Specialist review of Aspects of the Marine Ecology report relate to:

ENVIRONMENTAL AUTHORISATION FOR EXPLORATION OF OIL AND GAS GRANTED TO SASOL / ENI – MARINE ECOLOGY EXPERT INPUT

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Conflict of interest statement:

I am occasionally subcontracted by Pisces Environmental (the Marine Ecologist) to provide marine mammal specialist reports for EIAs such as this one, notably on the distribution of marine mammals. Some of my original wording on this subject has been used in this in the Marine Ecology Report (Annex D1) report I was not contracted to contribute to this specific report.

Author Qualifications: I, Simon Elwen PhD have over 20 years of experience working with cetaceans and other marine species. I have worked in multiple countries and study sites both globally and in Africa and covered a wide range of research, conservation and impact assessment scenarios. I have published over 50 peer reviewed papers, supervised a range of MSc and PhD projects as well as produced multiple impact assessment contracts and reports.

Our research group and company *Sea Search* actively takes the approach of conducting scientific research that is relevant to and informs meaningful conservation actions. We engage at a variety of levels from on-the-ground training (e.g. marine tourism operators), through the provision of specialist advice for environmental impact assessments which can directly mitigate harmful activities and at higher policy levels. Core Directors Dr Simon Elwen and Dr Tess Gridley are both invited members of the *IUCN Species Survival Commission, Cetacean Specialist Group* and the *South African Marine Mammal Top Predator Working Group*. SE has been a member of the *International Whaling Commission Scientific Committee* since 2017 and TG is one of the few African representatives of the *International Quiet Ocean Experiment (IQOE)*.

Background:

As part of the exploration programme, the Applicant (ENI) plans to drill up to six deep water wells within Block ER236, four wells within northern area of interest and two wells within the southern area of interest. The starting location (in the northern or southern area) is not yet defined, nor is the sequence of wells. The expected drilling depth would be approximately 3 800 m to 4 100 m in the northern area of interest and 5 100 m in the southern area of interest, from the sea surface, through the seabed, to target depth.

I (S. Elwen) have been requested to comment on two aspects of impact assessment: the Marine Ecology Report (Annex D1) and reviews there of by E Cordes: benthic ecology and seeps, and M Fournet: noise impacts) and the Oil spill modelling report (Annex D4, and reviews thereof by A Bracco and C Paris). In particular, I was asked to evaluate concerns raised by the appellants that the environmental authorisation was granted based on flawed and incomplete information resulting in the Minister rendering a decision in circumstances where she did not have all relevant information before her.

Summary of Main Concerns:

- The Marine Ecologists Report (MER, Annex D1) and Oil Spill Report (OSR, Annex D4) focus almost exclusively on the impacts of the short term and localised exploration drilling phase. Subsequently the appeal and Ministerial decisions were presumably made on this basis too. However, the exploration phase is a precursor to the exploitation of any oil and gas that may be discovered. The impacts of long-term hydrocarbon extraction will be substantially broader in spatial scale (e.g. hydrocarbon transport away from the site, increased production-level volumes in any spills) and long term (decades). Additionally, hydrocarbon extraction here will lay the foundation for *further expansion of fossil fuel infrastructure in both marine (e.g. rigs, tankers) and terrestrial ecosystems* (e.g. refineries). A *strategic assessment* and broad and long-term perspective of the environmental impacts of hydrocarbon extraction within the framework of global sustainability goals and climate change impacts should have been considered during decision making but was not included in the Final EIA Report.

- Neither the MER nor the OSR take into account *significant changes in commercial shipping routes* which will likely occur during production phases (likely concentration of existing routes to avoid production locales) which has implications on all forms of pollution from noise to spills especially in related to existing protected areas.

- Neither the MER nor the OSR sufficiently take into account the implications of habitat loss or spill damage during extraction/production phases relating to the storage and transport of extracted hydrocarbons. Whether stored at the drill site before transportation, or piped directly to shore, the potential start points of spills/accidents can be far removed from potential extraction sites and importantly, much closer to shore and/or protected and key biodiversity areas.

