South-West Coast Scientific Group

Response by the South-West Coast Scientific Group to Otway Basin 3D Multiclient Marine Seismic Survey Environment Plan

South-West Coast Scientific Group

The South-West Coast Scientific Group of the Clean Ocean Foundation comprises three retired academics, a Marine Biologist, a Medical Academic and a Physicist. We have a combined 50 years' experience in Marine Sciences and 35 years in evaluation of research for policy development.

As they did in the community consultation, we refer to TGS through this document as shorthand for its Otway Basin 3D Multiclient Marine Seismic Survey Environment Plan.

We attended the TGS community consultation in Warrnambool and recognised that LGAs, NGOs and community organisations need independent scientific advice about information given by the company.

At ConocoPhillips' consultation in Warrnambool, the company's speaker objected to the use of the term 'seismic blast.' Nevertheless, we use that term for anything above 120dB.

We confirm that the Clean Ocean Foundation is recognised by NOPSEMA as a relevant person.

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10th August 2023

Rejection of Otway Basin 3D Multiclient Marine Seismic Survey Environment Plan

We believe that TGS's Environment Plan (EP) should be rejected on the following grounds.

1. The Australian Government is currently developing National Anthropogenic Underwater Noise Guidelines.
2. There is no need for 3D seismic surveys.
3. Biased and inaccurate assessment of the threat to zooplankton and inadequate recognition of that effect on the entire ecosystem:
    a. Zooplankton
    b. Fishes and Eels
    c. Cetaceans and Pinnipeds
    d. Birds
4. Misrepresentation of the Bonney Upwelling and its connection to the valuable feeding grounds in the Operating Area (OA).
5. Use of unrepresentative samples of the OA for assessing the presence of whales and birds. No assessment of the threat to the Short Fin Eel and its importance to Budj Bim UNESCO World Heritage site.
6. Flawed assumptions in the JASCO modelling which is used in the EP.
7. Noise Pollution: inadequate recognition that noise-induced damage is cumulative.
8. Inadequate Risk Management Planning and Risk Mitigation.
9. Inadequate community consultation in relation to:
    a. The links between TGS and Schlumberger which faces prosecution by NOPSEMA,
    b. Budj Bim UNESCO World Heritage site, and
    c. Middle Island's Little Penguin colony.
10. Conclusion.
11. References.

1. The National Anthropogenic Underwater Noise Guidelines.

The Australian Government is currently developing National Anthropogenic Underwater Noise Guidelines, which includes an update to EPBC Act Policy Statement 2.1 - Interaction between offshore seismic exploration and whales: Industry guidelines.

The Clean Ocean Foundation requests a moratorium on applications for approval of environment plans until the national guidelines have been completed.

We understand that JASCO has submitted data for consideration in formulating the plan. A review of this JASCO report by international experts may determine that the JASCO information used in this application is obsolete.

The Clean Ocean Foundation requests that the latest version of JASCO's reports provided for the Australian Government's development of National Anthropogenic Underwater Noise Guidelines be made available to us.

A moratorium would protect NOPSEMA from reputational damage if it approved applications at a lower standard than will apply next year.

2. There is no need for 3D surveys.

Judging by TGS's reliance on modelling, for instance by JASCO, previous 2D surveys could be modelled to give equivalent information to 3D surveys.

The Senate Inquiry heard that modelling the large amount of 2D data is possible. Other less destructive technologies are available for surveying but the industry will not take them up until it is required by Government.[39]

The Clean Ocean Foundation recommends NOPSEMA to reject the EP because 3D seismic testing is unnecessary.

3. Biased and inaccurate assessment of the threat to plankton and inadequate recognition of that effect on the entire ecosystem.

a. Plankton

Marine plankton are classified as phytoplankton (plants) or zooplankton (animals). Zooplankton consume phytoplankton which form the basis of marine food webs. The abundance of phytoplankton can be measured by satellite imagery of Chlorophyl-A.

Phytoplankton are eaten by zooplankton which are eaten by small marine creatures which are eaten by larger ones. This is the cycle of marine life. The OA is where baleen whales (e.g. Pygmy Blue and Southern Right Whales) eat plankton.

Zooplankton form the basis of marine food chains and in particular Antarctic Krill (*Euphausia superba*) are considered keystone species.[8] Keystone species "are only those species having a large, disproportionate effect, with respect to their biomass or abundance, on their community"[33] This means that any significant impact on keystone species has a cascading and widespread impact on the ecological community they support. While most zooplankton in the Bonney Upwelling do not fall into this strict definition, they do fall into the definition of key species because they drive ecosystem processes, energy flows, or both. Fundamentally these zooplankton form the basis and functioning of the wider Bonney Upwelling ecosystem and disturbance of these process will have knock-on effects. In the literature, there is no dispute about the overall importance of zooplankton to the marine ecosystem functioning or over the importance of krill in particular to whales as a food source.

The proposed TGS survey area is 45,000 km^2 in depths ranging from 115 to 5000m, with acquisition expected to occur from 200 to 400 days. We know that the noise associated with seismic blasting kills or seriously debilitates many zooplankton species[23,46], including killing krill larvae at least up to 1.2 km from the source of the sound. TGS disputes these data and we show why this viewpoint is biased and incorrect (Vide infra). Assuming that the mortality of krill larvae is accurate, and the survey lines are less than 1.6 km apart (stated in TGS's application), the survey has the potential to kill krill larvae across the entire survey area to a depth of at least 1.2 km. Critics of McCauley et al.[23], Richardson et al.[36] suggest that zooplankton will recover within 4 days but this assumption is based on the life cycle of small copepods living in an energetic or high current environment and misunderstands the life cycle of krill. Krill have a breeding season that lasts ~5 months. Once the eggs are fertilised they sink to depths between 100 and 2000 m. The eggs hatch and the larvae move steadily to the surface over a few months growing through four developmental stages. The adults spawn multiple times across the breeding season and reach sexual maturity at 2 years.[18] Given the length of time krill larvae spend in the areas vulnerable to seismic blasts (depths to 1.2 km), the scale of the potential mortality of larvae is immense (54,000 km^3). If even a fraction of the potential mortality of krill larvae is realised, it would have an immense impact on the populations of this keystone species. Krill only reproduce in the warmer months. Since entire year-classes of larvae would potentially be killed, the notion that they will recover in 4 days[36] is ludicrous. Their life cycle does not allow it.

The Clean Ocean Foundation wishes to see the importance of plankton, especially krill, better described in the EP.

There is an absence of knowledge regarding the impact of seismic blasts on marine zooplankton. The limited knowledge that we do have is for surface surveys. We know nothing of deeper water

impacts. The EPBC Act specifically states that lack of scientific knowledge is not a sufficient reason to allow a damaging activity to occur. The mortality of krill larvae caused by seismic blasting has been shown in shallow surface waters, but the results imply a catastrophic level of mortality to those larvae beyond our currents surveys. These observations, in their entirety, provide evidence that seismic surveys should not be permitted (in any form) in the proposed region as they destroy the food source for the Pygmy Blue Whales, seabirds, and other species. We already have evidence that the whales themselves have been losing condition over the last 20 years (Peter Gill, Personal Communication).

The Clean Ocean Foundation regards these risks to the marine fauna as reason to reject the TGS application and EP.

Richardson et al.[36] critiqued the work of McCauley et al.[23] suggesting that while the impact of the mortality on zooplankton may occur, that the recovery rates would render the problem negligible. A critical review of the report shows that the work cannot be used in a scientifically valid way to reduce the importance of McCauley et al.[23] Among the limitations of Richardson et al.'s report are:

1. The modelling is being used to argue against direct observations. This is not how modelling is used scientifically. Models cannot negate the observed real evidence; rather observed evidence is used to inform and modify modelling such that it better reflects reality.
2. The model is not a peer reviewed report and has not been published in the scientific literature. This means that it is the opinion of its three authors. Further, the report was funded by the industry's lobbying organisation, the Australian Petroleum Production and Exploration Association (APPEA), which greatly damages the report's independence and credibility.
3. The modelling was based on small zooplankton with several-day reproductive time scales from the North West Shelf, a high current region. Krill was not included. Zooplankton abundance, species composition and diversity in tropical areas are substantially different compared with those in temperate environments,[9] and the high current regimes of the North West Shelf do not apply to temperate Australian waters. Extrapolating what may or may not occur from a tropical to temperature environment tells us little about the Bonney Upwelling and the OA.
4. The authors use the CSIRO's Ocean Forecast Australia Model (OFAM) to represent the upper ocean circulation around Northern Australia in which they seed particles (representing reproducing populations of zooplankton) uniformly across a hypothetical survey site. The model assumes (in substantial error) that zooplankton populations are uniformly distributed across the ocean. They are not. This has been clearly shown[9,21].
5. The authors attempt to model the growth of populations of all zooplankton (all species combined) using a simple logistic model to estimate the population growth across time. Apart from the substantial confounding across species (i.e. the life cycle of krill species is completely different from the average copepod), the model assumes a carrying capacity which they estimate in summer from other CSIRO sources. Carrying capacity of an environment for any species or group of species is not static; it varies both across time and space. Since the carrying capacity of the system is critical to the size of the population and how much it can grow, this single estimate that drives the model is inadequate. This becomes a one-time estimate of population size potential based on an assumed uniform seeding level. These are compounding errors rendering the results largely meaningless.

