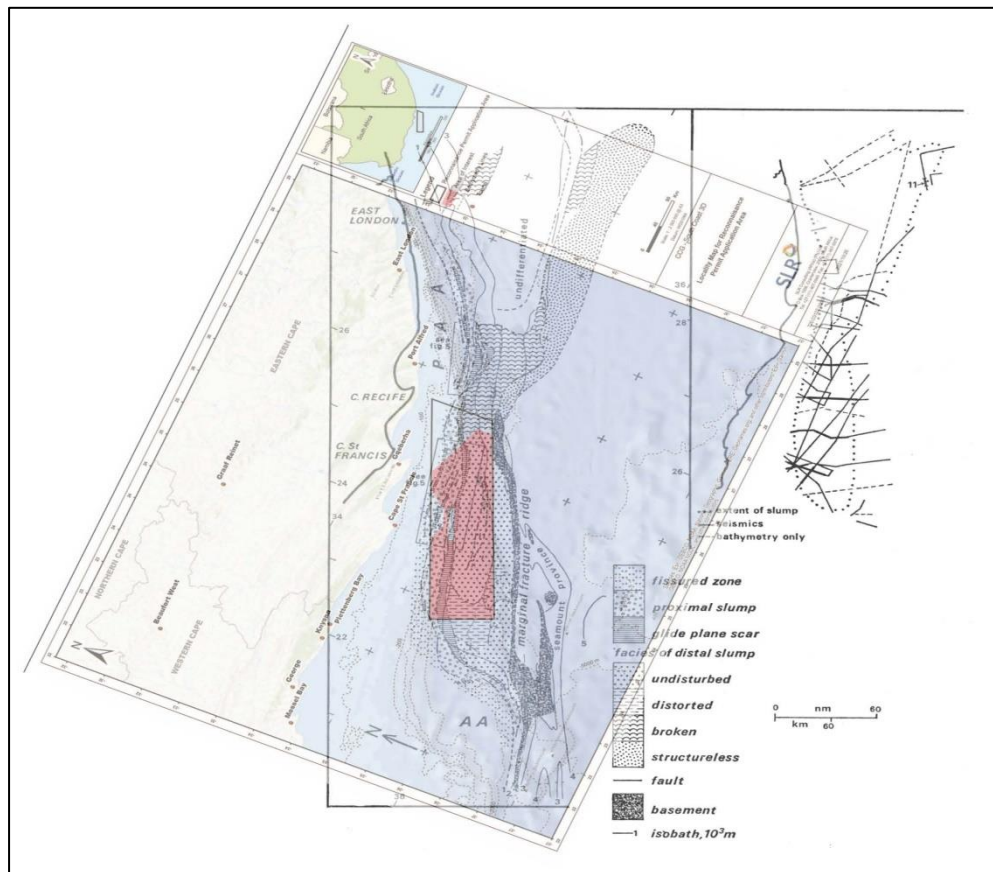


Figure 1. Overlay of proposed seismic survey area showing the extent of the Agulhas Slump

In a recent review of similar, but smaller submarine slumps in the Gulf of Mexico, Fan et.al (2020) recorded 85 landslides, of which 75 had been triggered by distant seismic activity between 2008 and

¹¹¹ Acknowledgement: Section L written by Jan Ackert Pr. Sci. Nat.

2015. Triggering was identified as being earthquakes of magnitude ranging from Mw 4.9 to 7.3 centred as much as 1000km away (Fan et.al. 2020).

In 2004 a storm initiated the huge mudslide that destroyed the Taylor Energy platform, an aging facility called MC20A. Despite years of effort and expenditure of more than \$230 million, oil is still flowing from beneath the legs of the downed platform at a magnitude estimate to be at least 100 barrels per day. This event is the longest oil spill in U.S. history (MacDonald, 2019).

It is apparent that the current application is intended to conduct a 3D seismic survey over the area and that no drilling or other means of exploration are considered. It is however, significant to note that reactivation of subterranean slumps and turbidity currents may occur due to shear failure, causing plastic strain and excessive shear induced pore fluid pressure, causing reduced material strength and landslides (Fan, 2020).

All of the mechanisms of failure described above can be induced by the proposed seismic survey, which intends blasting seismic energy into the marine sediments. The EAP, has failed to recognise the potential risk of land slides and turbidity currents to marine ecological systems and has not included any recommendations to mitigate against this risk.

M. PUBLIC PARTICIPATION

The Green Connections submits that the public participation process was inadequate to facilitate meaningful public participation for the following reasons:

- The CGG EMP and appendices are voluminous and highly technical nature, requiring expert input;
- While the application was published in various newspapers, there is no indication that other means (such as radio broadcasts, notices in communities etc.) were used to notify coastal communities and small-scale fishers living inshore of the seismic survey area of interest; and
- While the draft EMP indicates that a virtual meeting will be held with representatives of the commercial fishing sectors active off the Southeast Coast,¹¹² no provision has been made for meetings (virtual or otherwise) with other I&APs (including coastal communities and small-scale fishers living inshore of the seismic survey area of interest).

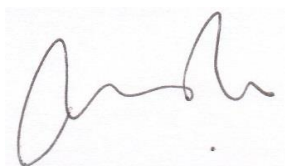
¹¹² CGG EMP para 4.4.3. p23.

The NEMA environmental management principles stipulate 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 submitted that this principle has not been adhered to.

In addition, the MPRD Regulations include provisions relating to meaningful consultation with I&APs.¹¹³ Among other things, the application must also make known the application by placement of notice in local schools, public libraries, municipal offices, and Traditional Council offices.¹¹⁴ The Regulations also stipulate that the notice inviting members of the public to submit comments must specify the date by which such comment must be submitted, 'which date may not be earlier than 30 days from the date of such notice'.¹¹⁵ A 30 day commenting period is thus the minimum commenting period anticipated.

In light of the above, it is submitted that the Reconnaissance Permit application should be refused.

Signed at Durban this 29th day of November 2021



Adrian Leonard Pole

¹¹³ Regulation 3 of GNR.527 of 23 April 2004.

¹¹⁴ Regulation 3(3)(d) of GNR.527 of 23 April 2004.

¹¹⁵ Regulation 3(4)(a) of GNR.527 of 23 April 2004.

ANNEXURE A - The Green Connection Submission



P O Box 24308

Lansdowne

7779

www.thegreenconnection.org.za

29th November 2021

Appendix A.

Comment on the speculative 3D seismic survey over a number of licence blocks in the Algoa Basin off the East Coast of South African:

Review of the CGG proposed seismic survey: Marine Faunal Assessment

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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 structures 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, fish, and turtles (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 CGG Services SAS Ltd (CGG) is proposing to undertake speculative 3D seismic survey over a number of licence blocks in the Algoa Basin off the East Coast of South African (Figure 1). SLR Consulting (South Africa) (Pty) Ltd (SLR) has been appointed by CGG to compile the Environmental Management Programme report (EMPr) to be submitted as part of the application for a Reconnaissance Permit to undertake the survey. SLR in turn has approached Pisces Environmental Services (Pty) Ltd to provide a specialist report on potential impacts of the proposed operations on marine fauna in the area. (CGG SERVICES APPENDIX 5: MARINE FAUNA)

Given the limits of time, the Green Connection has not attempted to critique all aspects of the report. The failure to review or critically comment on other aspects of the report not mentioned here should not be regarded as support for conclusions or recommendations.

Species:

Turtles:

Five species of turtles are found in South African waters. The Leatherback (*Dermochelys coriacea*) and the Loggerhead (*Caretta caretta*) turtles nest on the beaches of northern KwaZulu-Natal. The Green turtle (*Chelonia mydas*) is a non-breeding resident, while the Hawksbill (*Eretmochelys imbricata*) and Olive Ridley (*Lepidochelys olivacea*) turtles occur as strays in our waters.¹

The CGG Marine Fauna study (CGG SERVICES APPENDIX 5: MARINE FAUNA) acknowledges that concerns have been raised over the survey's impact on turtles, referring to a 2000 paper (McCauley et al 2000)pg 117.. CGG acknowledges the importance of such animals globally, and further acknowledges that the hatchlings will drift southwards in the current and could be found in the Reconnaissance Permit Area.