- Multiple shortcomings of the OSR are reported by specialist reports (Bracco, Paris), an additional key point to note that may be easily overlooked is that the models used in the OSR work with broad scale, usually remotely sensed *highly averaged* data (which miss potentially important localised current or wind features) and are *averaged across a range of weather conditions* with the average scenario being treated as the most likely. However, in this industry *most accidents happen during extreme weather events*, which often have very atypical wind or swell characteristics (e.g. different directions and much greater power). Given the predicted increases in both the power and frequency of extreme weather events, and likelihood of an accident taking place under unusual weather conditions, the OSR has likely <u>significantly underestimated</u> the scale of an oil spill event.

General comments

The oceans are recognised as one of most valuable assets of the people of South Africa, providing a range of 'services' for people including for entertainment, as a transport corridor, source of food, and a source of minerals among many others. The value of the oceans is widely recognised at the highest levels of government including within the UN Sustainable Development Goals and are cited as a core motivator for the South African Operation Phakisa (OP, started in 2014) and within this, the Marine Spatial Planning (MSP, started 2017) initiative. The MSP initiative set out to consciously maximise the use and value of the oceans in a coordinated way, with the goal of avoiding conflicts between marine users and conflicts with the environment (Finke et al. 2020). However, in a recent global assessment of the progress on SDGs per country (IUCN 2020), South Africa scores poorly in general and our achievements in areas of relevance to the oceans is listed as "stagnating" in terms of SDG14 (Life below Water) and SDG 7 (Affordable and Clean Energy) and "decreasing" in terms of SDG 13 (Climate Action), suggesting that despite the investments of Operation Phakisa, there is little progress on broader sustainability goals. Further exploration and production of hydrocarbon reserves cannot contribute positively to any of these goals, and from a broader perspective, continued development in these areas will negatively affect the country's chances to achieve these global sustainable development goals.

The only area where SA scored well in the SDG14 *Life Below Water* was in the sub-goal ranking the "*Mean area that is protected in marine sites important to biodiversity*". This is as a result of the successes of the MSP process and specifically the identification of various important biodiversity sites including EBSAs, CBAs and most importantly the declaration of new Marine Protected Areas. However, even with these successes less than 5% of our EEZ is officially protected by a Marine Protected Area (and much of this area remains multi-use, so that real protection is actually lower than this) – this is well below the global target of 10% set by the Convention on Biodiversity in 2004, let alone the 30% goal suggested by the World Parks Congress in 2014 (overview here).

As useful and beneficial as spatial planning and Marine Protected Areas are for planning, conflict avoidance and conservation, they *remain vulnerable to impacts well outside their boundaries due to the fluid and interconnected nature of the ocean and most life within it*. The boundaries of marine protected areas (MPA, EBSAs etc), are completely pervious to noise, chemical spills, water degradation, and solid pollution which may move in or out of these areas with currents and tides. Thus, activities hundreds and even thousands of kilometres away can affect the overall habitat quality within these areas. In parallel, many of the species using protected areas are wide ranging, the Marine Ecology Report (Annex D1) highlights many relevant aspects of this including movement of endangered sharks (Fig 18), turtles (Fig 21, 22), seabirds and cetaceans, all of which range across thousands of kilometres of ocean. So, although impacts such as vessel and rig presence appear spatially restricted in comparison to the range of these species, any impact on individuals (injury, hearing impairment, reduced feeding, increased pollution load), may have measurable effects across a population that is using *a much wider area*. Thus, although the physical components of oil extraction (ships, rigs) are relatively localised, the activities are effectively *impacting a far larger area of the ocean, the coastal environment and the living organisms that are reliant on it, including species 'shared' with protected areas and other countries*.