6. The model uses a simplistic approach in calculating zooplankton mortality and population growth. They correctly state that natural mortality is very hard to estimate in the wild and then go on to use natural mortality estimates based on laboratory studies. To state the obvious, these are mortality rates in the laboratory, not the wild, and are meaningless in this context. Natural mortality in the wild varies by size, across space and across time (predation, availability of resources, etc.). A simplistic one-off value tells us very little about the recovery rate of an impacted population. This is a compounding error of the approach.

This study amounts to an exercise in modelling, but the approach is simplistic and does not contribute to assessing the impact of seismic blasts on the population of zooplankton in the Bonney Upwelling and the OA, nor for that matter in the NW Shelf environment. The zooplankton species are different, the baseline assumptions used in the model do not apply to the Bonney Upwelling and thus are fundamentally flawed, and there are compounding oversimplifications in the calculation methodology. The model used is essentially a steady state model. These approaches were widely used in fisheries for decades and have ultimately been discarded because they simply do not represent real-world ecological interactions or processes.

Significantly, in the final section under Model Caveats, Richardson et al.[36] acknowledge many of the above limitations in their approach and the limited usefulness of their results. They are important limitations but they only appear at the end of the document and not in the executive summary. Furthermore the initial report produced by Richardson et al.[36], on which the APPEA publication is based, explored what would happen if they "turned the current down" to something realistic for southern Australia. This model run resulted in the recovery rate for small three-day life cycle zooplankton exposed to a 3D seismic survey increasing from three days to three *weeks*. This sobering result was not presented in the APPEA paper. Furthermore, these APPEA paper results have been widely misrepresented by APPEA and the gas industry to justify seismic blast surveys.[39] This is willful misrepresentation of the available data. Finally, this report has not been published in the scientific literature. Would it survive scientific peer review by a high ranking journal as McCauley et al.[23] has? One can now add the results of an independent study of how small copepods respond to exposure from small air gun signals[46], where the results support the findings of McCauley et al.[23].

The Clean Ocean Foundation asks TGS to accurately represent the findings of McCauley et al.[23]

The Clean Ocean Foundation asks TGS to desist from quoting Richardson et al.[36] until their report has been peer-reviewed and published in the literature, and not just by APPEA/CSIRO.

The Clean Ocean Foundation asks NOPSEMA to set aside any studies funded by the industry lobby group APPEA. This is apprehended bias, which prevents unprejudiced consideration of the facts and may result in selecting one preferred outcome over another, as we have indicated above.

A second publication, the work of Fields et al.[14], has been used to counter the research of McCauley et al.[23]. This paper examines the mortality of copepods (specifically *Calanus finmarchicus*) to seismic blasts, but has absolutely no bearing on the issues with respect to the zooplankton in the Bonney Upwelling. The McCauley at al[23] study stated, quote, "The 'copepods dead' category was dominated by the smaller copepod species (*Acartia tranteri, Oithona spp.*)". These copepods

had an average size of 0.5 mm, while the Fields et al.[14] copepods *Calanus finmarchicus*, were about 2.5 mm in length or five times bigger than those in the McCauley et al. study, which actually reinforces their observation that smaller copepods were more susceptible to damage. Vereide et al.,[46] using similar size copepods as that of McCauley at al.,[23] obtained similarly higher mortality resulting from air gun signal exposure. In addition the Fields et al.[14] copepods are not a species of zooplankton present in this environment, but more significantly, McCauley et al.[23] clearly states that there is a substantial issue with krill mortality. Krill was not part of the Fields et al.[14] study.

b. Fishes and Eels

The impact of seismic surveys on fishes has not been widely addressed. Much of the work has been conducted using modelling approaches where estimates of impacts have been established based on the physical structure of various organs, the use of caged experimental studies and laboratory research. The state of the science was reviewed by Carroll et al.[10] who provided a detailed summary. Subsequent to this paper there has only been one additional study of particular note.

Table 1, taken directly from Carrol et al., examined 28 studies on adult/juvenile fishes, fish eggs, fish larvae and elasmobranchs (sharks). The red, yellow and blue highlighted parts of the table indicate possible or measured responses to seismic sounds, representing 24 of the 28 studies (86%). The green represents studies that found no impact of seismic surveys (17 of the 24 studies - 71%). The percentages do not sum to 100 because some of the studies found both positive and negative responses.

While these data are in themselves concerning when it comes to assessing the impact of seismic surveys based on a precautionary principle, there are two fundamentally significant further issues shown here. Firstly, Carroll et al.[10] failed to find, and thus refer to, any research identifying community level impacts on fishes or sharks. It is not listed on the table and none of the papers referred to address these concerns. Community impacts refer to how the fish assemblages may change with time (periods > 1 year) as a result of components of the assemblages suffering significant damage (i.e. changes in abundance of some species and/or groups of species that potentially lead to cascading ecosystem impacts). Secondly, the grey areas in the table refer to aspects of seismic survey impacts that have not been researched. **Thirty-seven of the 40 (93%)** possible categories of study that we should have some data (excluding categories unlisted) have no usable information to allow us to assess the potential impact of seismic testing on the most diverse group of vertebrates in the world. Marine fishes constitute ~14,800 of the ~33,000 species of fish with another ~900 elasmobranchs (almost entirely marine). It is estimated that there are approximately 45,000 vertebrates.

The proponents of the seismic survey intended in the Bonney Upwelling region use the results of Meekan et. al.[26] to suggest that seismic surveys do not impact fishes. It is worth pointing out that this paper certainly attempts to address community level impacts of seismic surveys on the North-West Shelf of Australia. These authors found no impact of the process on the community structure of benthic (bottom dwelling) fishes using techniques of baited underwater videos and tagged fishes, although the study made no attempt to look for small scale physiological impacts on any fish. Points to note from this paper; reviews have described it as intriguing and worthy of further research. Nevertheless, the study used what are termed BRUVS to collect abundance data of fishes. These are baited underwater camera systems used to attract fish and are intrinsically

biased (there are reviews demonstrating this in the scientific literature: unknown fishing selectivity).[48] This means that the results are not definitive and require further work. Further, the study examined impacts over 8 months and in waters less than 80m in depth. Eight months does not constitute a sufficient time scale to fully assess community level impacts as it does not represent seasonal variability, interannual variability, or recruitment cycle (recruitment defined as the size at which fishes become susceptible to the fishing gear used) for many of these species. Furthermore, the study was conducted in waters less than 80m in depth whereas the proposed seismic survey region in the Bonney Upwelling is off the shelf break and is thus well in excess of 150m, resulting in different benthic community assemblages. This tropical study cannot form the basis for the determination of ecosystem impacts on the temperate south coast of Australia and has no validity in justifying seismic surveys in these environments.

Based on Carroll et al.[10], and an understanding of the diversity of marine fishes and sharks, seismic surveys are proceeding in an **information vacuum**. Attempts to use data gathered from the North West Shelf (a tropical ecosystem) and apply them to the Bonney Upwelling region (a temperate ecosystem) are scientifically flawed. The Precautionary Principle should be applied to the environmental impact.

The Clean Ocean Foundation proposes that in our current state of limited knowledge, the Precautionary Principle should be applied.

The Clean Ocean Foundation asks NOPSEMA to set aside any studies conducted by members of APPEA, i.e. The Australian Institute of Marine Sciences who were the first, last and seven of twelve authors[26]. This is again apprehended bias, which prevents unprejudiced consideration of the facts and may result in selecting one preferred outcome over another, as we have indicated above.