The CGG study quotes Hughes (1974), Tucek et al (2014), and de Wet (2013) in outlining the behaviour of juvenile turtles. A more recent paper which is not cited in the study describes how juvenile loggerhead turtles spend about 43% of their time on the surface in the day and about 29% at night (Freitas, Caldeira and Dellinger, 2019).² This study found that neonates in their first year stayed most at the surface, while juvenile turtles with straight carapace length (SCL) spent most of their time diving. This raises the question of the lack of mitigation proposed for such animals given that MMOs would not be able to spot them

CGG acknowledges that hatchlings are attracted to light, (Witherington & Bjorndal 1991; Salmon 2003) but did not refer to Wilson P et al (2018) which outlined the effect of artificial light on the dispersal of neonate turtles.³ The authors described how "Artificial light reduced their swim speed by up to 30%, increased the amount of time spent in nearshore waters (by 50 to 150%) and

¹ <https://www.marineprotectedareas.org.za/turtles>

² <https://www.sciencedirect.com/science/article/abs/pii/S0022098117306639>

³ <https://www.int-res.com/abstracts/meps/v600/p179-192/>

increased the variance in bearing (100 to 180% more variable), regardless of oceanographic conditions. Under ambient conditions, ocean currents affected the bearing of hatchlings as they left the shore, but when light was present, this effect was diminished, showing turtles actively swam against currents in their attempts to move towards light. After accounting for the effects of currents on hatchlings dispersing under ambient conditions, turtles swam offshore by moving perpendicular to the coastline and did not appear to orient into incident wave direction. Overall, light disrupted the dispersal of hatchlings, causing them to linger, become disoriented in the nearshore and expend energy swimming against ocean currents”.

Wang et al (2007) found that loggerhead turtles significantly moved towards blue, green, yellow and orange LED lightsticks. Turtles are attracted to ships lights, being impacted by fishing boats with lights at night⁴.

There is no mention of the lighting of the survey vessel and the gear it is towing with the airgun arrays. However, there is mention of ensuring that the vessels are well lit so as to not pose a hazard to fishing vessels. At night, the literature indicates turtle would become disorientated and possibly move towards the seismic survey vessels rather than avoiding them. It would also be very difficult for observers to spot the juvenile turtles and even adults that might be spending nearly a third of their time in deep dives at night.

The CGG study spends some time explaining how female loggerhead and leatherback turtles would generally remain within 300km of their nesting sites, which are 500km north of the proposed survey site. However, they do admit that both species are highly likely to be encountered in the Reconnaissance permit area.

CGG does not distinguish between juvenile and adult turtles in their proposed mitigation measures.

⁴ <file:///C:/Users/User-PC/Downloads/23308249.2018.pdf>

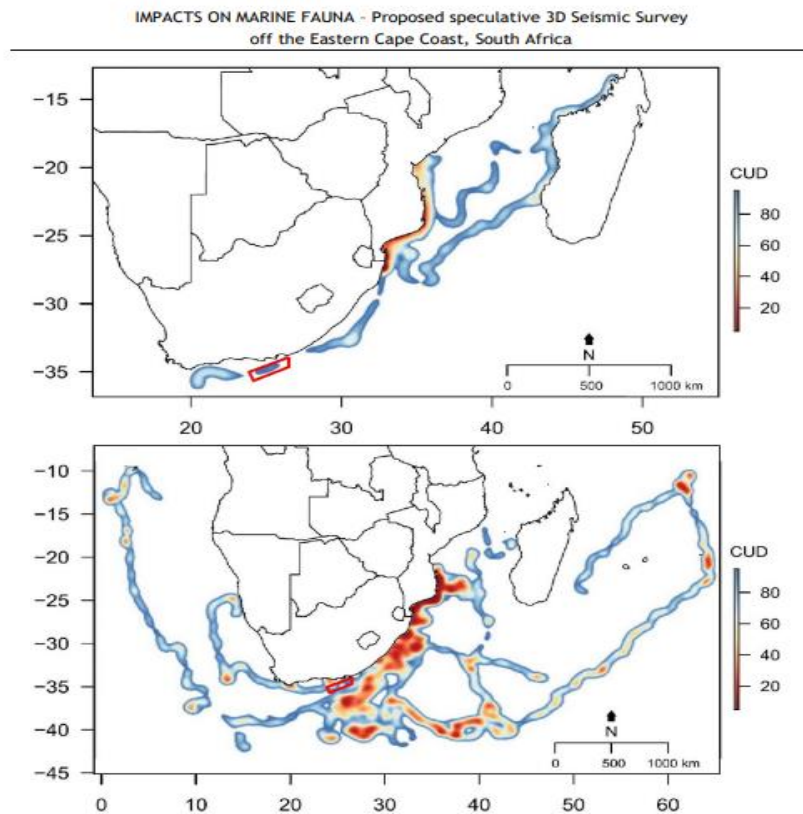


Figure 28: The Reconnaissance Permit Area (red polygon) in relation to the migration corridors of loggerhead (top) and leatherback (bottom) turtles in the south-western Indian Ocean. Intensity of shading for Cumulative Utilization Distribution (CUD): light, low use; dark, high use (adapted from Harris *et al.* 2018).

In the IUCN Red listing, the Leatherback is described as ‘Critically Endangered’, and the Loggerhead and Green turtles are ‘Endangered’ on a global scale. Leatherback Turtles are thus in the highest categories in terms of need for conservation in CITES and CMS (CGG SERVICES APPENDIX 5: MARINE FAUNA).

According to the CGG study, the sensitivity of turtles to the seismic impacts would be medium as the number of individuals encountered would be low. No references are given from which this conclusion was determined. However, CGG acknowledges that the sensitivity of hatchlings and juveniles would be high, as they are unable to actively move away from the blasting and other impacts.

According to the definition of sensitivity ratings, a very High rating is “Species, habitats or ecosystems listed as globally Endangered (EN) or Critically Endangered (CR) by IUCN, or listed as EN/CR on national or regional Red Lists”. It is not clear therefore, why the sensitivity of turtles has been rated by CGG as medium, particularly because they themselves acknowledge that the sensitivity rating on juvenile turtles would be high.

In Appendix 1 of the CGG study (APPENDIX 5: MARINE FAUNA), and assessing the impact significance on turtles the following observations are made:

The impact would be negative – the seismic survey would have an adverse impact and it would be direct given that juvenile turtles cannot swim away and are acknowledged to be impacted by sound of the frequency that the survey would use.

While the manner in determining the impact assessment appears complex and rather subjective, we offer a critique of the rating given by CGG. CGG proclaims a rating of Low to Very Low which implies natural recovery is possible and the effects will be short lived effects, thus no mitigation is required. No mitigation is recommended for the impacts on juvenile turtles despite the cumulative impact potential being High, due to the critically endangered status of these animals.

1. The impact intensity is medium to high if applied to adult and juvenile turtles respectively. Given that the turtles are critically endangered, any impact on even a few individuals should be regarded as affecting the population disproportionately. If juvenile turtles are affected, this can have a permanent impact on the survival of the population. There is insufficient evidence to demonstrate that there is no harm, so the precautionary principle should be applied.
2. Given that turtles are migratory, should juveniles be killed or disorientated to the extent that their demise affects the future of the population, this would mean that there would be fewer turtles on a global scale. Such an impact would thus be International as it would mean fewer turtles would be found in other parts of the world. The duration would be permanent as once the juvenile turtles have been killed, or their behaviour altered to affect their mortality, that is a permanent impact.
3. We would therefore rate the magnitude of the impacts as Very High. With High Sensitivity and High to Very High Magnitude, we regard the Significance rating as High.
4. The status of turtle populations requires that they need conservation support and natural recovery is unlikely. International best practice for fishing net mitigation requires turtle excluder devices, so it is clear that mitigation for seismic surveys should be required too.

The CGG study seems to rely mostly on scientific papers issued prior to 2012 and we have referred to several more recent papers in our submission. The limits of society's knowledge must also be taken into account.

In a 2018 paper, Wildermann et al, focused on the research priorities that are needed for improving our knowledge of immature turtles and identified two main themes:

- The need to understand population ecology, habitat use/behaviours;
- The applied conservation research to look at threats and management.

