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24th June 2017

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RE. PROJECT REFERENCE 720.16030.00003

This letter serves as an objection to the proposed speculative two-dimensional (2D) seismic and three-dimensional (3D) seismic survey by Petroleum Geo-Services (Project Reference 720.16030.00003) off the Southern and Eastern coasts of South Africa in the area situated approximately 15 km offshore roughly between Mossel Bay and Port Edward.

The objection is based on the following, *inter alia*:

LEGISLATION:

Section 24 of the Constitution affords everyone the right to an environment that is not harmful to their health or well-being. One of the objects of the Mineral And Petroleum Resources Development Act 28 of 2002 (MPRDA) is to give effect to section 24 of the Constitution by ensuring that the nation's mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development. The granting of prospecting rights under the MPRDA is thus made subject to environmental protections and constraints. Oil "reconnaissance " and other activities relating to mineral exploration are no longer included in the list of activities in the schedules to the Environmental Impact Assessment regulations promulgated in terms of NEMA (National Environmental Management Act). Furthermore, and since the repeal of S39 of Minerals and Petroleum Resources Development Act, there is no legislative oversight for such proposed activities. There is accordingly a lacuna in South African environmental legislation regulating oil and gas exploration.

It cannot be disputed that marine ecosystems are under threat and require protection, for both conservation and for those whose livelihoods are dependent on the ocean, such as fisherfolk.

This structural weakness in protective environmental law has had the consequence so far of legitimising illegal activities at Tonmin mines (https://mg.co.za/article/2017-05-16-the-day-big-mining-won-the-battle-to-wreck-the-environment), with the resultant dune collapse. Also despite clear scientific evidence that seismic surveys affect marine ecosystems, the ExxonMobil Exploration and Production South Africa Limited/Impact Africa Limited seismic survey was extended, without consultation, well into the whale migratory season in 2016. International mitigatory measures are united in restriction of seismic surveys during the known breeding and migration periods of cetaceans and turtles[i]. In 2016, the highest number of whale strandings in the history of the east coast of South Africa was recorded (https://www.researchgate.net/publication/317400489 Annual Marine Strandings Report for KwaZulu-

Natal South Africa 2016). This is a coincidence which demands critical review of suspected risk by all relevant governmental departments and organisations.

Until the repeal of S39 has been challenged and provision is made for oil reconnaissance and exploration as a scheduled activity in terms of the provisions of NEMA and subject to the provisions of the Environmental Impact Assessment regulations under the jurisdiction of the Department of Environmental Affairs, mining prospecting and reconnaissance operations in sensitive ecosystems should not be permitted. Until environmental impact assessments work inside the "One Environmental System" and a prohibition against harm is applied, the process of seismic surveying along the South African coastline should be resisted.

TIMING OF IMPACT

According to what is contained in the application under discussion, the recommended timing of the proposed survey (Dec 2017 to May 2018) is lodged with the caveat of being ultimately dependent on a permit award date, availability of the survey vessel and the scheduling of 2D and 3D surveys to either coincide or not. The timing of these surveys is critical for least possible impact on seasonal breeding, feeding and migrations. Nowacek *et al* (2013) concluded that the best way to mitigate negative impacts of seismic surveys on marine mammals is to separate them in time, space, or both. It is my submission that there should be no leeway given in the proposed temporal window of this survey, except to reduce the scheduled duration, given the degree of threat due to the survey area overlapping Humpback whale, Southern Right whale, sardine and critically endangered Leatherback and endangered Loggerhead turtle migration routes.

IMPACT ASSESSMENTS BIASED BY KNOWLEDGE GAP

The EMP relies much on assumption drawn from foreign studies and shows bias to short-term indicators, with a lack of information about sound thresholds (audiogram data to inform hearing sensitivity and acoustic trauma levels) and recovery from impact across all local species. The EMP has shown some of the clear behavioural changes evidenced in response to seismic surveys, but these behaviours are seldom directly interpretable. There is no certainty around whether these responses are accompanied by quantifiable physiological effects that could potentially lead to biologically significant impacts on individuals or populations. This many fundamentally significant unknowns must affect the validity of the impact assessments, making 'minimising impact to acceptable levels' guesswork at best.

A very recent study (22 June 2017) by McCauley *et al* is alarming in its revelation of seismic airgun impact on zooplankton : "Given the extensive spatial scale for serious impacts on plankton observed here, combined with the repeat and sustained nature of many seismic surveys in a comparatively small spatial area, it is highly probable that significant depletion or modification of plankton community structure is occurring on the scale of 3D seismic surveys undertaken." McCauley *et al* warn of the ramifications for ocean ecosystem structure and health considering a significant component of zooplankton communities comprises the larval stages of many commercial fisheries species and healthy populations of fish, top predators and marine mammals are not possible without viable planktonic productivity. It goes without saying that this massive destruction of plankton will have a direct and adverse effect on all marine life, which ultimately affects mammals including the human population. In conclusion, the proposed activities are of the nature that are in direct conflict with the constitutional principal that every person is entitled to an environment that is healthy and free from harm.