These impacts are especially important for highly endangered species and populations such as the coastal humpback dolphin, of which a small population of fewer than 100 individuals (Vermeulen et al. 2017) lives along the KZN coast north of the Tugela River especially around Richards Bay harbour, and the two turtle populations which nest in the reserves of northern KZN – only 80 leatherback turtles are estimated to remain here (see 3.2.7, ME report). The fluid and interconnected nature of the oceans and the vulnerabilities of spatial planning is most evident in the massive areas

potentially affected by oil in the case of a blowout. Although the accuracy of the existing oil spill modelling has been questioned (Bracco 2020, Cordes 2020, Paris 2020), even the approach used in the existing models, showed that it is likely that oil released in the southern drilling block off Durban, would end up off East London, 100s of km away, within a matter of days (e.g. scenario 2a in Fichera 2018). Note that these models are built on averaged conditions and not extreme weather events which would likely be the true 'worst case scenarios'.

Although the ME Report (MER) is largely accurate in its interpretation of impact levels based on standard industry guidelines, and it does a good job at covering a wide range of subjects and species, it is inherently limited by the desktop-top only nature of the study and *falls short in addressing longer-term perspectives on the project* (production and transport). Cordes review of the MER highlights some of the shortcomings of the report notably in terms of benthic life forms including deep water corals and sponges, for which almost no data were available, and the lack of accounting for 'oil at depth' in the event of an oil spill, which was a significant contributor to deep sea ecosystem damage in the Deepwater Horizon spill. Fournet's review of the MER relates to the impacts of noise and highlights several shortcomings – notably a lack of noise modelling for any stage of the project (exploration, production etc.) in the EIA which would help to better estimate the impact of noise into protected areas, the impacts of noise on specific prey and top predator species, and an assessment of long-term changes in the marine soundscape which may affect both local and migratory species.

Further, some of the *language used* related to the scale of impacts, although mostly correctly interpreted in light of existing industry definitions (but see Cordes review of MER, where he highlights several areas where impacts should likely have been given higher values), could be considered misleading to those not familiar with industry terminology. Notably, impacts are considered 'minor' or 'moderate' if they only produce impacts for a short period, affect only a portion of a species or habitat or are of a very low likelihood (e.g. oil spills). However, these broad definitions *still allow for a significant amount of damage to life and habitats to take place*.

In light of these shortcomings in data and modelling information, a *strongly precautionary approach* must be taken when considering the potential impacts of this project and all its future implications. If the project is still considered for further development, effort must be made to fill in these significant data gaps (e.g. benthic impacts, marine mammal presence, oil spill routes under extreme weather events).

A note on wording and categories of Impact:

The terms used by the ME to classify the magnitude of an impact by Extent, Duration, Scale, Frequency as well as the Sensitivity of the receiver, are widely applied in the impact assessment field and largely defined by SA EIA Regulations. The MER provides an overview of how various magnitudes and impacts are combined with sensitives to form final measures for planned activities on pages 79-83 of the report, and unplanned accidents on p135.

'*Minor impacts*' are defined in Table 13, ME report, are those which have:

1) an Impact of *Medium Magnitude* on Receptors with *Low Sensitivity* or

2) an Impact of *Small Magnitude* on receptors with *Medium Sensitivity*.

Small Impacts affect "*a specific area, system, aspect (physical), group of localised individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels over a short time period*"

Medium Impacts affect "*a portion of an area, system, aspect (physical), population or species at sufficient magnitude to cause a measurable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) and may bring about a change in abundance and/or distribution over one or more plant/animal generations, but does not threaten the integrity of that population or any population dependent on it (physical and biological).*"

The ME report describes the process for the assessment of the impact of **accidental events** on p135. Accidental or unplanned events are described as those "which may conceivably occur as a result of project activities (e.g. vessel accidents and loss of well containment/blowout), but with a low probability ... and the risk significance is based on a *combination of the likelihood (or frequency) of the incident occurring and the consequences of the incident should it occur.* The assessment of likelihood and consequence of the event also *includes the existing control and mitigation measures* for this project" [edited for brevity, italics my own]

Specific points of concern.

Available Data is lacking:

The ME Report is a desktop only study and thus lacks key baseline information on species presence and their potential responses and recovery rates to impacts. This is well acknowledged within the report but it means that in key areas, decisions to grant the environmental authorisation for the proposed project may have been made in the absence of adequate data.

