FINAL BASIC ASSESSMENT REPORT FOR THE PROPOSED PROSPECTING IN SEA CONCESSION AREA 10B BY TRANS ATLANTIC DIAMONDS (PTY) LTD

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Appendix 3:

Marine Specialist Study

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TRANS ATLANTIC DIAMONDS

MARINE SPECIALIST IMPACT ASSESSMENT FOR EXPLORATION AND PROSPECTING ACTIVITIES IN SOUTH AFRICAN SEA AREA 10B

August 2022

ANCHOR environmental

Anchor Environmental Consultants Report No. 2039/2

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Report prepared for:

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EXECUTIVE SUMMARY

Anchor Environmental Consultants were requested to undertake a marine specialist study for Trans Atlantic Diamonds (Pty) Ltd who are applying for a diamond prospecting right for Concession Area 10B, located offshore of the Northern and Western Cape coastlines of South Africa. It is located approximately 13 km south-west of Lepelsfontein and extends for approximately 31.5 km of the coastline. Water depth across the concession area ranges from approximately 15 m to 95 m.

Proposed activities include geophysical exploration and sampling/prospecting to detect the presence of paleo-beach deposits at different submerged sea levels that occur in Concession 10B, which are known from other concessions to contain diamondiferous gravels. Seismic surveying will be conducted using a dedicated survey vessel with a hull-mounted MBES (high frequency range) and Topas sub-bottom profiler (SBP) system (mid-frequency range) collecting high-resolution acoustic data along lines 50 m to 200 m apart throughout the concession area. Sampling will be undertaken in targeted areas identified through the analysis of the acoustic survey data. Four potential methods of collecting geophysical samples from the seabed are being considered. A Van Veen grab with a sampling capacity of approximately 50 kg will be used to collect baseline environmental data on sediment and benthic macrofauna at 20-50 sites. Geotechnical samples to assist in understanding the sea floor geology and resource evaluation will be collected at 100-200 sites using either vibracoring, gravity coring or sonic coring.

In addition to this, the applicant has proposed prospecting with a uniquely designed drill tool that can dredge gravel from the seabed. Pending the final tool design, the drill bit footprint will be between 3 and 5 m^2 with an expected average hole depth of 3 m. Sample volumes are anticipated to be in the range of 9 to 15 m^3 per sample. An estimated total of 300 samples spaced at roughly 300 m apart from north to south will be required in two sampling phases of 150 samples each. This equates to a surface area of 1500 m^{2,} and 4500 m^3 of sediment (based on a drill size of 5m^2). Material from drill sampling will be processed onboard and tailings will be discarded overboard in a designated area to avoid sensitive habitats, reefs and important fishing areas, thereby causing temporary sediment plumes. In the resource development phase, 20 potential resource areas of not larger than 500 m x 300 m will then be identified and require an additional 60 of these samples spaced on a 50 m grid. This equates to 1 200 samples covering a surface area of 6 000 m^2 (based on a drill size of 5 m^2), and a total volume of 18 000 m^3. A sampling rate of 30 samples per day would equate to a period of approximately 40 days including the original 300 samples. It must be noted that this drilling methodology and the associated noise, vibration, disruption to the seafloor, and sediment plumes have been identified as destructive sampling within this specialist assessment and has been assessed as having potentially MEDIUM significance negative impacts on local benthic communities. Recent Marine spatial planning documents have identified destructive sampling as a prohibited activity within the Namaqua Coastal Area EBSA or the CBA area (Harris *et al.* 2022). The acoustic surveying, coring and Van Veen Grab sampling are considered non- destructive and potential impacts of these activities are assessed as very low. The low impact nature of acoustic sampling and coring makes these activities permissible within this area. Cumulative impacts with this necessary essential mitigation have been rated as VERY LOW

A description of the affected environment is provided. Habitat and biota of conservation importance were identified and mapped in relation to the proposed survey area. The likelihood of occurrence of

affected marine fauna within the proposed survey area was ascertained from available literature. Important user groups such as fisheries are described and mapped in relation to the proposed survey area. Potential impacts from the proposed exploration and prospecting activities were identified. Impacts were assessed and, where possible, mitigation measures have been identified to avoid/minimise/reduce any impacts.

Assessment of potential impacts associated with the proposed activities range from medium to insignificant, but with effective mitigation these are all reduced to very low, low or insignificant (see Summary Table below).