DURATION OF IMPACT

The EMP's Potential Impact Assessment has not given adequate consideration to the duration of impact. The length of time a particular area is surveyed influences the degree of impact.

Stress does not present as an indicator for the impact ratings of this EMP. Acoustic pollution presents as less visible but unceasingly pervasive disturbance to the marine and other ecosystems, which are subjected to the consequences of a seismic survey. Significant stress due to prolonged exposure to seismic and anthropogenic underwater noise has been measured in a number of species (Finneran *et al*., 2002; Eckert *et al.* 1998; McCauley *et*

al. 2003; Rollard *et al*. 2012) and these studies indicate that chronic elevations of stress to the organisms in the ecosystems may cause metabolic maladaptation, suppressing growth, immune system function, thermoregulation and reproduction with implications for individual and population fitness.

The EMP acknowledges hearing loss or damage to be a concern for a large number of species (fish, sea birds, turtles, seals, whales and dolphins) tempering their apprehension with notes of an improbability of proximity to airguns. McCauley, Fewtrell and Popper (2003) found that the ears of fish exposed to an operating airgun sustained extensive damage to their sendory epithelia. The damage was regionally severe, with no evidence of repair or replacement of damaged sensory cells up to 58 days after air-gun exposure. This damage was seen at exposure levels that might occur several kilometers away from the sound source.

Madsen *et al.* (2006) overturned the assumption that received airgun noise levels decrease with less and less impact on the exposed animals further from the noise source. They found high exposure levels at considerable ranges from the air-gun array and that received sound pressures and sound exposure levels may actually increase with range beyond 5 km range up to 12.6 km from source. They believe this high frequency acoustic by-product on marine mammals should not be dismissed lightly and that it poses the challenge of how to mitigate where animals can dive in and out of high exposure levels at considerable ranges from the air-gun array.

The EMP also recognizes that the adverse effect of continuous noise exposure may intensify and last for a considerable time after the termination of the sound source. It must be remembered that this survey will be operational every 10 seconds for 24 hours a day for 6 months, frequently compounded by multibeam bathymetric sonar output. Maladaptive neuroplastic changes within the central auditory pathway symptomatic of noise exposure induced tinnitus is not broached by the EMP. Animal models of tinnitus show it is a complex perceptual phenomenon affecting the quality of life of those afflicted. Mann *et al* (2010) claim that hearing impairment could play a significant role in some cetacean stranding events[ii], and stranding events with causal links to seismic activity have been indicated in Humpback whales, Minke whales and beaked whales by Cucknell, Boisseau and Moscrop (2015).

The impacts of unilateral and indiscriminate traumatizing noise exposure beyond the boundaries of the safety zone (such as decreased foraging efficiency, increased energetic demands, reduced group cohesion, compromised ability to nurse calves, reduced ability to communicate, increased risk of predation and decreased reproductive success and hampered avoidance of anthropogenic threats like entanglement and bycatch) on already depleted populations experiencing the cumulative impact of multiple stressors, warrant questioning the lack of a precautionary approach and the 'low' significance rating given by this EMP. The lack of baseline data regards auditory physiological effects and degree of reversibility of these, should not be construed as free rein to proceed unchecked until negative effects are demonstrated.

RECURRING IMPACTS NOT CONSIDERED

The EMP has not taken into consideration the probability of recurring seismic surveys, the risks associated with compounded behavioural disturbance and how chronically-present sound could constitute a threat to populations by changing behaviour and distribution regularly at critical times and in critical areas.

Cumulative acoustic limits should be established. These limits should be appropriately matched to the spatiotemporal scale and exposure rate of the risks to individuals and populations. Measurement of noise budget, such as those under consideration under the EU Marine Strategy Framework Directive (Tasker et al. 2010), should lead to limits on the source levels that are introduced on a regional scale, especially in areas where noise pollution is increasing. Survey planning involving large sound sources should consider whether there are other vessels using similar sources along the coast, making it hard for animals to avoid exposure.

MITIGATION MEASURES INADEQUATE

The EMP insists that PGS must comply with a variety of international protocols but none of these protocols are specific to underwater noise. Seismic surveys and bathymetric multibeam sonar acquisition are anthropogenic sonic phenomena that are actively pursued for their powerful affective qualities. The EMP advances no reasonable and practical measures to protect the environment and mitigate the enhanced effects of bathymetric multibeam sonar acquisition when operating it together with the airgun array.

The EMP has also not sufficiently considered the degree to which the total impact of the survey can be mitigated. Existing guidelines do not offer adequate protection to marine turtles and mammals, given the complex propagation of airgun pulses; the side-lobes of unknown energy and propagation of multibeam sonar operations, the difficulty of monitoring in particular the smaller, cryptic, 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 protection and to address data gaps.

These recommendations are not extensive and are intended to complement those provided by SLR.