The ToR from ENI to the ME were for a desktop study requesting largely generalised descriptions. Desktop studies are limited in what they can achieve as they are reliant on published or grey literature and are usually forced to make on extensive projection of information from nearby or similar areas. Therefore, the results of the ME Report are within this framework and limitations.

However, given the lack of surveys and published information in this offshore environment, especially the benthic environment it is clear that there are significant data gaps in terms of even basic information such as species presence and diversity, let alone more detailed information on aspects such as behavioural or physiological responses to human impacts or population recovery rates etc.

Cordes, provides a good overview of multiple shortcomings in the available data and its potential impacts with a focus on benthic environments and life forms. Another area where recent data are notably missing is for cetaceans (whales and dolphins). Some information is available from nearshore studies (e.g. humpback dolphins: Atkins et al. 2016, and humpback whales: Findlay et al. 2011). However, the offshore areas impacted by this project have no information available on even basic data such as species presence, numbers or behaviours since the end of commercial whaling in the 1970s, when regular observations were made a wide variety of deep water species such as sperm whales, killer whales and the poorly known (and very sound sensitive) beaked whales. Substantial ecosystem changes have occurred since this time as well as substantial recovery of most large whale stocks, so decisions are being made on nearly ~50 year old data.

The lack of available biological data especially in deeper waters, and the uncertainty in other areas such as oceanographic conditions, oil spill modelling and long-term environmental changes, clearly hampers the ability of the MER to provide definitive answers on the nature and scope of impacts of this project. Given that surveys of potential drilling sites using remotely operated vehicles (ROVs) are planned as part of the drilling procedures to aid in site selection, it is entirely feasible and reasonable that surveys like this (as well as for cetaceans and turtles), should be done as part of the EIA and *prior to environmental authorisation* to allow for a fully informed assessment of environmental impacts on these poorly known habitats.

Subsequently, it is reasonable to conclude that the decision makers *did not have sufficient information at their disposal* to make an accurate assessment of the real impact of the operation.

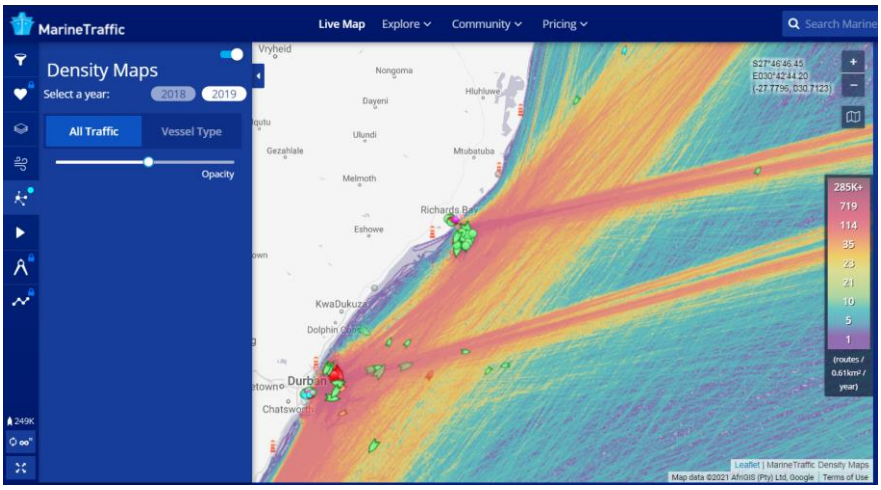
Ship strikes on megafauna:

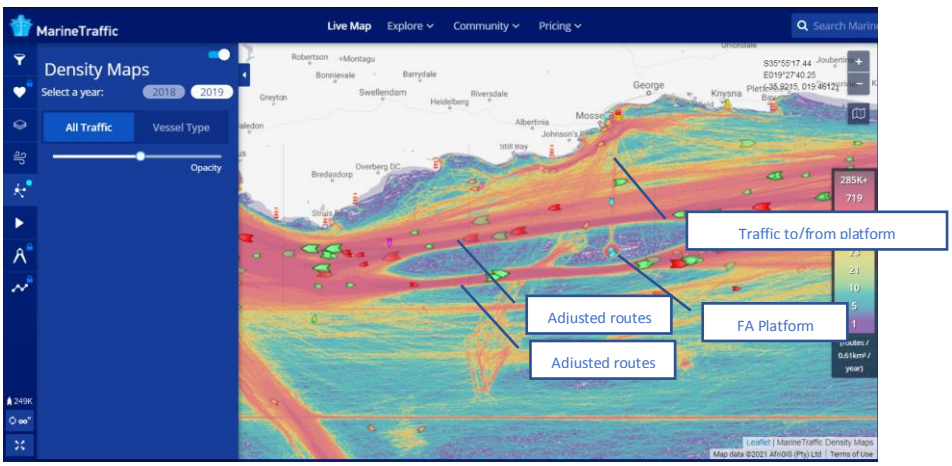
Although the total number of vessels and trips involved in exploration and production will be small in comparison to existing traffic in area from the ports of Durban and Richards Bay as well as those transiting the east coast of Africa – those vessels will be using new routes and importantly will likely result in changes in existing shipping routes to avoid the production platform during the decades long production phase, which may follow if the findings of exploration are favourable.

The ME report does not sufficiently address the issues related to vessel traffic associated with the project during the operational phase or the impact (noise, ship strikes) on other vessels which will be forced to adjust course due to the large traffic exclusion zones around oil production rigs.

I provide below two screen shots of averaged heatmaps of AIS derived boat traffic density from www.MarineTraffic.com for the 1) impact area off Durban and Richards Bay to show the high traffic density in this area and 2) a similar chart for the area encompassing Mossel Bay port and the Oil Production Platform almost due south thereof. In this image you can clearly see the density of traffic associated with trips between these locales, as well as the massive shift in other shipping around the platform area.

Given the sensitive nature of many of the areas surrounding the potential drill sites –the *cumulative increase* of more ship traffic as well as *adjusted ship traffic routes* and their associated increases and concentration in noise and pollution, **could have an as yet unconsidered negative effect on the environment** – notably by increasing traffic density into sensitive habitats, protected areas or migration routes.





Evaluation of the Impacts of noise:

The ME Report notes noise from drilling and helicopters as "minor" to "negligible", and noises from Vertical Seismic Profiling and noise transfer to key canyon habitats is not addressed. The assessment of the ME aligns with widely used industry standards. Note that M Fournet's review of the MER deals with the impacts of sound in substantially more detail.

Re Helicopter noise. Although behavioural responses of marine mammals have been noted to close approaches or fly overs of helicopters, these have all be short term behavioural responses such as changes in dive times or area avoidance (see Jepson et al. 2013 p 15 for general overview). As helicopters typically approach and leave landing sites quickly they will only likely to be low enough to have an impact on animal behaviour for a matter of minutes in any week. Given the low density of cetaceans at that depth, there is likely be a low chance of any animals passing within the audible impact zone during any landing or take off. Given the high use of helicopters around ports including V&A in Cape Town and Richards Bay/Durban where commercial flights and port ship pilots are ferried by helicopter with great regularity, any additional impact from this project seem small and I concur that the ME's assessment that Increase in Noise" is ***reasonably assigned as a 'Minor Impact'.***

Given the definitions on impact scale above (which are widely applied in the impact assessment field), the desktop-only nature of the report, the ephemeral and/or localised nature of many of the noise sources in this project, relative to existing impacts (i.e. other ship traffic) and the environment/populations it is likely to affect (assuming a very cautious zone of 5km radius for behavioural changes), and even accounting for unknowns such as the next location of drill sites - the ME's assessment that "Increase in Noise" is ***reasonably assigned as a 'Minor Impact'.***

However***, all impacts will be negative*** and contribute to a growing suite of cumulative impacts, the implications of which are not well understood and extremely challenging. Assessing the population level consequences of multiple smaller or more localised stressors is a relatively new and growing study field (Pirotta et al. 2018, Booth et al. 2020, Derous et al. 2020).