Immature turtle survival can have a significant effect on population growth and reproductive potential, but despite immature turtles constituting the majority of the population, it is of concern that much of the research has concentrated on adult females. For example, cumulative survival can be influenced by life stage duration, the associated stage and habitat threats (Velez-Rubia et al 2018).

Community based monitoring, for example by small scale fishers, could also add to the databases of knowledge and aid conservation management (Wildermann 2018).

There are serious concerns relating to the supposedly effective mitigation measures for minimizing harm to turtles during seismic surveys. Three studies have been published using data collected by observers on seismic vessels that were relevant to assessing whether visual methods are an effective manner of detecting turtles in order to implement real-time mitigation measures.

- Three out of eight turtles observed by Gurjão et al. (2005) were recorded at distances of 6–8 m from the ship (the distances to the others were not stated).

- Parente et al. (2006) noted that most of the 46 sea turtle sightings off Brazil occurred within 50 m of the ship and in 'calm' sea conditions.
- For 240 turtle sightings off Angola, Weir (2007) reported that detection rates were significantly higher during very calm sea conditions of Beaufort 0 or 1 and noted that visual detection was ineffective in Beaufort sea states of >1 (Nelms 2015)⁵.

In the CGG study it states that "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." These mitigation measures rely on observers spotting turtles, something that (Nelms 2015) has been shown to be ineffective. Given the results of Nelms (2015), we would argue that this is a meaningless statement, especially when the sea conditions off the South African coast are considered.

It is therefore reasonable to assume that if the mitigation measures are not effective, then there is no possible mitigation available and the activity should not be allowed to go ahead as it would result in unacceptable harm.

The CGG study refers to the indirect impacts arising from the seismic survey effects on turtles' prey, which include jellyfish and organisms eaten from inshore reefs. The study concludes that the impacts would be of low magnitude.

However, the impacts of seismicity on jellyfish are not mentioned at all in the study. Therefore it cannot be assumed that jellyfish would be unharmed and it is therefore not easy to understand how the impacts can be concluded to be of low magnitude. Lack of information might mean that the impacts are unknown but it would then be important to apply the precautionary principle in order to avoid unacceptable harm.

According to CGG study pg 107 which cited a paper from 2011, oil spills would primarily affect hatchling survival and stated that "Turtles encountered in the project area would mainly be migrating adults and vagrants".

This area could include juveniles being swept down in the agulhas current and as juvenile turtles are the majority of the turtle population, this statement appears blatantly misleading.

The consultants appear to be attempting to downplay the negative impacts of their proposed development.

Their own review shows that juvenile turtles will be migrating down the coast precisely over the months of the survey – from February to April. They have ignored this in proposing to do the seismic surveys over the exact time that critically endangered species is passing through the area.

Fish Management.

The CGG SERVICES APPENDIX 5: MARINE FAUNA highlights a number of impacts on fish populations and draws on various literature sources to show that sound would cause harm to fish, but with no discussion relating to the extent of such harm.

5

<https://reader.elsevier.com/reader/sd/pii/S0006320715301452?token=165D69C13B36141BB553133E22FA564DE5980EE59D90D38608D36883970F84C46837161F14AFD7326AD9CDFE8FD19514&originRegion=eu-west-1&originCreation=20211124195243>

Popper and Hawkins (2017)⁶ caution against using laboratory studies as a proxy for behaviour in the wild, as animals reared in captivity could be habituated to noise. For example, studies that showed certain species recovered from all apparent physical effects within ten days of exposure but this took place in the laboratory and an animal in the wild with similar injuries would have lower fitness and be more susceptible to predation and disease until recovered.

In some studies, fish could experience internal damage due to impulsive sounds. This damage appears to result from rapid oscillation of the walls of the swimbladder when stimulated by an impulsive source. In such cases, it appears that the swimbladder expands and contracts rapidly, thereby damaging the proximate organs including liver, kidney, gonads and the swimbladder itself (Halvorsen et al., 2012b; Halvorsen et al., 2012c) (cited in Popper&Hawkins 2017).

The Swedish review does not propose noise levels for flight behaviour or a temporary threshold shift (TTS) in fish because, unlike damage to internal organs, both flight behaviour and hearing damage are linked to the species' specific sensitivity to frequency and sound intensity. And using the existing literature, it is not possible to assess whether flight behaviour negatively affects the species at the population level or whether the effect is related to the area and period of time (Popper and Hawkins 2017).

Ocean noise levels have been increasing, with ambient noise levels having increased by as much as 12dB in 30 years in some parts of the ocean. All fish can hear low-frequency sounds (<500hz) and can be disturbed by sounds from human activities (Popper 2014).

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 (Wilkinson, S., and Japp, D.W., 2016). The primary fisheries in terms of highest economic value and greatest landed tonnage 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 (*Sardinop socellatus*), anchovy (*Engraulis crasiolus*) and red-eye round herring (*Etrumeus whitheadii*). Secondary species include a large assemblage of demersal fish of which monkfish (*Lophius vomerinus*), kingklip (*Genypterus capensis*) and snoek (*Thyrstites atun*) are the most commercially important. 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 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 refers to a long-standing fishery based on a large assemblage of primarily 35 different species. The fishery extends both into warm-temperate and cool-temperate biogeographical regions, but operates relatively close to shore. Within the Western Cape the predominant catch species is snoek (*Thyrstites 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 in number and includes resident reef fish (Sparidae and Serranidae), pelagic migrants (Carangidae and Scombridae) and demersal migrants (Sciaenidae and Sparidae). Crustacean fisheries comprise a trap and hoop net fishery

⁶ <https://academic.oup.com/icesjms/article/74/3/635/2739034>

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 (Wilkinson, S., and Japp, D.W., 2016) [Russel 2018].

In 2016, the Responsible Fisheries Alliance contracted William Russell to conduct a desktop study to assess the impact of seismic surveys on South African fisheries and it was concluded in April 2018⁷. It was hoped that the findings would act as a resource for strategic discussions going forward with the seismic exploration industry, government, and the fishing industry, to help mitigate against the impacts of seismic surveys. It appeared that seismic surveys have had an impact on different fisheries, for example:

- A significant impact was noted by the small pelagic fishery. Long surveys of around 6 months and the cumulative impact of multiple surveys, particularly in 2013, may have cost the industry a lot of money.
- Squid experience an impact of low frequency seismic sound which is of serious concern since there appeared to be a drop in squid jig catches with seismic surveys.
- Whilst rock lobster fishers experienced no significant drop in catches, research is required on different life history stages, which have different levels of sensitivity to airgun sounds. Findings among related species show that egg development among specific crustaceans may be retarded, metabolic rates increased and internal organs damaged following exposure to high amplitude anthropogenic sound. Similar impacts are thought to exist for the prawn trawl fishery.
- Impacts on the West Coast's tuna pole and line fishery appear to be localized, disrupting fast swimming tuna migration flow by forcing them to move on.
- Where there were cumulative impacts from repetitive surveys in the same area, as has occurred off Southern Namibia tuna fishing grounds, catches 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.

According to observations of marine fauna near seismic surveys, they often take advantage of a "sound shadow" that exists closer to the surface.

Cummings, et al 2004, (cited in Russel 2018) *As sound waves bounce off the surface of the water from below, they interfere with themselves "destructively," meaning that the high point of the direct wave combines with the low point of a reflected wave to cancel each other out (similar to the way noise-cancellation headphones work). In this case, the cancellation is far from perfect, so there is no "zone of silence," but received levels can be significantly lower near the surface, offering refuge to animals escaping dangerous or annoying sound levels below.*

⁷ <https://www.rfalliance.org.za/wp-content/uploads/2018/10/Assessing-Impact-of-Seismic-Surveys-on-South-African-Fisheries-April-2018-1.pdf>

Cumulative exposure for resident species in the demarcated area could amount to a considerable impact. Given the reefs and habitat where residential fish and other organisms live is of biodiversity significance, it should be noted that over the course of a four month survey, the following results were calculated.