- **Inclusion of the impact of multibeam bathymetric sonar in the mitigation measures**. Ocean depth, multibeam echo sounders sweep a swath up to 7.4 times water depth and so affect a wide area. Potential impacts on marine mammals may range from physical damage, including gross damage to ears and the 'bends', temporary and permanent threshold shift (deafness), to perceptual (masking biologically significant noises) and behavioural impacts (temporary or permanent displacement and stress) as well as indirect effects (reduced prey availability) (Gordon *et al.,* 1998). High intensity, low and mid-frequency sonar has been implicated in some fatal strandings (Frantiz, 1998). Research should be undertaken to determine the effects of bathymetric sonar on beaked whales in areas of steep bathymetry close to an adjacent coastline, when sonar is used seawards (Filadelfo *et al*, 2010[iii]).
- **An environmental monitoring boat** should be employed to search the area surrounding the seismic survey for the presence of any animals, including injured or dead animals. It should also be used to investigate the issue of entrapment in survey equipment, such as the streamer tail buoys.
- The speed at which the ship moves plus duty cycle and beam shape of the equipment governs the number of pulses of a given intensity a point in the survey area will receive. Likewise it governs the ability of animals to avoid the noise. These criteria need to be continually revised by onboard Marine Mammal Observers to ensure that they are up to date, precautionary, and take into account masking effects and other potential lower-level sub-lethal impacts to individuals and populations.
- Even modest levels of noise reduction could substantially reduce impacts on marine mammals. **Alternative survey technologie**s [iv]are being developed that are likely to be less harmful and should be prioritized.
    - Marine vibroseis emit vibrations instead of bursts of intense sound.
    - Airgun silencers reduce noise at the higher frequencies. They are made from acoustically absorbent foam rubber and significantly reduce noise levels above 700 Hz to a maximum of 6 dB with an additional increase in sound levels around 100 Hz. From this it is hypothesized that fewer airguns might be needed when conducting seismic surveys with an airgun silencer in comparison to the current system.
- Establishing a **hearing threshold-based safety zone** during seismic survey activities is an increasingly common practice. Establishing a safety zone based on a Permanent Threshold Shift would reduce the likelihood of physiological effects resulting in killing of individuals, but it is not clear if physiological effects resulting in harm to cetaceans would be avoided. Such models, however, yield only approximate and often underestimated safety zone radii and should therefore be validated with field measurements (McQuinn and Carrier, 2005). Temporary Threshold Shift-based threshold is likely to increase the size of the safety zone to beyond several kilometers, which would be difficult to monitor effectively using the methods traditionally employed during seismic surveys. Rather than establishing the safety zone radius solely based on a fixed distance, the safety zone radius should be

the most conservative of either 500 meters or a radius determined using propagation models based on the best available data and science for a pre-determined acoustic threshold.

- The **pre start-up (or restart-up) observation period should be extended to a minimum of 60 minutes**. Turtles are relatively slow swimmers and may take up to an hour to respond to and escape an area affected by a seismic survey (Eckert et al. 1998). This will also increase the probability of detecting deep-diving species. Cuvier's beaked whales have recently been timed diving for longer than 2 hoursv. Ideally start-up/ restart should be determined based on the maximum duration of species-specific deep-dive cycles. This has the disadvantage of increasing the sound duration, but may avoid barotrauma incidents such as to the Cuvier's beaked whale stranding coincidental to the ExxonMobil Exploration and Production South Africa Limited/Impact Africa Limited KwaZulu Natal coast seismic survey of 2016. (https://www.researchgate.net/publication/317400489 Annual Marine Strandings Report for KwaZulu-Natal South Africa 2016).
- Regulators and project proponents should establish communication for the duration of the survey with **stranding networks** and conservation organisations local to the survey to fully understand the potential effects of the survey on the greater marine environment and take further mitigatory action should stranding reports register adverse effects to unusual species or increased numbers.

Yours sincerely,

Janet Solomon

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[i] ACCOBAMS 2010, JNCC 2010, IWC 2012.

[ii] Mann, D., Hill-Cook, M., Manire, C., Greenhow, D., Montie, E., Powell, J., Wells, R., Bauer, G., Cunningham-Smith, P., Lingenfelser, R., DiGiovanni, Jr., R., Stone, A., Brodsky, M., Stevens, R., Kieffer, G., and Hoetjes, P. 2010. Hearing loss in stranded odontocete dolphins and whales. PLoS ONE 5(11): 1-5. e13824. doi:10.1371/journal.pone.0013824.

[iii] Filadelfo R, Mintz J, Michlovich E, D'Amico A, Tyack PL, Ketten DR. Correlating Military Sonar Use with Beaked Whale Mass Strandings: What Do the Historical Data Show? , Aquatic Mammals, 24 September 2010

[iv] Weilgart, L. (2013). A review of the impacts of seismic airgun surveys on marine life. Submitted to the CBD Expert Workshop on Underwater Noise and its Impacts on Marine and Coastal Biodiversity, 25-27 February 2014, London, UK. Available at: http://www.cbd.int/doc/?meeting=MCBEM-2014-01

[v] Schorr GS, Falcone EA, Moretti DJ, Andrews RD (2014) First Long-Term Behavioural Records from Cuviers from Cuvier's Beaked Whales (Ziphius cavirostris) Reveal Record-Breaking Dives. PLoS ONE 9 (3): e92633. Doci:10.1371/journal.pone.0092633

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