Re: Impacts of noise from "Vertical Seismic Profiling" The ME Report (page 116) considered the impact "insignificant and will not be assessed further here." There is accordingly *no impact rating for VSP*. However, the acoustic specialist (Fournet) raised several concerns related to the numbers and specifics used in the ME report (mainly source volume/amplitude and the lack of information on this method, lack of propagation modelling and underestimation of the duration of this survey method).

The ME report states "*VSP source generates a pulse noise level around 190 dB re 1µPa at 1m in the 5 to 100 Hz range and decreases rapidly with distance from the source*." Although 190dB is a loud sound, it is on a par with the known source levels of large ships such as super tankers and container ships (the sounds of which are continuous and would be audible to whales for 10s of minutes to hours), as well as the source levels of some natural sounds including blue (McDonald et al. 2001) and fin whale (Weirathmueller et al. 2013) calls. The frequency of the VSP pulse is below the peak hearing sensitivity of most dolphin species but broadly overlaps with the vocalisation frequency (and thus peak hearing sensitivity) of many baleen whales. Humpback and southern right whales mostly communicate in frequencies above 100Hz(Hofmeyr-Juritz & Best 2011, Erbe et al. 2017, Marley et al. 2017), while other baleen whales such as Omura's, sei, blue and fin whales overlap more directly in this frequency band with calls from ~20 Hz upwards (e.g. (McDonald et al. 2005, Cerchio et al. 2020). So there is clear potential for masking of calls from this source as well as other engine noises, although given the impulsive nature of the signals this must be considered brief and of negligible impact compared to shipping. Further, the VSP signal produced is directed into the sea floor so sounds in the water are likely to be much softer. Given the above, I agree with the ME's assessment

that the impact is likely small, although given the wide range of unknowns this ***should have been formally evaluated and not simply assumed***.

Re: Overall noise from drilling activities (i.e. section 4.3.4 in the ME report) were assigned as minor/negligible impact from the 'entire operation' inclusive of ships, drilling, helicopters, VSP etc and not any one specific operation (as above).

Given the impact definitions above (which are widely applied in the impact assessment field), the desktop-only nature of the report, the ephemeral and/or localised nature of most noise sources relative to existing impacts (i.e. other ship traffic) and the environment and populations it is likely to affect (assuming a cautious zone of 5km radius for behavioural changes of most smaller animals), I concur that the ME's assessment that Increase in Noise" for the exploration is *reasonably assigned as a 'Minor Impact' given industry guidelines.*

However, this assessment ***does not adequately capture*** the long-term implications of this project. Although exploration is relatively short, production will continue for decades, resulting in increased shipping and noise between shore and the rigs (and its associated sound), as well as result in adjusted shipping routes for other vessels (see above) which will have significant impact on the noise levels over a wide area of the KZN coastline (including in protected areas). Given the unknowns of this deep water environment, such as the potential for novel and poorly known species to occur in the benthic environment (sponges, corals etc), the lack of reasonable data on cetaceans present in the area or their behaviour (notably sound-sensitive beaked whales which were historically caught there in high numbers), the duration of the impact (decades for production) and the still expanding understanding of the *negative impacts of noise* on an increasingly wide range of species, I concur with Fournet's acoustic specialist report that the ***impacts of noise have likely been underestimated and not been adequately assessed.***

Re: Impacts of noise on canyons and sensitive habitats – The ME report states (p116) that "*As no drilling operations will be performed in canyons, direct and indirect impacts of noise on sensitive receptors associated with such habitats would be avoided.*"

Although I concur with the ME that this seems reasonable from a NOISE perspective most impacts, even behavioural ones tend to occur within 5km of a source, Fournet rightly points out that there are a significant number of unknowns (bathymetry, bottom type, propagation parameters) and that without a good sound propagation model, it is not reasonable to draw conclusions.