The proponents of seismic surveys have argued that these process have been widely conducted in southeast Australia over many years and that there has been no scientific evidence suggesting that any negative effects have occurred. Based on the work of Carroll et al.[10], the most obvious reason for no evidence that negative impacts have been found is because no studies have been conducted that specifically look for them. Moreover, there is anecdotal evidence from commercial fisheries which confirms negative impacts that seismic surveys have on fishes.[13,27,42]

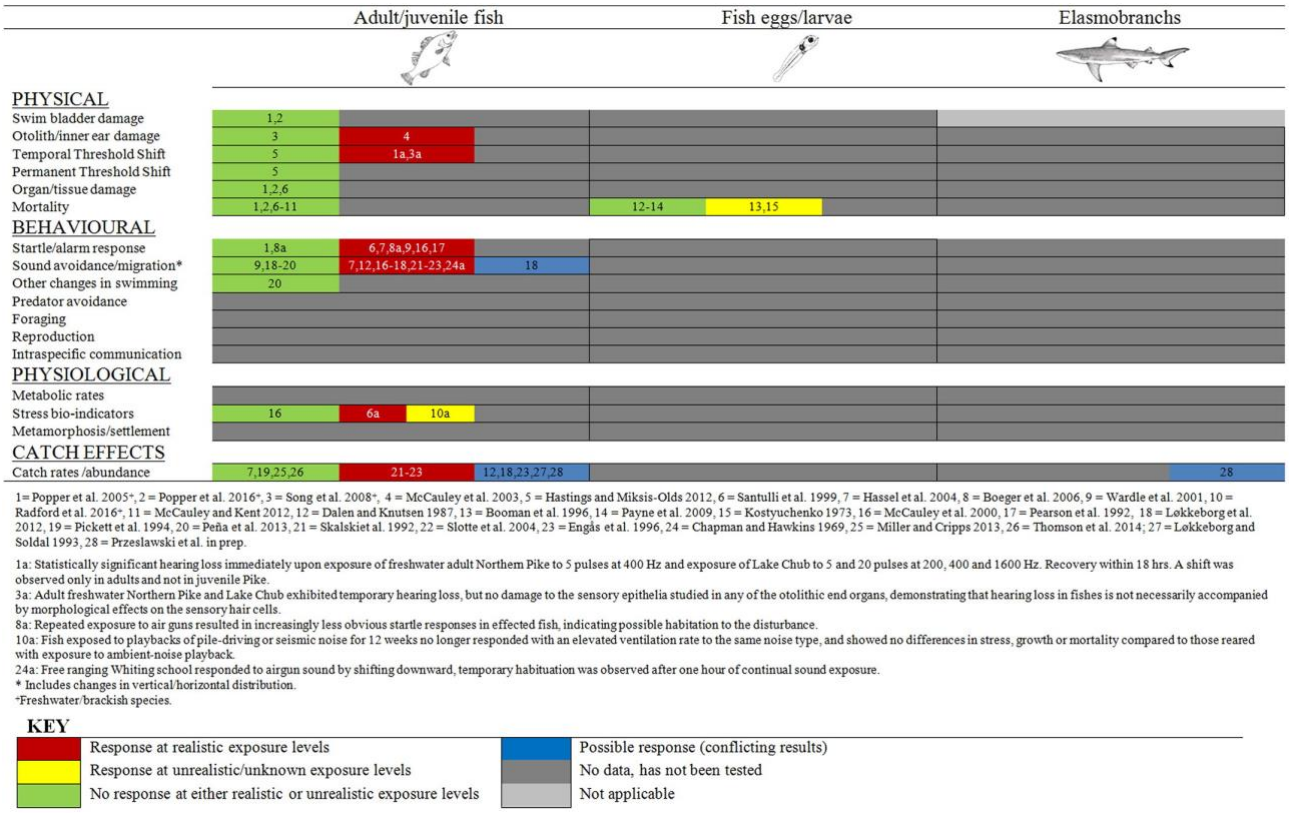

Table from Carroll et al. (2017)[10].

Damaging impact of seismic blasting on short fin eels.

Short fin eels have an immense cultural value for the indigenous peoples of South-West Victoria, forming the basis of a UNESCO World Heritage site at Budj Bim. Their cultural connection to the land and the eels stretches back 40 to 60 thousand years which Australia has global responsibilities to protect.

The Clean Ocean Foundation asks why Budj Bim is not included in the World Heritage sites listed in the application?

The Clean Ocean Foundation asks who at Budj Bim has been consulted and what information was given to them?

The Clean Ocean Foundation asks why the threat to eels from seismic surveys has not been mentioned in the TGS application?

Eels have a unique life cycle with adults migrating to the ocean in spring and migrating from South-Western Victoria all the way to the Coral Sea to their spawning grounds. Those that survive this long and arduous journey reproduce in the deeper waters and then die – they only reproduce once in their lifetime. This means that reproducing animals do not get a second chance and anything that reduces the number of eels reaching their spawning grounds has a negative impact on the numbers of offspring. The spawned eggs hatch into larvae and these then use the currents to drift back down the Australian east coast and migrate back to the rivers from where their parents came.

It is well known that seismic blasts kill fish. We also know that these surveys change the behaviour of fish: they can disorientate them and they can make them more vulnerable to predators, and other adverse impacts. Specific information about seismic blasts relating to short fin eels is absent but the effects on other kinds of eel are damaging.[1,34,38,40] We have no reason to believe that short fin eels are any different.

Eels are vulnerable throughout their life cycle. Adult eels have a single opportunity to successfully reproduce. They are already under significant pressure from climate change, impacts on the land that pollute their rivers, and water extraction. Larval eels return on ocean currents to South-West Victoria as part of the zooplankton. These currents pass through the OA.

Studies have shown that seismic blast surveys kill about 64% of zooplankton out to at least 1.2 km[23] from the sound source and so larval eels are almost certainly killed by these activities. Adding an additional pressure to these already vulnerable animals is irresponsible and a breach of our duty to protect World Heritage sites and cultural traditions that may be 60,000 years old and ignores consultation with Indigenous groups who venerate the importance of eels to their society.

We accept that there are multiple impacts that are harming the number of eels returning to South-West Victoria. However, we have control over whether or not there are seismic blast surveys in the Otway Basin. As we have every reason to believe that these seismic blasts are damaging the eels stocks through disruptions to their migration patterns, we have a social and legal responsibility to protect these vulnerable animals from known damaging activities like seismic blast surveys.

The Clean Ocean Foundation asks NOPSEMA to reject the TGS application because the threat to eels has not been declared or discussed with Indigenous groups, nor has the threat to the UNESCO World Heritage Budj Bim site been considered.

c. Cetaceans and Pinnipeds

In this section we focus on groups of animals (other than fishes) that are prevalent in the Bonney Upwelling system. These feed on a variety of invertebrates and small fishes and are considered the most vulnerable of the species in the region, for example Pygmy Blue Whales.[29]

As detailed elsewhere, seismic surveys are in fact explosions and have a well-documented history alluding to their impact on marine mammals. As far back as Aubrey et al.[7], who reported on the use of "seal bombs" with sound exposure levels of 190dB re 1 μPa^2-s at 1 m to deter seals from impacting commercial fish catches. 190dB is two orders of magnitude less than the ~230dB associated with seismic blasts (the distance that these sounds travel is well documented: see McCauley et al.[23]).

Potential impacts of noise include interruption of essential behaviours[50], masking signals of interest (e.g., the sounds of predators, conspecifics or prey)[19], displacement from crucial habitat[11], direct physical injury including temporary or permanent hearing loss[16,22], and in extreme cases, death[15].

NOPSEMA is well aware of the issues associated with seismic surveys.[2,3] A common thread with the environmental plans approved by NOPSEMA is the acceptance of the use of literature and hydro-acoustic modelling to form the basis of determining the degree of impact of seismic survey activity on this group of animals (and others). We find no reference to requirements that

the organisations proposing seismic surveys do anything further to determine the potential damage. The two examples provided stipulate a 10-km buffer (around the seismic source) for the protection of whales (Southern Right, Pygmy Blue) and primarily by association pinnipeds and birds.