Results are sobering: an area roughly 60km by 90km in size would be subject to 40,000 shots at this biologically significant level (over 300 per day on average). An area of about 150km by 120km would experience 20,000 shots, and an area of 240km by 200km would hear 1000 shots in the course of the survey (Russel 2018).

Mitigation measures could include the need to adjust the survey boundaries to protect resident species from the highly disruptive repeated exposures (Cummings et al 2004, cited in Russel 2018). It would appear that failure to adjust the survey boundaries could result in unacceptable harm.

According to Russel 2018, observations by fishers were that when seismic surveys take place, the fish leave. A study by Engas et al (1996) showed that catch reductions took place up to 18 nautical miles from the survey area. Within this area, catch reduction was 68% with reductions of 45-50% in surrounding areas, and which continued after shooting finished. Five days after the seismic survey finished, fish stocks were well below the starting point (Russel 2018).

Tuna fishers reported that during the Southern Bluefin Tuna migration which coincided with seismic surveys, poor catches were experienced. Similar reports emerge from Australia leading to speculation that migratory patterns shift due to seismic surveys (Russel 2018).

During 2013 there was a significant drop in catches, resulting in around 200,000 tonnes catch. Given that there was an intensive period of seismic surveys around that time, one asks the question whether these surveys could have reduced catches? Johan De Goede of DAFF's pelagic section made an observation that in 2013 DAFF set a healthy TAC for anchovies, but in the end only around 80,000 tonnes was caught. He said that he had heard from skippers that on their fish finding equipment, they could see the fish, but the fish were deeper than their purse seine nets could reach. In the earlier section covering fish behaviour response to seismic airgun shots, a key observed behaviour is that the fish go deeper.

In total, only around 200,000 tonnes of small pelagic fish were caught in 2013. Pierre Le Roux of Etosha Fishing Corporation in Namibia stated that during the pilchard season in 2013, there was a seismic survey close to their fishing grounds. He said there were obvious signs that the fish were being disrupted as they would be fishing and the fish would suddenly disappear and it would take three or so days before they found the fish again. Also earlier in this report, herring is described as one of the best hearing fishes, the fish's ear structure being connected to the swim bladder, which amplifies sound. Based on the above, there appears evidence that these small pelagic fish are more sensitive to seismic sound (Russel 2018).

In conclusion we would argue that there is evidence of harm and given the importance of fisheries's contribution to livelihoods, the risk of catch reductions poses risk of unacceptable harm.

The economic value of the fisheries:

In 2013 and 2015, total commercial fisheries catch was estimated at approximately R6 billion and the wholesale value of all fisheries was estimated at R8 billion. Squid accounted for about 7% of total wholesale value (Russel 2018).

While the fisheries sector contributes around 0.1% to GDP nationally, the sector contributes over 5% to Gross Provincial Domestic Product in the Western Cape (DAFF 2015). Hara et al. (2008) estimated that the Western Cape accounts for around 90% of the value of the fisheries sector, 95% of deep-sea and inshore hake catches (the most commercially valuable sector), 71% of industry employment and nearly 72% of industry income.

In terms of contribution to exports, the Western Cape accounted for 85% of South Africa's total fish exports in 2012 (WESGRO 2014) outside of the Western Cape, the only significant fishery activity occurs in the Eastern Cape (Port Elizabeth and Port St Francis) where the squid fishery is based and a small proportion of South Africa's sardine, inshore trawl and line fish catch are landed (Kaiser Associates, 2012) (Russel 2018)

Formal employment in the fisheries sector was estimated at about 9300 direct jobs in the hake sector, with squid employing about 3000 people locally (Russel 2018) (CGG Appendix 6 pg 41).

Although small-scale fisheries contribute less than 1% to South Africa's GDP, they play an important role in the provision of protein and employment – particularly in the about 136 coastal communities around the coast with over 8000 fishers supporting their families through fish related livelihoods. Globally, small-scale fisheries play a significant role in food security, poverty reduction and income generation (Béné et al 2007; Heck et al 2007; Béné et al 2010; FAO 2003). The importance of this sector is further underlined as it employs over 95% of all men and women engaged in fisheries worldwide and that, of these, more than 90% are to be found in developing countries (FAO 2009).

In Africa, it is estimated that the fishing sector provides income for over 10 million people engaged in fish production, processing and trade. And the sector contributes to the livelihoods and food security of over 200 million people on the continent (Isaacs & Hara 2015)⁸.

As far as can be ascertained, at no point is there a recognition of the value that indigenous knowledge can play in the management of fisheries and marine conservation. Observations and traditional local knowledge could be valuable additions to EMPs but it appears that in conducting their studies, the consultants failed to consider the impact of seismic surveys on the fisheries on which thousands of people depend upon and the possible means of mitigating harmful impacts. The CGG public participation report simply lists organisations that they notified when they put out the advert, there is no record of any activities which would promote public participation as per the NEMA principles.

Given that there is an existing commercial fishery industry in South Africa which provides jobs and contributes to the national economic development, and that seismic surveys could potentially reduce these livelihoods with negative consequences for families who depend on the fisheries, there would seem to be a need for the oil and gas industry to provide evidence of no harm before they are given any permission to continue. Failure to apply the precautionary principle would lead to economic hardship for the fisheries and those who depend on them.

Hamilton (2021)⁹ showed how the promises of the oil and gas industry do not deliver in terms of economic local benefits but do result in increased hardship for the affected local economies.

⁸ https://cer.org.za/wp-content/uploads/2016/08/Backing-Small-scale-Fishers_PLAAS.pdf

⁹ <https://thegreenconnection.org.za/wp-content/uploads/2021/10/Economic-impacts-of-offshore-oil-and-gas-on-South-Africa.12042021-1.pdf>

Reproduction is vital to population sustainability but can be very sensitive to stress and changes in environmental conditions. Even if yearly variations in spawning stocks are not necessarily correlated to recruitment, long-term reduction in egg production is expected to lead to a mean decrease in the population. In addition, spawning is the most clearly quantifiable investment in a specific mating and, as such, directly related to fitness. Moreover, for many fish species, the spawning period may be highly sensitive to impacts from noise, if individuals gather in dense, localized spawning aggregations. Disturbances in the spawning period may thus affect a larger fraction of the population than disturbances during other periods. Additionally, fish may be vulnerable to external stressors during spawning, because fish are often in their poorest body condition in this period.¹⁰

Spawning of the majority of species endemic to the area occurs in spring and summer. Many of these species, as well as numerous pelagic species that frequent nearshore waters are targeted by line-fishermen and form an important component of the commercial and recreational line fishery. These line fish are typically associated with shallow- and deep-water reefs inshore of the Reconnaissance Permit Area. (CGG SERVICES APPENDIX 5: MARINE FAUNA pg. 37).

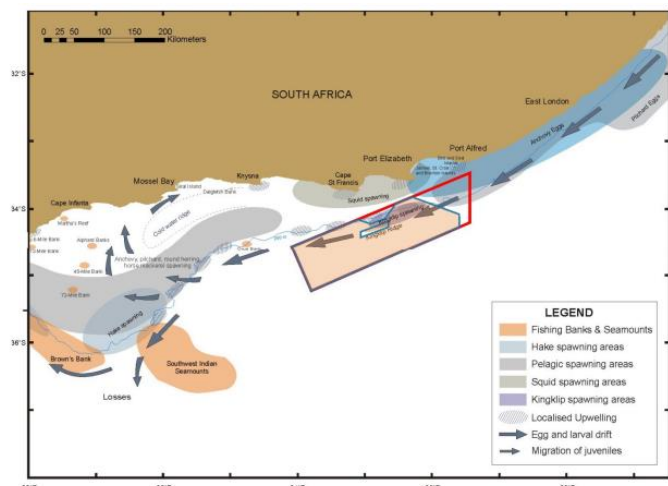


Figure 13: The Reconnaissance Permit Area (red polygon) and area of interest for 3D acquisition (orange polygon) in relation to important pelagic and demersal fish, and squid spawning areas (after Anders 1975; Crawford et al. 1987; Hutchings 1994). The 200 m depth contour is also shown.