However more importantly the ME report largely only accounts for noises for the exploration drilling phase and makes little account for long term changes in the soundscape due to the project or it's knock-on effects. Noise impacts during production may be significant, especially if shipping channels are adjusted to bypass any platforms as is done in Mossel Bay (see above), in which case noise impacts would be from vessels associated with the platform as well as contributions from all other vessels passing around the coast.

Evaluating noise impacts (and other impacts, for that matter) of exploration drilling in isolation from subsequent production activities draws an artificial distinction between two very interrelated processes. The two are necessarily interlinked as production will likely follow exploration, if successful.

RE: Role of noise and vibrations may in causing localized behavioural changes or call-masking.
The ME report states that there is no evidence of significant behavioural changes that may impact on the wider ecosystem. These impacts are assessed to be "minor".

As addressed above, given the scale of impacts needed to be assessed as anything above 'minor', any behavioural impacts related to noise (even major ones) during the exploration drilling phase would largely be localised and temporary in nature, so the assessment of "***minor"*** is likely reasonable within general guidelines of EIAs even if the potential impacts affect large numbers of animals.

However – a fundamental shortcoming in impact assessments of this nature is the lack of data and studies in the target environment (drill site) and broader impact (affected shipping routes etc). A similar project on land would likely require an in-depth biodiversity assessment of the impact area to identify species presence across a range of taxa (insects, mammals, reptiles, plants etc) and identification of key behaviours (e.g. bird migration routes), sensitive species etc. As the target environment in this case is the deep ocean floor the vast majority of this information is lacking and yet a desktop review is regarded as sufficient.

This is an aspect that should be considered in the EIA process, and by decision-makers. I suspect (but do not know) that as the scale of the areas involved is much larger than a similar terrestrial site and is as ocean floor habitat is relatively more uniform, an approach to impact assessment is used in the industry that "Since we can't do it properly we won't do it at all" and literature surveys, extrapolation and expert opinion are regarded as good enough.

RE: Impact on MPAs, CBAs and EBSAs from oil-release events.

All these aspects fall under the Assessment of Impacts from Accidental Events within the ME Report, rather than more predictable impacts of known and regular activities (shipping, noise, drilling etc). The calculation of risk for *accidental activities* differs from that for planned activities in that it is "based on a combination of the likelihood (or frequency) of the incident occurring and the consequences of the incident should it occur" (ME report p134).

The Impact Assessment for any of the oil spill scenarios above is based on the initial oil spill modelling report. This report was questioned by Paris and by Bracco who points out several key shortcomings including that the model used relies on long-term averages and fairly broad spatial scales and thus often underestimates current speeds and variability, and may miss important changes in direction with depth resulting in higher oiling levels reaching key habitats. In the two scenarios considered by the ME which provide a percentage chance of oil reaching the coastline, these are 7.5% (scenario 1, near surface spill for one hour) and 8.3% (scenario 3, Riser disconnect). Given the unknowns and errors pointed out by Bracco, it is highly likely that remodelling of these scenarios would result in a much higher likelihood of oil reaching the coast (or other important habitats) and that the assessment of risk as 'minor' is likely an underestimate.

Further considerations: The oil spill modelling is based on *averaged* oceanic conditions over a period, or rather *average results* of spills modelled over a period (Jan 2013 to Feb 2018, p28, Annex D4). By definition – these *do not then account for a 'worst case scenario'* which would involve a spill under 'unfavourable' conditions, for example a tropical storm, onshore winds or unusual current conditions.

Accidents are most likely to happen in extreme weather conditions (see figure below taken from Necci et al. 2019 review of World Offshore Accident Database). The Agulhas Current area can be very powerful and hurricane level storms and other extreme events happen with regularity in this area (for example, Hurricane Domoina 1986, floods 1987, coastal erosion event 2007, Storm Irina 2012, Cyclone Kenneth in 2019), and references within the ME report of giant waves over 20m high recorded within the Agulhas current. There is a clear trend in global and African climate conditions for an increase in the frequency and power of 'extreme weather conditions' as well as subtler changes such as shifts in storm tracks (Davis-Reddy & Vincent 2020, Miller et al. 2020). I can see no reference within either the oil spill modelling report (Annex D4) or ME report (Annex D1) of either extreme weather conditions or the likely increase therein over the coming decades when oil extraction will likely be taking place.