NOPSEMA's responses states "NOPSEMA required the titleholder put in place effective whale detection and control measures to demonstrate that blue whales would not be injured or displaced from foraging in BIAs. In response, the titleholder included a 10-km observation zone that applied to the foraging BIA and a 10-km buffer; 10-day interval aerial surveys; the use of passive acoustic monitoring; and trained marine fauna observers / PAM operators to implement a shutdown of the seismic array should a blue whale be detected entering the shutdown zone of an active seismic source" (https://docs.nopsema.gov.au/A702829) with respect to blue whales.

We presume that the 10-km range comes from a 3-km visual search distance from the survey vessel (onboard observers) and 10 km from 10 day interval aerial searches for whales. Both of these requirements are inadequate based on simple calculations of blue whale cruising speeds and dive durations. With respect to the 3-km visual searching for whales, the dive duration of such whales is variable, typically of the order from a few up to fifteen minutes, depending on what the whales are doing. Owen et al.,[31] and Davenport et al.[12] used a single Pygmy Blue Whale tagged with a high resolution tag attached for seven days to give an average dive time of 7.6 minutes and maximum of 17.5 minutes. Thus in a single dive, these whales can move ~1.3 km in 7.6 minutes or 2.9 km at their maximum dive time (while cruising) and substantially farther at higher speeds. This suggests a whale can easily move from visible range to beyond without being detected. The point here is that from simple observations of the behaviour of blue whales[31], the requirements of seismic survey shutdown specified by NOPSEMA to prevent harm to whales in the Bonny Upwelling cannot be achieved at all either by onboard observers or aerial surveys. This argument is equally applicable to southern right whales (dive time < 33 min)[6]; maximum speed ~ 17km/hr[4]; and Australian fur seals (dive time 6 min, cruise speed 9 km/hr[5]).

With the information provided in the previous paragraph, we note that the Federal EPBC Act states with respect to Pygmy Blue Whales that "The risk of physical impacts is minimised by implementation of the practical measures outlined in the EPBC Act Policy Statement 2.1 – interaction between offshore seismic exploration and whales. While the seismic guidelines advise that seismic surveys should be undertaken outside of biologically important areas at biologically important times". It further states that "it is not known at what distance from a seismic source, behavioural impacts may occur or the extent of any behavioural impact".

Based on the requirements of the EPBC Act, it is incumbent upon the proponents of the seismic surveys to have an understanding of the range impacts of their surveys on the whales. The 10-km range has no basis in the scientific literature and is easily debunked by simple whale cruising speed and diving behaviour calculations. It appears to be based on the modelling criteria of sound propagation in waters from sound propagation models and has no replicated and published scientific literature to support it.

The Clean Ocean Foundation asks that TGS justifies the use of 10 kilometres as the safe range.

Further, "Under the EPBC Act, environment assessments are undertaken to support environmental and heritage protection and biodiversity conservation. A person must not take an

action that has, will have or is likely to have a significant impact on any of the matters of environmental significance without approval from the Commonwealth Minister for the Environment. An action is a project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things". The actions and activities of NOPSEMA and the proponents of such activities with respect to seismic surveys, at face value, are a breach of the obligations under the EPBC Act.

The Clean Ocean Foundation asks that TGS complies with the EPBC Act.

We observe that Action Area A.2 of the Blue Whale Conservation Management Plan states "Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury, and is not displaced from a foraging area". This requirement is in place regardless of activity type (migration, foraging, breeding), behaviour (nursing, singing, resting, etc.), time of year, and time frame of use. There is some evidence that blue whales feed year round[28]. Blue whales must be able to use Biologically Important Areas without injury.

The Clean Ocean Foundation contends that the EP is inconsistent with the Blue Whale Conservation Management Plan and we respectfully request NOPSEMA to not accept the EP.

In addition to the above, we can demonstrate from the scientific literature that the impact of seismic surveys, regardless of the modelled sound levels, propagation or received sounds by whales, has impacts well beyond the specified 10 km range.

In 2019, Kavanagh et al.[20] published a paper in Nature (across large spatial scales and multiple species) showing negative impacts on both baleen and toothed whales. They modelled data from whales observation (> 8,000 hours) covering an area of more than 880,000 km^2 finding a significant negative impact of seismic activity across species and habitats. Their results found an 88% (82–92%) decrease in sightings of baleen whales, and a 53% (41–63%) decrease in sightings of toothed whales as a result of seismic surveys (compared with control surveys). Weilgart[47] presented a conference paper to the "CBD Expert Workshop on Underwater Noise and its Impacts on Marine and Coastal Biodiversity" that lists a wide variety of impacts of seismic noise on marine mammals. Among many salient issues raised (with associated reference to the scientific literature) are the observations of Richardson et al.[37] who state that there were changes to dive durations and breathing patterns in bowhead whales up to 54–73 km from seismic surveys at received levels that could be **as low as 125 dB re 1μPa**.

These examples demonstrate significant issues with impacts of seismic survey noises on cetaceans. Again, we are presented with the counter argument that seismic surveys have been in operation in the Bonney Upwelling regions for decades and there does not appear to be an effect. We respond with the same statement as above that few resources have been provided to actually assess the impact, hence no observations have been made. The level of impact on cetaceans and other species in the area is assessed based on hydro-acoustic modelling methods rather than on the direct measurement of the impact of the animals in question. Modelling does not inform the debate, only replicated experimental studies with the animals in question. If TGS believes that its surveys have not had an impact on the marine environment, it should fund independent baseline and follow-up surveys of the OA.

The Clean Ocean Foundation requests a response from TGS about how it will accommodate the information about whale movements and speed, and safe distance from seismic blasts.

We have focussed on the whales here, but this does not lessen the significance of other species present in the ecosystem. The whales represent the species with the widest and quickest movement capability. What about the species with less mobility (e.g. benthic fauna)? We would expect these to be protected with a more stringent strategy (EPBC Act) established to consider the whales.

d. Birds: Seabirds and Migratory Shore Birds.

Seabirds highlight the interdependence in the ecosystem, starting with krill. Some seabirds such as shearwaters and petrels, prey directly on krill. Others, such as gannets, terns and albatross, as well as tuna, prey on bait fish that may have fed on krill.

There is only one published scientific study of the effect of seismic surveys on birds which was carried out on the African Penguins.[32]

On page 170, the application refers to Reid et al., 2002, but it does not appear in the Reference List. We assume the reference is:

Reid, T.A; Hindell, M. A.; Eades, D.W.; and Newman, M. 2002. Seabird Atlas of South-eastern Australian Waters. Birds Australia Monograph 4. Birds Australia, Melbourne.[35]

A more detailed source of vulnerable and endangered birds in the OA is Cornell University's database called eBird[43] which is a compilation of citizen scientist birdwatchers' records. For recent data on seasonal presence and relative abundance of seabirds around the OA, the following link is relevant. Port Fairy Pelagic, Lady Julia Percy Island, VIC, AU - eBird Hotspot

Tables 31, 32 and 33 of the EP lists the species present in the OA. Most are categorised as threatened or endangered. The plankton-rich OA is an important feeding area as maps in the Seabird Atlas show, as do images of chlorophyll A (Figure 1, below).

On page 27 of the Wildlife Conservation Plan for Seabirds 2022, it states "Proposals for oil and mineral exploration and exploitation should be adequately assessed, and as appropriate, conditions imposed to ensure there are no adverse effects on seabirds or their habitats."[49]

Some measure of the importance of the OA for local birds like the Sooty Shearwaters breeding on Griffith Island, Port Fairy, and the distant ones can be inferred from the presence of the Campbell Island Albatross. It only breeds on Campbell Island group, New Zealand's furthest south sub-Antarctic Island at 52.54°S, 169.14°E.

The Clean Ocean Foundation believes that seismic surveys in the OA imperil large populations of vulnerable, threatened and endangered birds, and that TGS has not assessed the risks accurately.