The potential impacts of most concern that were assessed as MEDIUM negative significance prior to mitigation were seismic disturbance to marine mammals, seabed sampling, and impacts on the Namaqua Coastal Area EBSA and CBA. It is known that migrating humpback and southern right whales are frequently encountered on the west coast of southern Africa and encounters with odontocetes such as dusky dolphins and Heaviside's dolphin (the latter is listed as near threatened on the IUCN red data list) are likely throughout the year. Furthermore, humpback calves are vulnerable during the southern migration which takes place during the months of September and October. Of the proposed seismic survey activities, the Topas sub-bottom profiler system which uses shallow (35-45 kHz) and medium penetration (1-10 kHz) "Chirp" seismic pulses to map the sediment horizon could present a risk to dusky and Heaviside's dolphins. These species are regarded as mid-frequency cetaceans that could be at risk during the proposed seismic survey. Effective implementation of mitigation measures should ensure that potential impacts on marine mammals arising from the proposed seismic survey activities in concession 10B would be reduced to LOW significance. Cumulative impacts, however, are assessed to be of MEDIUM significance (duration increased long-term).

Table i **Summary table of potential marine ecological and fisheries impacts associated with offshore diamond exploration activities (seismic survey and sampling/prospecting) in South African Sea Area concession 10B.**

Impact	Consequence	Probability	Significance	Status	Confidence
Seismic disturbance to invertebrates	Very Low	Probable	**VERY LOW**	-ve	Medium
With Mitigation	Very Low	Probable	**VERY LOW**	-ve	Medium
Cumulative Impact	Medium	Probable	**MEDIUM**	-ve	LOW
Seismic disturbance to fish No mitigation	Very low	Possible	**INSIGNIFICANT**	-ve	Medium
Cumulative Impact	Medium	Possible	**LOW**	-ve	Low
Seismic disturbance to marine mammals	Medium	Probable	**MEDIUM**	-ve	Medium
With Mitigation	Low	Improbable	**VERY LOW**	-ve	Medium

Impact	Consequence	Probability	Significance	Status	Confidence
Cumulative Impact	High	Improbable	**MEDIUM**	-ve	Low
Seismic disturbance to seabirds	Very low	Possible	**INSIGNIFICANT**	-ve	High
With Mitigation	Very low	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative Impact	High	Improbable	**MEDIUM**	-ve	Low
Seismic disturbance to turtles With/ Without Mitigation	Very Low	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative Impact	Medium	Improbable	**LOW**	-ve	Low
Marine megafauna collisions with survey vessels	Low	Possible	**VERY LOW**	-ve	High
With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative Impact	Medium	Possible	**LOW**	-ve	Low
Benthic impacts of seabed sampling and tailings disposal	Medium	Definite	**MEDIUM**	-ve	High
With Mitigation	Low	Probable	**LOW**	-ve	Medium
Cumulative Impact	Medium	Probable	**MEDIUM**	-ve	Low
Fine sediment plumes	Very low	Definite	**VERY LOW**	-ve	High
With Mitigation	Very Low	Definite	**VERY LOW**	-ve	Medium
Cumulative Impact	Very low	Definite	**VERY LOW**	-ve	Low
Waste discharges during vessel operations	Very low	Probable	**VERY LOW**	-ve	High
With Mitigation	Very low	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative Impact	Low	Improbable	**VERY LOW**	-ve	Low
Impacts on objectives of Namaqua Coastal Area EBSA and adjacent CBA	Medium	Definite	**MEDIUM**	-ve	High
With Mitigation	Very low	Probable	**VERY LOW**	-ve	High

Impact	Consequence	Probability	Significance	Status	Confidence
Cumulative Impact	Medium	Probable	**MEDIUM**	-ve	Low
Impact on fisheries	Very Low	Possible	**INSIGNIFICANT**	-ve	High
With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative Impact	Medium	Possible	**LOW**	-ve	Low

Seismic disturbance to seabirds was assessed to be of LOW risk and with the implementation of mitigation (see below) is reduced to INSIGNIFICANT. For the cumulative impact assessment, however, the extent increases to regional and duration increases to long-term (>15 years), and this raises the overall consequence from very low to high and the overall significance from INSIGNIFICANT to MEDIUM. However, our confidence for the assessment of cumulative impacts decreases from medium to low due to the paucity of information available on the current and planned activities of all the various rights holders.