The inshore portions of the project area thus overlap with major fish spawning and migration routes, and ichthyoplankton abundance in inshore waters over the continental shelf is likely to be seasonally high (CGG SERVICES APPENDIX 5: MARINE FAUNA pg. 21). The CGG SERVICES APPENDIX 5: MARINE FAUNA (page 32) acknowledges that anchovies spawn intensively around the 200m contour between Mossel Bay and Plettenberg Bay between October and January, whereas pilchards spawn during spring and summer on the Agulhas bank. The shift in the distributions of anchovy and sardine to the south and east during the 1990s and early 2000s was attributed to improved conditions for spawning by these species to the east of Cape Agulhas (van der Lingen et al. 2005; 2006; Roy et al. 2007; Coetzee et al. 2008).

Despite the variable nature of how fish respond behaviourally during exposure to sound from seismic surveys, there was still a core knowledge-based conviction that fish could abandon their spawning sites if exposed to seismic blasting, so the advice to protect these areas and periods was not changed.(Vereide 2021).

This report concludes that “Furthermore, noise is not the only stressor that affects reproduction, and multi-stressor approaches could provide more insight into anthropogenic effects on underwater life. Thus, future management should also focus more on the overall effects of human impact on the ecosystem, by integrating different types of pressures instead of managing them one by one”.

South Africa has an ecosystem approach to fisheries. “While the concept of an Ecosystem Approach to Fisheries (EAF) remains somewhat confusing to some stakeholders, including some scientists, the principle is very simple and is just an acknowledgement that, in order to ensure sustainable and

¹⁰ Vereide (2021) <https://www.mdpi.com/2077-1312/9/4/436/htm>

productive ecosystems and fisheries, it is essential to take into account the interactions that inevitably take place between different species and other elements making up an ecosystem, the fisheries operating in that ecosystem and other sectors impacting on it. The rationale for EAF is therefore no different to recognizing that when driving on public roads it is essential to take into account other users of those roads, be they other cars, heavy vehicles, pedestrians or wandering animals. Failure to do so is likely to lead to nasty accidents, as will failure to implement an ecosystem approach to fisheries. There is ample evidence for this conclusion in the history of modern fisheries and fisheries management”¹¹

Biodiversity and impact of seismics

The CGG study describes the Algoa to Amathole ecologically or biologically significant area (EBSA) as follows: *Complex ocean circulation occurs where the Agulhas Current leaves the coast, following the shelf break resulting in the formation of cold-water eddies, intrusions of Agulhas water onto the shelf and large offshore meanders of the Agulhas Current. Consequently, this EBSA includes spawning areas, nursery areas and key transport pathways for demersal and pelagic fish, which in turn support a myriad of top predators, including shark and seabird breeding and foraging areas. The Algoa Bay islands support the easternmost colony of Endangered African penguins and the largest colony of Cape Gannets in southern Africa. Regionally ‘Critically Endangered’ leatherback and regionally ‘Near Threatened’ loggerhead turtles migrate through the EBSA between their nesting and foraging grounds, with hatchlings of both species also passing through during their dispersal from the nesting beaches. Green turtles have also been sighted in the area. The EBSA includes 36 ecosystem types, 18 of which are threatened and a further seven that are Near Threatened. Sensitive features and species include submarine canyons, steep shelf edge, deep reefs, outer shelf and shelf edge gravels, and reef-building cold-water corals ranging in depth between 100 and 1,000 m. It also contains several key biodiversity features, including: stromatolites; sites where coelocanth are present; a ‘Critically Endangered’ localised endemic estuarine pipefish, several priority estuaries, rare ecosystem types of limited spatial extent and a few existing coastal marine protected areas.*

The CGG study further quotes Harris 2020 in which the author describes a classification of activities that are compatible with biodiversity rich areas. CGG claims that seismic surveys, as a non-destructive petroleum exploration method, are compatible with ESAs and even within certain conditions inside CBAs.

Petroleum production however is classified as incompatible in CBAs. This appears thus to be a meaningless and disingenuous classification. If oil exploration is incompatible, then there is no point in allowing the harm that might arise from pre-exploratory activities. By allowing such pre-exploration, in effect, one is opening the door to lobbying by fossil fuel interests and pushing back against the necessary conservation required to ensure ocean protection.

In our view, seismic surveys pose a risk of unacceptable environmental harm which would be exacerbated by subsequent exploration and production permits. Russel (2018) notes that the highest impact period for fisheries catches would be April, May June and therefore seismic surveys should not take place at this time.

Weak mitigation: Despite a thorough description of the spawning seasons and an acknowledgement of the harm that could be done through conducting seismic surveys, the mitigation measures for fish seem insufficient and inappropriate. Observation of obvious mass mortalities is not considered an event that stops the survey, but only “**when estimated** by the MMO to be as a direct result of the

¹¹ http://awsassets.wwf.org.za/downloads/wwf_a_decade_of_eaf_online_version_final.pdf

survey” (CGG SERVICES APPENDIX 5: MARINE FAUNA page123). This appears to be highly subjective. Surely the precautionary approach would indicate that to avoid unacceptable harm, the seismics should halt until it can be established that the fish mass mortality is not due to the seismic surveys.

The other mitigation measure also appears extremely weak.

“If **possible**, schedule the 3D survey periods from February to late May, thereby avoiding the sensitive fish spawning period in spring and early summer **to some extent**.” (CGG SERVICES APPENDIX 5: MARINE FAUNA pg. 123). Our emphasis. The qualifiers “ if possible” and to “ some extend” would not provide mitigation to avoid unacceptable harm.

There is also no acknowledgement that the climate crisis has affected the onset of seasons, so it is not easy to predict when these periods will occur.

A 2021 paper which focused on the effects of sound from seismic surveys on fish reproduction drawing from Norway provides some recommendations drawn from decades of fisheries management (Vereide 2021)¹². Scientific advice should avoid spawning areas and based on the result that several fish species moved away for a distance of at least 18 nautical miles from the blasting area, an additional 20 nautical miles (nearly 40 km) buffer zone around spawning grounds was recommended to be closed from 3D seismic surveys.

The Green Connection submits that the mitigation measures proposed for fish are totally inadequate and amount to no mitigation. Given the importance of fisheries in the local economies of the coastal communities for example, the local Eastern Cape squid fishery in terms of jobs and contribution to economic production, the seismic surveys will pose a risk of unacceptable harm.

Plankton.

Plankton form the basis of the food chain and underpin ocean productivity. Impacts of seismic surveys, if significant, would again indicate the need for a precautionary approach, given the role that plankton have in the health of the marine ecosystems.

In 2017, McCauley et al¹³ published a paper showing that seismic survey air gun operations negatively impact zooplankton. This paper was based on results conducted in the field: “ Here, the abundance of zooplankton exposed to experimental airgun signals decreased by more than 50% in comparison with the control groups, and effects were observed up to 1.2 km from the airgun source. They concluded that seismic surveys have a highly negative impact on zooplankton, particularly, small copepods. Thus, attention was created, as these organisms constitute the basis of the food web and support many of the most important fish stocks worldwide.

A further study was carried out in controlled field experiments at a depth of 6m found less mortality, and that zooplankton were only affected close to the sound (Fields et al 2019) . However, McCauley found significant mortality in the aftermath of the air gun arrays passing and Field’s (2019) experimental study showed 22% mortality but much closer to the source. Mortality continued to be observed ten days after the seismic exposure. These studies seem to indicate that there is an impact on the zooplankton which could have an impact on the fisheries production.

Given the movement of the survey vessel through the water and the fast flowing Agulhas current, it can be expected that larger volumes of water (containing zooplankton which cannot escape) will be

¹² <https://www.mdpi.com/2077-1312/9/4/436/html>

¹³ <https://www.nature.com/articles/s41559-017-0195>

exposed to the seismics. This would indicate that increased numbers of plankton would be exposed and impacted from the explosions compared to a slower moving body of water.

According to CGG SERVICES (APPENDIX 5: MARINE FAUNA pg. 129), 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 and in kingklip in the 'spawning box'.

It can be anticipated that kingklip breeding behaviour would be impacted by noise, given their "drumming" behaviour¹⁴.