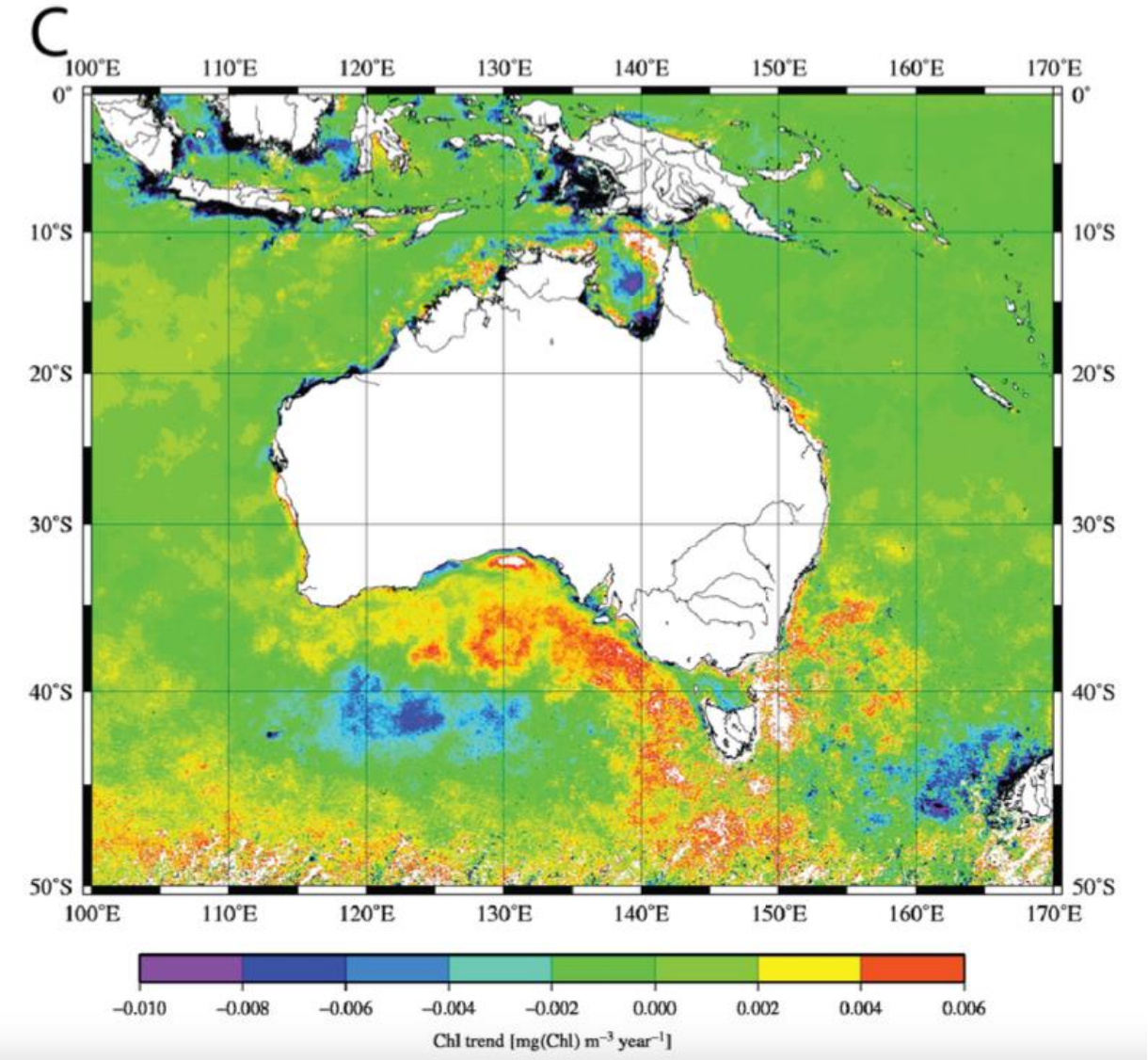

Figure 1. Trends Chlorophyll A in the Australasian region between 2003 and 2019 (Thompson et al. 2020)[44]

Little Penguins

The Little Penguin is a tourist attraction around the Otway Basin. To the best of our knowledge, no research has been done on the effects of seismic blasting on the Little Penguin, or as significantly, on its prey species. There have been observational reports of the strong impact of blasting on Southern Rockhopper Penguins which were found floating unconscious near blast sites off Marion Island and Saldhana Bay, South Africa.[32]

There is only one published scientific study which was carried out on the African Penguins.[32] Within 100km of their colony, penguins showed avoidance of their preferred feeding areas during seismic activities, leading to increased effort for their overall foraging. Longer term repercussions on hearing could not be excluded.

A report in the New Zealand Herald, 17th January 2018 stated:[30]

"I don't see why it wouldn't hold for our little penguin, especially if the blasting overlaps with foraging habitat like in the South African study," University of Auckland marine scientist Associate Professor Craig Radford said.

"These little guys spend a considerable amount of time at sea foraging and if they are as sensitive to sound as the South African species then there is the potential to disrupt their foraging behaviour."

Dr John Cockrem, a professor of comparative endocrinology, said "Seismic surveys conducted within 100km of Korora foraging areas could have adverse effects on breeding success and survival of the penguins."

Middle Island penguins have not been studied by tagging so their feeding range is unknown. Little Penguins are hard to spot because they are under the water much of the time. The peak month for sightings in January. About 10% of sightings are beyond the Continental Shelf. Little Penguins have been seen in or near the OA between February and April at almost 40°S. As the Little Penguins in Warrnambool are at latitude 38.3°S, this is a distance of around 200 km.

Penguins are among the most threatened bird families, largely due to the negative effects of competition with fisheries, climate change and oil pollution.[8] The Precautionary Principle should be applied. No blasting should occur within 100km of the range of Little Penguins. The OA is within that range.

Finally, Australia has international treaty obligations to protect albatross and other sea birds.

The Clean Ocean Foundation advises NOPSEMA to reject the TGS application because of its threat to birds.

4. Misrepresentation of the Bonney Upwelling and its connection to the valuable feeding grounds in the Operating Area. (OA).

TGS provided a map showing the extent of the Bonney Upwelling occurring in SE Australia (page 91, Figure 2 below). The region where the proposed survey will be conducted does not appear to overlap with the Bonney Upwelling but it is an artefact of the map chosen by TGS. The Bonney Upwelling that they have delineated reflects where the nutrient rich sub-surface waters come to the surface and begin the process of interacting with phytoplankton and sunlight which permits the high productivity of zooplankton, including krill, which underlies the entire ecology of the system. What is completely misunderstood by the applicants is that the exact location of the upwelling reflects where the nutrients rise to the surface and interact with surface currents and winds.

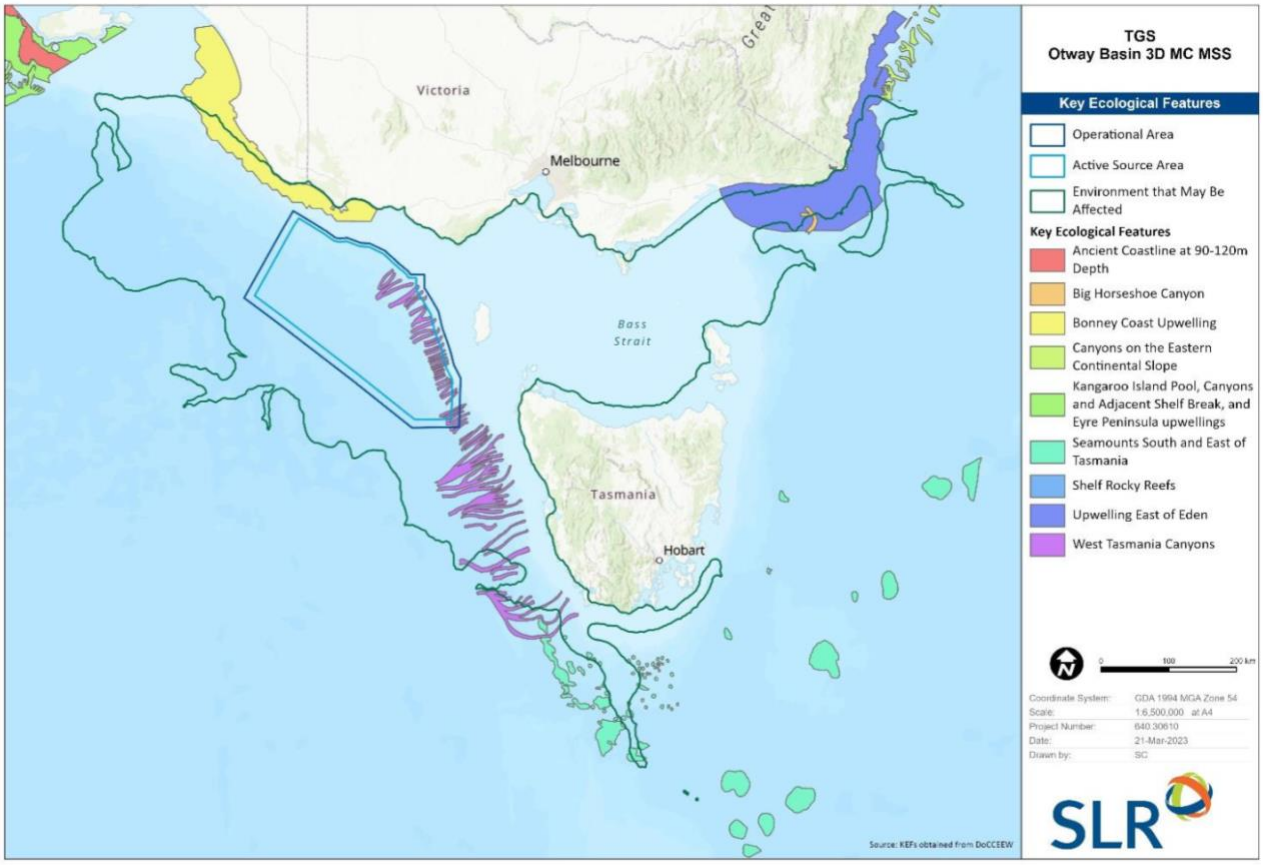

Figure 2: TGS application page 91. The area in yellow is categorised by the applicants as the Bonney Upwelling