The impact of prospecting on the Namaqua Coastal Area EBSA and Adjacent Critical Biodiversity Area is of concern and will have serious impacts should the 3-5 m^2 drill be used, with an impact rating of MEDIUM. This methodology is not compatible with the EBSA objectives as it is considered to be destructive sampling due to the large amount of sediment removed from the sea floor, noise and vibration created, high sample intensity during the Resource Development Phase, and turbidity associated with the plumes generated (assuming that plumes are discarded of in sensitive areas) and will have negative impacts on the surrounding benthic and pelagic communities. This high level of concern is largely due to the majority of the EBSA area being classed as a critical biodiversity area which is in a natural state. Destructive prospecting within CBA's is not permitted according to the 2022 National Coastal and Marine Spatial Biodiversity Plan (Harris *et al*. 2022). Since the entirety of Concession 10B is considered to be a CBA, this form of prospecting should not be permitted. Recommended essential mitigation is, therefore, for this destructive sampling to not take place within the concession. The caveat to this assessment is that, due to the low impact nature of acoustic sampling, small sample coring (10 cm diameter), and grab samples, we consider these activities as non-destructive prospecting and permissible within this area. Finally, should mining then be considered in this concession, the impacts will require "alternative CBAs and/or biodiversity offsets to be identified, and if this is not possible, the activity should be prohibited. However, if it is not possible to identify alternative CBAs to meet targets for the same biodiversity features that are found at the site, it is recommended that the activity remains prohibited." (Harris *et al*. 2022). With mitigation, the impacts on the EBSA and CBA are reduced to VERY LOW. Cumulative impacts with this necessary mitigation have been rated as MEDIUM.

Temporary exclusion of fishing vessels from the concession area during seismic survey and sampling/prospecting activities is also of potential concern. The historical fishing catch and effort reported by the potentially affected small pelagic sector in the 10B concession area is of insignificant national importance but may well be significant at an individual vessel and right holder level. However, the lack of overlap with fisheries data, coupled with the lack of nearby coastal settlements further show that the area is of limited significance for South African fisheries. The impacts were assessed to be INSIGNIFICANT without mitigation and NEGLIGIBLE with mitigation, albeit with an even lower probability of the negative effect occurring. When looking at cumulative impacts, the extent increases to regional, and duration increases to long-term (>15 years), and this raises the overall consequence from VERY LOW to LOW, however, the confidence in this assessment is reduced to low.

Offshore reef habitat is expected to be encountered in concession 10B. These offshore rocky reefs are colonised by a range of epifauna including bryozoans, encrusting and upright sponges, solitary and colonial ascidians, sea anemones and cold-water coral colonies – the latter being slow-growing and taking many years to become established. These reefs are considered sensitive habitat that must be identified from the seismic survey data and avoided when undertaking destructive sampling (with a suitable 100 m buffer to prevent smothering from tailings disposal). Baseline data on the reef habitat for monitoring purposes should be collected using drop camera during the grab sampling survey.

Mitigation measures recommended to reduce the severity of the potential impacts associated with the proposed prospecting in Concession 10B are summarised below.

Essential mitigation measures:

- A designated onboard Marine Mammal and Seabird Observer (MMSO) to ensure compliance with mitigation measures during geophysical surveying.
- MMSO to conduct pre-survey visual scans of at least 15 minutes for the presence of cetaceans, feeding seabirds and marine turtles around the survey vessel prior to the initiation of any acoustic impulses.
- "Soft starts" should be carried out for equipment with source levels greater than 210 dB re 1 µPa at 1 m over a period of 20 minutes to give adequate time for marine mammals to leave the vicinity. Where this is not possible, the equipment should be turned on and off over a 20-minute period to act as a warning signal and allow cetaceans to move away from the sound source.
- Terminate the survey if any marine mammals, seabirds or turtles show affected behaviour within 500 m of the survey vessel or equipment until the mammal has vacated the area.
- Avoid planning geophysical surveys during the movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (beginning of June to end of November) and ensure that migration paths are not blocked by sonar operations.
- For the months of June to November ensure that Passive Acoustic Monitoring (PAM) is incorporated into any survey programme.
- Record incidences of encounters with marine life (mammals, seabirds, turtles, seals, fish) their behaviour and response to seismic survey activity. Ensure that MMSOs compile a survey close-out report incorporating all recorded data to the relevant DFFE authorities.
- Vessel transit speed not to exceed 12 knots (22 km/hr), except within 25 km of the coast where it should be kept to less than 10 knots (18 km/hr), as well as when sensitive marine fauna are present in the vicinity.