Furthermore, neither the ME report nor the Oil Spill report consider oil spills from other sources during the production phase. Nowhere is it clearly described in these documents how oil will be transported away from the drill site once production begins. In Mossel Bay on the SA south coast gas is piped over 100km to shore (likely the best option here given local experience with the method and local weather conditions), in other locations, gas and oils are pumped to a floating storage platform (FPSO) before transfer to another vessel. During production, potential locations of ***oil spills would not be limited to around the drill site***, which substantially changes the implications of spills for any protected areas.

Direct routes or reasonably short routes from the likely drilling site (Areas of Interest) to Richards Bay harbours pass directly through the uThukela MPA. Even assuming a buffer is applied around the MPAs, it would be challenging to keep transport corridors more than 10km from the northern end of the MPA or the more than 25km from the southern end of iSimangaliso. Using Durban harbour would bring transport corridors within roughly 25km of the southern end of the uThukela MPA and the northern end of the Aliwal Shoal MPA.

uThukela has been developed as an MPA to protect a wide range of unique and sensitive habitats including estuaries, and sandy beaches, soft corals and sponge habitats and a range of mammal, turtle and fish species; the Aliwal Shoal MPA protects the unique reef systems of the shoal and their associated fish and top predators; iSimangaliso MPA also protects a wide range of habitats and species, notably small breeding populations of leatherback and loggerhead turtles.

Since production will continue for years to decades the chance and implications of accidents happening then are far more important than accidents during the brief exploration phase. iven these short comings, it is likely that the potential impacts of oil spills have been significantly underestimated and given the value of surrounding habitat and the potential impacts thereon, decisions should be based on 'worst case' scenarios and not averaged scenarios. The implications of oil spills over a much wider potential source area, and much longer time frame, while taking into account changing environmental conditions and increasing extreme weather events, must be considered in the environmental impact assessment process.

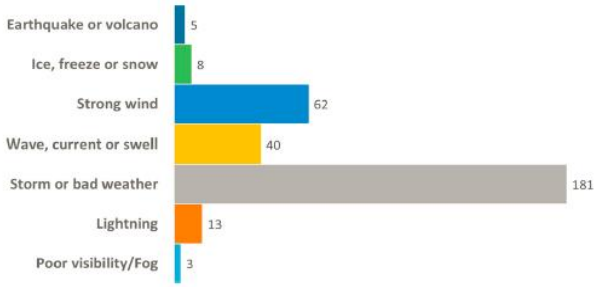


Fig. 3. Distribution of incidents by natural event trigger.

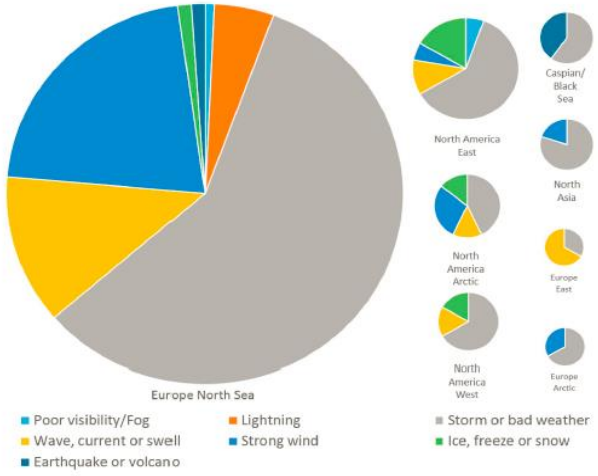


Fig. 4. Relative distribution of incidents per natural hazard trigger and geographic location.

Fig 4 from Necci et al. 2019. Lessons learned from offshore oil and gas incidents in the Arctic and other ice-prone seas. Highlighting that the vast majority of accidents in the offshore oil and gas industry are caused by extreme weather events – which are likely be increasing in both frequency and power globally

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