The distribution and productivity occurs over a much larger geospatial range, including the OA, which is why blue whales are found there. We understand that an application has been made to the Department of Climate Change, Energy, the Environment and Water to extend the Blue Pygmy Whale Biologically Important Area to the Operating Area proposed by TGS.

The Clean Ocean Foundation requests NOPSEMA to withhold approval until the application for an extension of the BIA has been decided by DCCEEW.

The Clean Ocean Foundation asks that TGS reassess the importance of the plankton-rich Operating Area for whales, dolphins, seabirds, transit of returning eel zooplankton, and other species.

A much better way to examine the impact of the upwelling is to look at the productivity that it produces and where it spreads which is better done with satellite images of chlorophyll (nutrients feed the phytoplankton which feed the zooplankton) (Figure 1 above). The bright red colours represent regions of high chlorophyll A, thus areas of high phytoplankton density and consequently areas of high zooplankton density (including krill).

A simple comparison of the chlorophyll density, the proposed survey area and the Bonney Upwelling region shows the actual upwelling zone (proper) does not overlap with the seismic survey area. The productivity (as measured by chlorophyll) that is entirely the result of the Upwelling completely intersects with the survey region. Thus, the argument that the proposed

seismic survey avoids the Upwelling is correct only in that it is misleading. It avoids the regions where the nutrient rich waters reach the surface, but it fully overlaps where the nutrients produce phytoplankton and result in the productivity sufficiently large to support krill, blue whales, and other vulnerable and endangered species.

The consequence of this observation in relation to the mortality that krill will be subjected to by the proposed seismic activity is potentially a very damaging impact to the only food source of blue whales. It is worth noting that krill are obligate schooling animals – they will always form large schools. This makes it difficult to determine whether the total abundance of krill has declined until it is too late; a well-known problem in many schooling fish fisheries.

The misalignment of the seismic survey with the actual productive waters of the Bonney Upwelling is a major flaw in the application and substantially hides the potential true impact of the process. This needs to be much better understood before any approval is given to the surveys.

The Clean Ocean Foundation asks TGS to include in its application a map that shows the continuity of plankton between the Bonney Upwelling and an area that extends beyond the OA.

We reaffirm that the EPBC Act specifically states that lack of scientific knowledge is no reason to allow a particular activity to proceed. There is a clear lack of knowledge demonstrated here by the applicants, but it remains unclear whether this is through a poor understanding of the Otway Basin ecosystem or if it is wilful ignorance.

6. Flawed assumptions in the JASCO modelling which is used in the Plan: inadequate information about the spatial details of each survey run and the next one.

The proposal states that during the seismic acquisition, the seismic vessel follows a series of predetermined parallel sail lines at around 4½ knots in a "racetrack" pattern, where the vessel changes direction at the end of each line. During data acquisition, the discharge interval is given as 18¾ metres for dual-source airguns or 12½ metres for triple-source airguns, corresponding to a 235dB discharge every 5 to 8 seconds. The data acquisition will occur continuously for 24-hours a day, seven days per week, for up to 200 days per year, except for the time in which the survey vessel is changing direction in its "racetrack" pattern. Once a survey pattern commences, there is no respite from the noise until the total pattern is completed.

This proposed pattern is quite different from the assumptions used in the JASCO model, where single lines of no more than 20-hours duration were used. Single sites were used to model the effects of each single air-gun discharge. The 24-hour accumulated sound exposure along a survey line (SEL_{24h}) was modelled by adding repeated discharges (every 12½ metres of travel) over the 24-hour period. This was found to be over 180dB out to around 30km either side of the 100- to 200-km-long survey lines so that an area of 3,000 to 6,000 km^2 is subject to noise louder than 180dB over an entire day. The actual survey, however, will have a greater total exposure given the duration of the survey.

The real question, however, is what actual exposure level of noise is harmful, given that noise damage is cumulative and permanent – the hearing damage does not heal. The JASCO report

uses noise levels for temporary- (TTS) and permanent-threshold shift (PTS), i.e. temporary and permanent hearing loss, from a variety of sources. However, there are extremely limited real data on the more-damaging impulsive noise hearing loss onset for marine mammals across a range of exposure frequency conditions. These limited data are for captive seals or dolphins and are based on avoidance behaviour or brain electrical activity. Almost nothing is known about the effect of intense impulses of noise on crustaceans, fish and invertebrates and there are no data at all for the baleen whales, such as the iconic Pygmy Blue Whale or Southern Right Whale, that are the more well known and important species around the Bonney Upwelling.

The estimation of hearing parameters relies upon extensive assumptions, extrapolation, and mathematical modelling of hearing using anatomical parameters, characteristics of sound production, and assumptions based on other species. Consequently, the TTS values taken from Southall et al.[41] that are used as "safe" levels are purely estimated from these mathematical fitting functions using non-impulsive noise and single (in most cases) individuals. The situation is worse for the far more concerning permanent hearing loss where there are no data at all! That the levels used for permanent hearing loss are arbitrarily set to be 20dB higher than those for temporary loss is ludicrous.

When various species are grouped together, based on biological similarities, the group audiograms use median values of individuals of different species, leading to substantial individual variability. There are insufficient data to analyse the variance. Taking just the mean value, as has been done, does not make sense. Each dose of noise contributes incrementally and permanently to hearing loss. Confidence levels are required to be stated. By way of analogy, using the median would be equivalent to a toxicologist advising that a new drug would be acceptable if only 50% of people were killed by it (the LD50 level). The precautionary principle requires taking the lowest confidence interval as the safest step.

Underwater sound propagation from a complex source such as an air gun array is confounded by a large number of factors, some to do with the source and some to do with the environment between the source and receiver. Small changes in environmental features can produce large changes in sound propagation loss estimates, so altering the modelled received levels. A modelling report is just that, an exercise in predicting a system's behaviour based on multiple assumptions. The JASCO report gives little information if the many assumptions used in their sound propagation modelling process are constant across the survey region. Furthermore, no estimates of potential modelling errors are presented.

The Clean Ocean Foundation requests that TGS provide the confidence intervals for all the data used. Without these, the data are incomplete and insufficient to determine "safe" levels.

Despite this lack of actual real knowledge of the hearing damage caused by intense noise pulses from air guns, the report uses the high value of 160dB as the "safe" (no effect) level, the highest levels that have been selected from older works with no measures defined and only superficial observational data. Recent work suggest that this value is much too high, and using it will increase the stress on populations, especially those endangered populations that are already under threat and for which there is no evidence about safe noise levels.[23]

While the greatest damage occurs to animals nearer the sound source, the number of damaged animals increases farther from the source. (The area of the affected zone and thus the number of

affected animals increases with the square of distance.) Unfortunately, the simple "all-or-nothing" approach preferred by regulators, where it is assumed that all animals whose exposure is below the RLp50 threshold are completely unaffected and all above are affected, severely underestimates the number of animals affected by the stressor. The authors have provided an example in which this "all-or-nothing" approach underestimates the number of affected animals by a factor of 280, i.e. there are **280 times** as many animals affected than what the "all-or-nothing" calculation would suggest.[45]

It is suggested that, along with the mathematical model of the noise distribution in the water, the determination of the number of affected animals uses a dose-response function coupled with the actual distribution of the animals.[45] Ignoring these factors can lead to significant errors in estimates of the area and numbers of animals affected. In addition, the selection of the exposure threshold also requires information on the proportion of the population that will be protected.