30 nautical miles off the coast between Port Elizabeth and Cape St Francis Spawning time between July and Sept. A 270 km² marine protected area (MPA) was proclaimed in 2019 to protect part of the Kingklip ridge, and encompasses depths ranging from 300 m to 1000 m. The area is also recognised as an ecologically and biologically significant area (EBSA) because of its importance in the life history of a wide variety of marine species, including kingklip. The MPA protects the seabed and the reef structure of the deep corals, which provide habitat for plants and animals and probably a nursery area for young kingklip and other juvenile fish, as they offer hiding places and suitable food sources. The MPA also excludes activities like seismic surveys for oil and gas exploration and habitat-damaging fishing practices that could not only disrupt the calls and aggregations of kingklip gathering to spawn, but might also result in their injury or death. While sensitivity of marine mammals to noise is fairly well understood by scientists, the same cannot be said of fish. Their responses to sound is a growing area of research, but there have been clues in the past that kingklip could be negatively affected by the pressure waves associated with noise-related impacts. For example, an earthquake in the early 1900s on the south coast apparently resulted in many kingklip washing up on beaches, presumably due to seismic waves in the seabed causing injury or sudden changes to their surroundings. And crew working on the support vessels for oil and gas rigs on the Agulhas Bank report that 'stunned' kingklip often rise to the surface when activities with a high-acoustic signal are undertaken <https://capmarine-sa.co.za/2021/04/22/deep-sea-drumming/>

However, Norwegian fishery management guidelines for seismics indicate that while they did not include mitigation measures for plankton up until 2018, due to contradictory results and the need to base plankton and adult fish management on updated scientific advice, they now are looking at restrictions for zooplankton. The Norwegians have now embarked on a project which will continue until 2023 and will then inform their management going forward.

The Green Connection believes that a precautionary principle should be applied, and that South African needs a comprehensive scientific analysis to inform the protection of plankton to protect our fish stocks. Until that time, seismic testing should be suspended.

The minimum mitigation is to avoid spawning areas and times of spawning and migration of larvae, juveniles after spawning.

The Ecosystem approach:

The necessity to take an ecosystem approach would imply the need to avoid both the fish spawning periods as well as the juvenile turtle migrations. This would as a minimum mitigation measure mean that seismic surveys should not take place from October until May. This would also ensure that whale migration routes would also be protected.

¹⁴ <https://www.nrf.ac.za/content/deep-sea-drumming>

The effectiveness of MMOs on board has been criticized due to their reduced ability to function during the hours of darkness. Again using the precautionary approach, seismic surveys should be banned during the hours of darkness and poor visibility due to mist or rain.

The following table is drawn from Shell EMPr and shows the different aspects of the ocean ecosystem and where the sensitive times are:

Transkei and Algoa Exploration Areas Environmental Management Programme (EMPr) Final Report June 2013 www.erm.com

Table 6.4 Summary of Scheduling Interactions based on Breeding, Migration, Fishing Seasons and Weather Conditions

Species/ Activity	J	F	M	A	M	J	J	A	S	O	N	D
Juvenile turtles in Agulhas current												
Fin whale												
Blue whale												
Southern right whale												
Sei whale												
Humpback whale												
Various resident cetaceans*												
Sardine Run												
Unconducive weather conditions												

* These include Cuvier's beaked whale, pygmy sperm whales, killer whale, false killer whales, pygmy killer whales, Risso's dolphins, sperm whales and shortbeaked common dolphin which are found throughout the offshore waters of the South Coast.

The CGG SERVICES APPENDIX 5: MARINE FAUNA provides some substantive descriptions of the affected ecosystem and the potential harm that seismic surveys could cause. However, in our view, the translation of the assessment into a classification of impact and mitigation measures leaves much to be desired. Given the contradictory science at this time, the CGG SERVICES APPENDIX 5: MARINE FAUNA (pg. 131) mitigation measures are not adequate. The proposal that seismic surveys avoid January to May avoids the spawning of fish but it then directly coincides with the migration of juvenile turtles.

There is no evidence that the impacts will be short lived and will disappear when the seismic surveys stop. Lack of evidence of harm is not evidence of lack of harm.

Climate change:

CGG SERVICES APPENDIX 5: MARINE FAUNA describe under their limitations, their failure to address climate change. *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.*

This would certainly constitute a fatal flaw in our opinion.

Climate change effects on marine ecosystems include impacts on primary production, ocean temperature, species distributions, and abundance at local to global scales. These changes will significantly alter marine ecosystem structure and function with associated socio-economic impacts

on ecosystem services, marine fisheries, and fishery-dependent societies. Yet how these changes may play out among ocean basins over the 21st century remains unclear, with most projections coming from single ecosystem models that do not adequately capture the range of model uncertainty. [Andrea Bryndum-Buchholz \(2018\)](#).

Jury (2020)¹⁵ writes that Sea-level rise in past observations and future projections (Fig. A4b) both show an upward trend due to global warming, and coupled ensemble projections from the Hadley and European models indicate that the shift toward drier weather, easterly winds, coastal upwelling, and a locally faster Agulhas Current may be sustained through the 21st century (see Fig. 6c) as a local response to the poleward shift of the subtropical ridge. Cross-shelf exchange could mitigate some of these effects. Some of the environmental changes could create opportunities for resource adaptation (Jury, 2019) and spark interest in aquaculture and ecotourism.

Various authors have published on the potential impacts of climate change on fisheries, for example the sardine run change in timing (Fitchett et al, 2019)¹⁶, assessing how distribution and abundance of marine species might be affected by climate change (Ortega-cisneros et al (2018)¹⁷.

Given that climate change related shifts for example increases in ocean acidification, shifts in the Agulhas Current, could add additional stressors to marine populations, and could impact on the ability of species to recover from seismic surveys. The failure to examine this marine impact poses a risk of unacceptable harm to the environment but has not been assessed.

The CGG report makes an extraordinary statement: *The proposed project will not necessarily change how we use hydrocarbons and has no direct influence on GHG emissions that would arise from the consumption of fossil fuels*. Given that South Africa is a signatory of the Paris Agreement and has embarked on a just transition away from fossil fuels, the availability and intention to use oil and gas from under the seabed would most certainly influence our climate change footprint. Further exploitation of oil and gas from the ocean would certainly add to our carbon emissions. The predicted negative impacts from the climate crisis are projected to have a higher impact in Southern Africa. The Green Connection would argue that by pursuing oil and gas from the ocean, there is no doubt that this would exacerbate climate change, leading to increasing droughts and extreme weather events, with worsening food and water insecurity.

In terms of energy technology and climate change – the world is changing. Renewables continue to get cheaper, as do energy storage options, at an even faster rate. Coal, oil and gas are becoming more financially risky. Climate change is being taken more seriously, and country emissions will have trade consequences. South Africa (SA) is not an island – politically and economically these world trends will affect South Africa, and obviously our country is also part of a shared global climate system.

Several specific events in 2021 have elevated these world trends to new levels, and our leaders should pay attention and act accordingly, so we are not left behind. These events are: the *Net Zero by 2050* report by the International Energy Agency (IEA), the outcomes of the G7 summit and three international climate change court cases – all of which have bolstered the transition away from fossil fuels. Key outcomes of these events reinforce the need for improvements in SA energy planning and

¹⁵

Jury, M. R.: Marine climate change over the eastern Agulhas Bank of South Africa, *Ocean Sci.*, 16, 1529–1544, <https://doi.org/10.5194/os-16-1529-2020>, 2020. <https://os.copernicus.org/articles/16/1529/2020/#section4>

¹⁶ http://www.scielo.org.za/scielo.php?pid=S0038-23532019000400019&script=sci_arttext&tlng=es

¹⁷ <https://www.tandfonline.com/doi/abs/10.2989/1814232X.2018.1512526>

climate change commitments. The improvements have been called for by many voices for years but are yet to take place.

The IEA report (May 2021) makes numerous recommendations, but the most important message about a global pathway to reach net zero emissions by 2050 is that there should be massive investment in renewable energy (RE), but **no new investments in coal, oil or gas from 2021**. This validates the criticism that the SA Integrated Resource Plan (IRP) 2019 still has limits on RE while adding 1500MW of new coal. The IEA report furthermore indicates that SA must tread very carefully with gas – and by using existing system assets, storage and RE deployment – gas is not necessary in SA. Given that SA is in the process drafting a Gas Amendment Bill (July 2021), it is critical that the energy department takes stock of international trends of increasing economic risk with gas and the rise of better alternatives.