The Clean Ocean Foundation requests that TGS provide information on what proportion of the population they will consider to be unaffected, what noise threshold that they intend to use, and how they will go about estimating these.

The Clean Ocean Foundation requests that TGS use a dose-response function, rather than assuming 50% of the population will be unaffected, and provides details of the dose-response function used.

The Clean Ocean Foundation requests that TGS provide the population distribution that is used in any calculations and what number of animals are in the area of damage that are not observable from the ship.

The JASCO modelling does not consider that the effects of the seismic discharges is just confined to the operational area. The underwater sound transmission channel from Bass Strait to Antarctica allowed air-gun noise from a survey undertaken off the western edge of the continental shelf in Bass Strait to be detected as far away as the Antarctic Continental Shelf, some 3,000 kilometres away.[17] Consequently, the proposed survey could allow widespread and thousand-kilometre-range noise pollution for up to 200 days per year.

The Clean Ocean Foundation requests that TGS to clarify how the noise pollution from the survey will impact animal behaviour at thousand-kilometre ranges.

Given that the Blue Whale Conservation Plan stipulates that "any blue whale continues to utilise the area without injury", the Clean Ocean Foundation request TGS to provide comprehensive justification as to how modelling demonstrates compliance with this requirement.

The consequences of the acoustic discharges are not just confined to hearing loss. A recent study demonstrated that these acoustic discharges are likely to prove deadly to zooplankton out to at least 1.2km from the source.[23] This was the limit of the published survey and so it is likely that mortality occurred beyond the 1.2km reported. Considering that this study used a **small 150in^3 air-gun, the much larger 3150in^3 air-gun array** to be used in the proposed survey will certainly cause mortality out to a much greater distance from each line. These are alarming findings on zooplankton that underpins the entire food chain. These intense acoustic discharges will increase the stress on populations, especially those endangered populations that are already under threat and for which there is no evidence about safe noise levels.

The Clean Ocean Foundation requests that TGS undertakes additional valid studies (independent, in-field, and spatially representative) to determine the actual range and impact that repeated intense acoustic discharges over the full duration of a survey pattern has on zooplankton, and to determine the true recovery time for zooplankton on the completion of that survey.

7. Noise Pollution: inadequate information about the spatial details of each survey run and the next one.

The proposal states that data acquisition will occur continuously for 24-hours a day, seven days per week, for up to 200 days per year, except for the time in which the survey vessel is changing direction in its "racetrack" pattern. Once a survey pattern commences, there is no respite from the noise until it is completed. Because no information is provided on how long each line is, how far apart the lines are, or how many lines constitute a survey, there is no indication of the actual area being exposed to this almost-continuous noise, or the total time that animals in the acquisition zone are being subjected to it. All that is provided in the proposal is that the acquisition geometry is "carefully designed to allow suitable coverage" (page 64), whatever that means.

The Clean Ocean Foundation requests clear clarification on how long each line is, how far apart the lines are, the total number of lines acquired once a survey commences, and the total duration of that continuous survey once it has commenced – these must be known by TGS if the acquisition geometry is "carefully designed to allow suitable coverage".

It is well known that excessively loud noise causes damage to the ear and that this damage is both cumulative and permanent. As the ear does not recover from cumulative damage, it is essential to minimise the total exposure to excessive noise levels. The question, then, is what is the definition of excessive?

The proposal states that introducing short-term seismic-discharge noise to an area that has an existing high background of vessel noise, such as the Otway Basin, is unlikely to impact marine species at the population level. This is blatantly incorrect! For a start, the noise is certainly not short-term, as it will last 24-hours a day, seven days a week, for up to 200 days per year! In addition, the background noise level is nowhere near the intense noise levels of seismic discharges which, even 30 kilometres from the source, reach over 180dB (according to their model). In other words, the JASCO model of a single line shows that an area of 3,000 to 6,000 km^2 is subject to impulse noise of more than 180dB over an entire day. It will be far worse for the full survey using multiple (hundreds?) lines.

As discussed earlier, there is a real lack of actual measured knowledge of the hearing damage caused by intense impulse noise, the most dangerous kind, from air guns. The values selected as "safe" do not consider the cumulative effect of repeated high-intensity impulses over an extended period of time. These values are somewhat arbitrarily selected from the modelling of short-duration continuous (non-impulsive) noise and extrapolated to other species for which no data exists. The recent work that is reported in well-respected scientific journals, such as that of McCauley et al.,[23] suggests that the so-called "safe" values are much too high, and that there is a real risk of permanent hearing damage occurring to those animals in the survey area. Almost all of these cannot swim fast enough to escape from the blast zone, despite the use of a "soft" start to each line.

The Clean Ocean Foundation requests TGS to provide information on the cumulative impacts on fauna from noise generated by its operations.

We understand that JASCO's modelling of the Scarborough Gas Field demonstrated that blue whales may suffer temporary injury as far as 60 kilometres from the sound source.

The Clean Ocean Foundation asks TGS to accept the 60-km range or, if they do not, to explain the difference between the Scarborough models and its models for the Otway Basin.

The Clean Ocean Foundation asks NOPSEMA to make available the JASCO report presented for the development of National Anthropogenic Underwater Noise Guidelines, which includes an update to the EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales: Industry guidelines. We also request copies of all independent reviews of the JASCO document.

The Clean Ocean Foundation asks NOPSEMA to set aside any studies conducted by members of APPEA, i.e. JASCO, who have been funded by the industry to conduct the above studies. This is again apprehended bias, which prevents unprejudiced consideration of the facts and may result in selecting one preferred outcome over another, as we have indicated above.

8. Inadequate Risk Management Planning and Risk Mitigation.

One of us has 20 years' experience of risk management planning using AS/NZ ISO 31000:2018 and its predecessors. That experience includes operational use and teaching students to Masters level in Australia, China and Singapore. He has marked approximately 800 risk management plan assignments.

The three key elements in risk planning are listing the risks, assessing the consequences and likelihood, and risk mitigation. Tables 46 and 47 in the Proposal show the criteria for assessing consequence and likelihood. Table 46 conflates distance with time, aggregates heterogeneous populations and groups, and gives arbitrary impacts for which there is often insufficient scientific evidence.

Table 47 uses historical frequency in the industry as a measure of likelihood. There is no peer-reviewed record that the industry has such information where biological risks are involved. It might be appropriate for non-biological risks such as waste discharges, atmospheric emissions, light pollution, streamer loss, collisions and hydrocarbon spills.

This risk management plan is a nonsense.

It would make more sense to have two risk management plans. It would fit better with Type A, B and C risk classifications. **Risks to the marine fauna and flora (phytoplankton) should comprise one plan, with the non-biological, largely engineering risks in a second plan.** This would permit better recognition of the areas of uncertainty and the need for the Precautionary Principle to be applied.

The Clean Ocean Foundation invites TGS to submit two risk management plans as described above. The plans should cover identification, assessment, mitigation, management and consequences to both-

1. **Marine life and species, individually, and**
2. **Overall ecosystems, habitat and food chains.**

Consideration of the flow-on impacts needs to be provided, with identification and assessment of the risks, impacts and consequences for-

a. The local region overall – communities, businesses, livelihoods, and jobs,

b. The social costs associated with such impacts and consequences.

c. Fishing and tourism in the short and long term need to be assessed.

The contents of Table 51 need to be applied after TGS revises its interpretation of the biological damage caused by seismic blasting set out above. It follows that Table 53 Acoustic Damage to the Environment is not moderate but very high. (major/catastrophic.)

The Clean Ocean Foundation regards the risk from noise pollution as very high.

The wording at the top of page 315 of the Proposal should be amended as indicated in the bold text below:

The physical presence of the survey vessels and towed acoustic equipment has the potential to result in the following effects on environmental receptors, including those that are recognised as key sensitivities within protected areas that overlap and ***within*** *the OA.*

1. *Disruption to normal animal behaviours;*
2. ***Catastrophic damage to the plankton-based ecosystem,***
3. *Displacement of animals from preferred,* ***plankton-rich*** *habitat: and*
4. *Collision with* ***ships*** *or entanglement of animals in towed equipment.*

The Clean Ocean Foundation requires TGS to state accurately the risks of seismic surveys to the marine ecosystem within the OA.