Other than gas exploration being out of line with IEA recommendations, Petro SA lost billions of Rands through Project Ikhwezi, when it tried to find more gas reserves, which turned out to be ~80% less than expected.¹⁸

Starting in the Netherlands in 2019, two more international court cases in 2021 (Germany and Belgium) have shown that **countries can be found guilty of violating human rights if climate change commitments are inadequate**. Furthermore, the recent Shell court case demonstrates that **even companies can be held responsible for climate inaction**.

Certainly from a climate change perspective, continuing with oil and gas exploration activities would contribute to unacceptable environmental harm. Given that there is no need for a seismic survey if you do not intend to proceed to exploit the oil and gas, the Green connection would argue that for climate justice reasons, this application should be refused.

Conclusion:

The Covid pandemic wrought havoc on the socio-economic fabric of society and at the end of 2021, new variants of the Covid-19 virus continue to put stress on our economy. Thousands of families rely on the ocean for their livelihoods, for food, through tourism and for sustaining mental health. Seismic surveys, we argue, are incompatible with less harmful job-creating activities on the coast.

In the last 12 months, we have seen a flurry of activity from DMRE in increasing applications for permits for seismic surveys. This gives rise to concerns of cumulative impacts of numbers of 3D seismic surveys, often over the same area or adjacent areas. In effect this means that migrating marine fauna, are potentially passing through a curtain of seismic explosions all along their migratory routes, towards their spawning or breeding areas, and potentially impacting of juvenile or larval survival.

The Green Connection therefore calls on the Minister of DFFE to **institute a ban on seismic testing** and to implement a Strategic Environmental Assessment, with input from the scientific community and focusing in addition on local and indigenous knowledge. The SEA can then inform the future of seismic surveys along the South African coast.

¹⁸ [‘PetroSA R14.5 billion impairment forensic report: Department of Energy & PetroSA Board briefing’](#), PMG, 1 Nov 2016.

References:

Many of the more recent references were sourced through a rapid literature review through peer-reviewed literature. These references are shown through the insertion of footnotes which directly link to the online source. Should that not be available, please do contact the Green Connection and we will gladly supply the reference.

Submarine Instability

- a. The entire 3D seismic survey area falls within the area of the Agulhas Slump (Dingle 1997)¹⁹. The slump represents the largest known submarine and terrestrial slump feature on the planet and covers an area of almost 80 000km² and is situated along the east coast of South Africa, extending from Plettenberg Bay in the south to north of East London. (Figure 1.).

The post-Pliocene feature lies on two major fault zones that are known to be active, namely the Cape Fold Belt and the Agulhas marginal fracture zone. Diagnostic features of the Agulhas Slump include a wide fissured zone, a prominent glide plane scar, tensional depressions in the head region and compressional features in the distal toe region. All of these features are thought to be a result of its structural setting along a sheared continental margin (Dingle 1977).

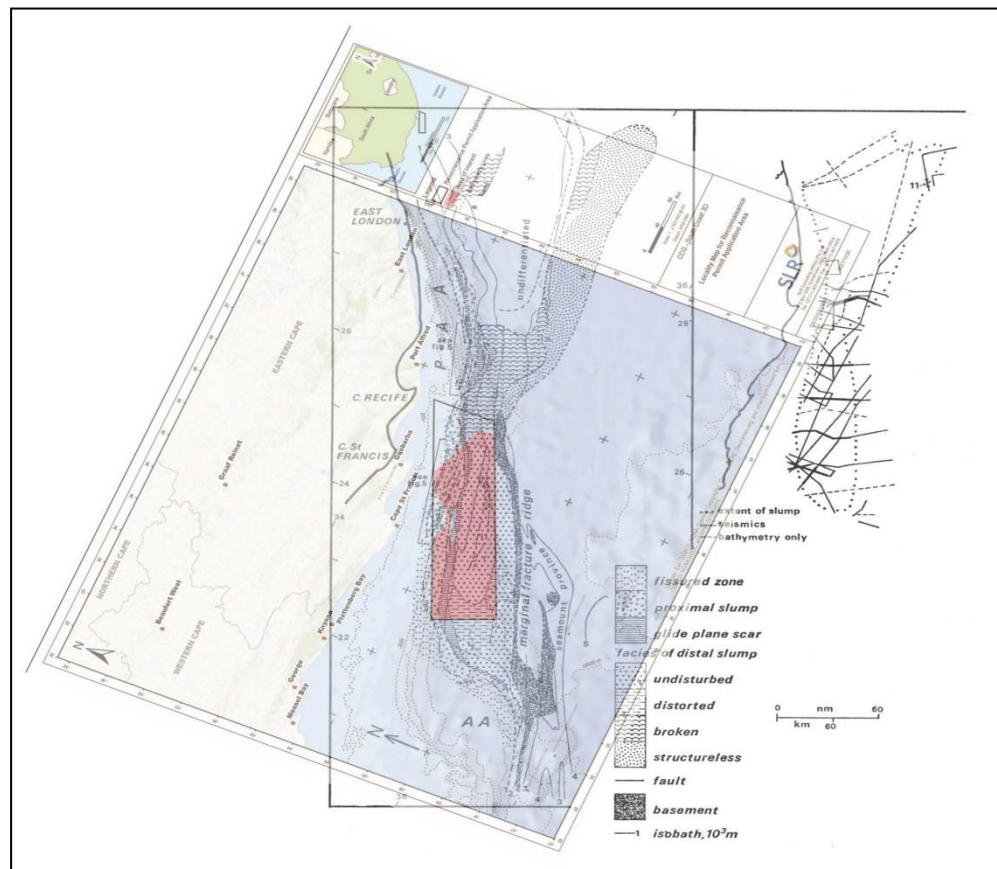


Figure 1. Overlay of proposed seismic survey area showing the extent of the Agulhas Slump

¹⁹ Dingle, R.V., 1977. The anatomy of a large scale submarine slump on a sheared continental margin. (SE Africa). *Jl geol. Soc. Lond.* Vol. 134, pp. 293-310.

- b. In a recent review of similar, but smaller submarine slumps in the Gulf of Mexico, Fan et.al (2020)²⁰ recorded 85 landslides, of which 75 had been triggered by distant seismic activity between 2008 and 2015. Triggering was identified as being earthquakes of magnitude ranging from Mw 4.9 to 7.3 centred as much as 1000km away (Fan et.al. 2020).
- c. In 2004 a storm initiated the huge mudslide that [destroyed the Taylor Energy platform](#), an aging facility called MC20A. Despite years of effort and expenditure of [more than \\$230 million](#), oil is still flowing from beneath the legs of the downed platform at a magnitude estimate to be at least 100 barrels per day. This event is the longest oil spill in U.S. history (MacDonald, 2019).²¹
- d. It is apparent that the current application is intended to conduct a 3D seismic survey over the area and that o drilling or other means of exploration are considered. It is however, significant to note that reactivation of subterranean slumps and turbidity currents may be occur due to shear failure, causing plastic strain and excessive shear induced pore fluid pressure, causing reduced material strength and landslides (Fan, 2020).

All of the mechanisms of failure described above can be induced by the proposed seismic survey, which intends blasting seismic energy into the marine sediments. **The EAP, has failed to recognise the potential risk of land slides and turbidity currents to marine ecological systems and has not included any recommendations to mitigate against this risk.**

²⁰ Fan, W., McGuire, J., & Shearer, P. M. (2020). Abundant spontaneous and dynamically triggered submarine landslides in the Gulf of Mexico. *Geophysical Research Letters*, 47, e2020GL087213. <https://doi.org/10.1029/2020GL087213>

²¹ MacDonald, I. R. (2019). Underwater mudslides are the biggest threat to offshore drilling, and energy companies aren't ready for them. *The Conversation*, March 11.

ANNEXURE B – Machoy Analysis



Mackenzie Hoy Consulting Acoustics and Wind Engineers

if you have a problem that nobody else can solve....