Risk Mitigation

The risk mitigation relies on marine mammal observers, passive sonar, aerial surveys and soft starts. These measures are inadequate and ineffective.

Observers can only see mammals on the surface out to 3.5km in good daylight conditions. Good visibility is rare in the proposed survey area, with common high wind and sea states, reducing the visibility of Marine Fauna Observers. Observers cannot see at night, and therefore any whales within the Observation and Shut Down zones will not be observed, resulting in an unacceptable risk of acoustic and strike injuries to whales within these zones. Observers cannot see 360 degrees, with vision impaired by structures on the ship (even when working from the bridge). A single observer monitoring throughout daylight hours is an ineffective technique to monitor for marine mammals (Annie Ford, Personal Communication). Furthermore, whales are primarily below the sea surface, with cryptic species rarely surfacing, particularly when disturbed. The danger zone is out to at least 10.2km. The farther from the ship, the greater the number of whales exposed to damaging noise pollution because of the area involved. (This is just the surface area – square of distance. We cannot estimate the significant water volume affected.)

The Clean Ocean Foundation requests acquisition occurs during daylight hours only, with two Marine Fauna Observers actively observing on the acquisition vessel at any one time. Additionally, three support vessels with two Marine Fauna Observers are required to adequately monitor the Observation zone out to 5 km or greater (a support vessel either side of the source, and a support vessel ahead of the source).

Aerial surveys are intermittent and restricted to good weather. Their proposed frequency of once in 10 days is grossly insufficient and its duration is not given. The nearest airfields renting aircraft are Ballarat and Mount Gambier. Warrnambool no longer has a rental service.

The Clean Ocean Foundation requests further information on the location of the base airfield, the frequency and duration of flights, and how aircraft to ship communication will work.

Soft starts only work for animals that can and will move out of the way which is not often the case, such as plankton, shell fish, and benthic fauna and infauna.[8,39]

Passive Acoustic Monitoring (PAM) only works when whales are communicating, and is ineffective at determining the range and bearing of animals. Whales often go for over 20 minutes without calling. Seismic blasts themselves can silence whales. As a means of locating whales in the danger zone, PAM is an unreliable and inadequate form of impact mitigation.

Recently, a whistleblower confirmed what has been long suspected. There was no place on the ship from which she could monitor all sides. The whistleblower spotted hammerhead sharks, whale sharks, dolphins and turtles but the ship was not required to halt the blasting except in some instances. The ship continued blasting through the hours of darkness without observers. "There's so much money involved in this. They will not give up a day," the whistleblower said.

TGS says in its risk management plan that it will continue operations during darkness. TGS is dissembling. To offer the above measures in mitigation and then to say that it will continue operations during darkness is untenable sophistry. How can the observers see the whales at night, especially at 3-kilometre ranges?

Even when observers are on board and well intentioned, the group pressure on that individual would most often result in a lower level of monitoring, as that person will be overpowered by the dominant determination of the ship's leadership and crew for whom the priority will invariably be directed to "getting the job done".

In Table 57, the rejected control measures printed in red all demonstrate TGS places profits above environmental protection. Gas is a taxpayer-subsidised, highly profitable industry. At risk from such a vandalistic approach is the industry's social licence.

The Clean Ocean Foundation believes that if TGS believes its previous activities have not harmed the environment, it should fund independent before and after assessments.

The Clean Ocean Foundation calls on TGS to fund independent before and after assessments.

Oils spills. Oil spills at sea by TGS are an unnecessary risk. The port of Portland is close to the OA.

In the case of an oil spill, much of the Victorian and Tasmanian coastlines are inaccessible to enable amelioration of the damage. Further, many of the chemicals utilised by industry to clean up oil spills are known carcinogens.

The Clean Ocean Foundation requests that refuelling is conducted in a port.

The Clean Ocean Foundation requests access to TGS's Oil Spill Emergency Response Plan, including a description of chemicals used to clean up spilled oil (incl. SDSs), and the location and number of vessels available to assist in the case of an emergency.

Conducting the seismic surveys during the peak Pygmy Blue Whale season demonstrates profit over conservation. These whales are present in the OA. Other species, such as Bluefin Tuna and Sooty Shearwaters, are present in the peak season too.

The Clean Ocean Foundation requests NOPSEMA to reject seismic surveys during the months when Sooty Shearwaters, Blue Fin Tuna, Pygmy Blue Whales or Southern Right Whales are present.

The residual risks shown of page 340 are inconsistent with the scientific evaluation presented above and are considerably understated.

The Clean Ocean Foundation asks TGS to revise the residual risks in the light of accurate scientific evaluation.

On page 354, the noise criteria and sound levels use old papers which have been superseded by newer ones, such as McCauley et al.[25], (plankton), McCauley et al.[24] (crayfish). Pages 354-437 are inaccurate and out of date. Please see our evaluation above and conduct a new literature review.

The Clean Ocean Foundation asks TGS to bring page 354-437 up to date.

On page 355, please revise in the light of our critique of the JASCO model and any draft National Guidelines.

Acoustic Disturbance Impact and Risk Summary.

Using bias in choice of papers, their interpretation and obscuration, TGS assesses the risks as moderate which become acceptable with mitigation. Hogwash! As our critique of the evidence demonstrates, the risks are very high and the mitigation measures ineffective.

The application does not state the TGS appetite for risk. For instance, it is not clear what risks to the environment the company is prepared to run before the reputational risk for TGS becomes unacceptable.

The Clean Ocean Foundation asks TGS to provide a copy of its organisational risk management plan approved at board level and outline how the risks in this application link back to the overall company's risk management plan.

The Clean Ocean Foundation asks TGS to rewrite the Risk Management Plan to an acceptable scientific standard.

Once ships are undertaking seismic surveys, how can TGS know that there will be compliance with the risk management plan and if deviations have occurred? What periodic reporting of risk to NOPSEMA will occur? When would NOPSEMA revoke permission to operate?

The Clean Ocean Foundation asks TGS to describe in a table how adherence to the Risk Management Plan may be <u>independently verified</u>, e.g. by NOPSEMA. Please provide further information on oversight, audit, compliance and consequences, and the frequency of these activities.

The Clean Ocean Foundation requests NOPSEMA to require TGS to mitigate risks with the best environmental options available not the cheapest ones proposed.

The Clean Ocean Foundation notes that NOPSEMA does not regard the detection and control measures provided in the EP as acceptable (Freedom of Information Order of 8th March 2023 (164) relating to the National Offshore Petroleum Safety and Environmental Management Authority – Otway Basin – Inspection Report: 2023-000755, https://www.aph.gov.au/parliamentary business/tabled documents/1715.)

9. Inadequate community consultation.

a. The links between TGS and Schlumberger which faces prosecution by NOPSEMA

At TGS's community meeting in Warrnambool, TGS was asked repeatedly about its links to Schlumberger which is being prosecuted by NOPSEMA. The speaker evaded the question repeatedly. TGS presumably realises that Schlumberger has lost its social licence to operate.

b. Short Fin Eels and Budj Bim UNESCO World Heritage Site.

The EP omits any reference to Budj Bim UNESCO World Heritage Site or its Short Fin Eels. This point has been covered in detail under Short Fin Eels. (Vide supra.)

c. Middle Island's Little Penguin colony.

The EP covers Little Penguins at Phillip Island but not the many colonies nearer the OA, most notably the Middle Island colony at Warrnambool, which has been omitted even although it is much nearer to the OA and is renowned for the use of Maremma dogs to protect the penguins from foxes, made famous in the film *Oddball*. In addition, the Middle Island Management Committee has not been consulted.

10. Conclusion

The Environment Plan submitted by TGS is a deficient, inaccurate evaluation of the mounting scientific evidence about the destruction caused by seismic surveys. The Risk Management Plan and risk mitigation are not fit for purpose. An application of some 1,450 pages (with seven pages of references) requires more than 30 days to evaluate.

In summary, the Clean Ocean Foundation contends that the EP should not be accepted by NOPSEMA in its current form because:

- **TGS has not adequately evaluated impacts and risks;**
- **TGS has not demonstrated that the impacts and risks are of an acceptable level;**
- **TGS has not adequately demonstrated that the impacts and risks will be reduced to low as reasonably practicable; and**
- **TGS has not consulted with all relevant persons.**

If TGS is permitted to resubmit its EP, we would ask that each of our questions and points be addressed and a document included that outlines where the Clean Ocean Foundation can find these changes in the application.

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