5 Coniston Way, Pinelands, 7405
Cape Town, South Africa

Tel: + 27 (0)21 531 4452
Cell: +27 825688924

24th November 2021
Rev 3

Dear Ms. McDaid,

Re: CGG Services SAS SLR Project No: 720.03122.00001

October 2021

**Proposed Speculative 3D Seismic Survey off the Southeast Coast of
South Africa**

1. Introduction

This document is a record of observations on matters raised in the specialist documents submitted as an environmental impact assessment (EIA) of the proposed 3D Seismic Survey off the Southeast Coast of South Africa.

2. Observations

2.1 The EIA for the project deals with the effect of the noise of the seismic survey equipment on sea life.

2.2 Specifically, it notes that:

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 cumulative PTS and TTS impact. The zones of PTS impact are predicted to range up to 800 m from the adjacent survey lines for the 24-hour survey operation scenario considered, and the zones of TTS impact are predicted to be up to 12.0 km from the adjacent survey lines. Much lower zones of cumulative PTS and TTS impact are predicted for marine mammals of other hearing groups.

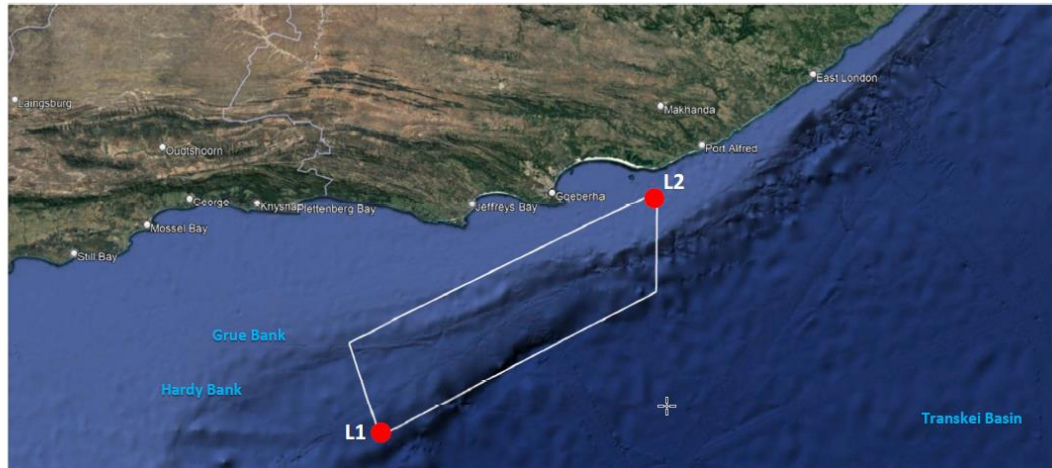
2.3 The abbreviations PTS and TTS stand for “permanent threshold shift” (i.e. injury resulting in death) and “temporary threshold shift” (i.e. injury). The report lists a table supplied by Southall et al (2019) which lists effects of noise on various mammals being seals, sea lions, whales, dolphins etc. The table is as follows:
(SPL – sound pressure level, SEL – cumulative sound exposure level)

Marine mammal hearing group	PTS and TTS threshold levels – impulsive noise events			
	Injury (PTS) onset		TTS onset	
	Pk SPL, dB re 1μPa	Weighted SEL _{24hr} , dB re 1μPa ² -S	Pk SPL, dB re 1μPa	Weighted SEL _{24hr} , dB re 1μPa ² -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

This table is often cited as listing the effects of underwater sound on the creatures listed but it is misleading; *none of the figures given has actually been measured* – they are all predictions calculated as a ratio of the volume of the swim bladder of a given mammal.

2.4 Further in the report, a noise prediction calculations have been done. The exploration area is 200 km x 50 km and model of the long range sources is at two locations, given in figure 11:

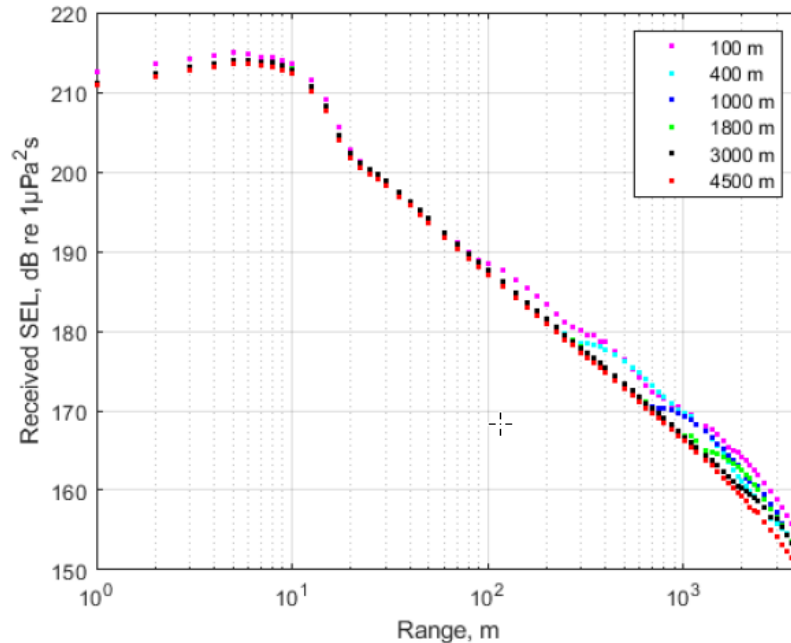
Figure 11 The selected two long range modelling source locations (L1 & L2) indicated as red dots. Permit area in white.



2.5 These locations are ~ 200 km apart. The use of only two locations so far apart renders the model meaningless. At least one location every 50 km ² would be meaningful.

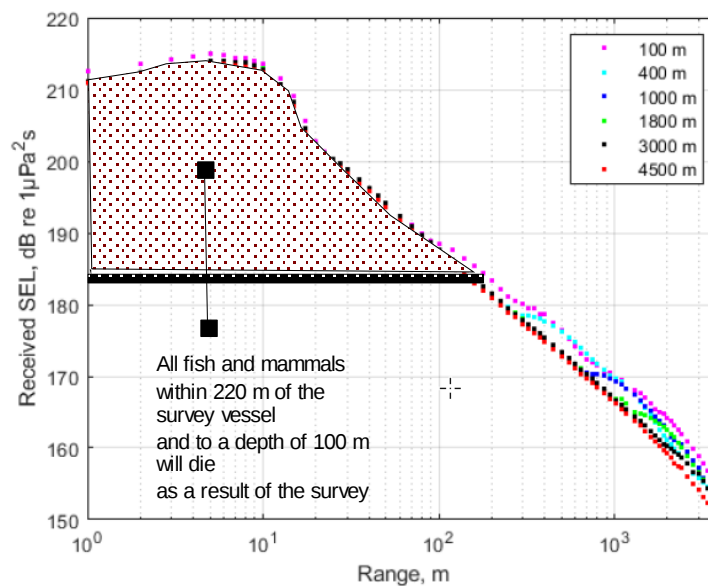
2.6 In figure 15 the maximum expected SEL from the source locations is given

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 with water depths of 100 m, 400 m, 1 000 m, 1 800 m, 3 000m, and 4500 m)



Thus, it can be concluded that

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 with water depths of 100 m, 400 m, 1 000 m, 1 800 m, 3 000m, and 4500 m)



2.7 Depending on the duration of the survey, there is potential to cause the deaths of many fish in the annual sardine run, to kill many whales, dolphins, seals and other mammals. Since new hatched fish will be most easily killed, the fish population as a whole will be greatly affected.

2.8 The study as presented is further flawed:

- a. No impact prediction of the effect on fishing grounds.
- b. No impact prediction of effect on sea birds.
- c. No impact prediction of effect on crustaceans.
- d. No underwater mapping study.
- e. No prediction of noise transmission via the Sofar underwater channel (see https://en.wikipedia.org/wiki/SOFAR_channel).
- f. The NIA is written in an obscure and confusing manner with meaningless references. It is rushed and fatally flawed.



T.E. Mackenzie Hoy Pr. Eng Bsc(Elec)

Registered professional engineer number 840428

for: Mackenzie Hoy and Associates Consulting

Acoustics Engineers