- Acoustic surveying, coring and grab sampling can take place over the entire concession due to their low impacts, however, all destructive sampling activities which utilise the large 3-5 m^2 drill must not be conducted.
- No tailings discharge to take place within a buffer of at least 100m from identified reefs and sensitive areas of potential ecological significance.
- Minimise prospecting activities within the northern-most section of Concession 10B closest to the MPA, to further reduce the chance of negative impacts occurring due to prospecting activity.
- Minimise prospecting activities along the southern boundary of Concession 10B, to reduce the possible impacts to the Sout Rivier estuarine habitat
- If possible, prospecting should primarily take place on the seaward side of the concession area, to minimise the risk to endangered and vulnerable coastal ecosystems.
- Prospect outside of fishing seasons, i.e., snoek line fishing peak during April- May.
- Conduct the survey outside of the main fishing season and time of peak recruitment of juvenile pelagic fish in this area (i.e. Conduct prospecting during August – December)

Best Practice Mitigation (Recommended):

- Planning and management of potential discharges to ensure that tailings are not discarded onto potentially sensitive habitats;
- Inform & empower all staff about sensitive marine species & suitable disposal of waste;
- Ensure compliance with relevant MARPOL standards;
- Develop a waste management plan using waste hierarchy;
- A Shipboard Oil Pollution Emergency Plan (SOPEP) must be prepared for all vessels and should be in place at all times during operations;
- Deck drainage should be routed to a separate drainage system (oily water catchment system) for treatment to ensure compliance with MARPOL (15 ppm);
- All process areas should be bunded to ensure drainage water flows into the closed drainage system;
- Drip trays should be used to collect run-off from equipment that is not contained within bunded areas, and the contents routed to the closed drainage system;
- Low-toxicity biodegradable detergents should be used in the cleaning of all deck spillages;
- All hydraulic systems should be adequately maintained, and hydraulic hoses should be frequently inspected;
- Spill management training should be provided, and crew members made aware of the need for thorough cleaning-up of any spillages immediately after they occur in order to minimise the volume of contaminants washing off decks; and
- Prior to survey commencement, key stakeholders (Potentially affected Fishing Industry Associations, organs of state and neighbouring concession holders) should be consulted and informed of the proposed survey activity and the likely implications thereof.

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LIST OF ABBREVIATIONS

Anchor/ AEC	Anchor Environmental Consultants (Pty) Ltd.
BCS	Benguela Current System
CBA	Critical Biodiversity Area
CBD	Convention on Biological Diversity
CPUE	Catch per unit effort
DFFE	Department of forestry, fisheries and the Environment (Formerly DEFF and DAFF)
DIN	Dissolved Inorganic Nitrogen
DMR	Department of Mineral Resources
DO	Dissolved Oxygen
EBSA	Ecologically or Biologically Significant Area
EEZ	Exclusive Economic Zone
FLO	Fisheries Liaison Officer
IBA	Important Bird and Biodiversity Area
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature
LMP	Linefish Management Protocol
MARPOL	The International Convention for the Prevention of Pollution from Ships
MBES	Multi Beam Echo Sounder
MMI	Marine Mammal Institute
MMO	Marine Mammal Observer
MMSO	Marine Mammal and Seabird Observer
MPA	Marine Protected Area
MPRDA	Mineral and Petroleum Resources Development Act (Act 28 of 2002, as amended)
MSL	Mean Sea Level
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act No. 107 of 1998, as amended
NH3-N	Ammonia
OMP	Operational Management Plan
PAM	Passive Acoustic Monitoring
PNE	Protected Natural Environment
PSU	Ocean salinity is generally defined as the salt concentration in sea water. It is measured in unit of PSU (Practical Salinity Unit), which is a unit based on the properties of sea water conductivity. It is equivalent to per thousand or (o/00) or to g/kg.
PTS	Permanent threshold shift
ROV	Remotely Operated Vehicle
RQO	Resource Quality Objectives
SADCO	Southern African Data Centre for Oceanography
SAMLMA	South African Marine Linefish Management Association
SAMSA	South African Maritime Safety Authority
SANBI	South African National Biodiversity Institute
SAPFIA	South African Pelagic Fishing Industry Association

SBP	Sub-bottom profiler
SOPEP	Shipboard Oil Pollution Emergency Plan
TAC	Total allowable catch
TAD	Trans Atlantic Diamonds (Pty) Ltd
TAE	Total allowable effort
TSS	Total Suspended Solids
TTS	Temporary threshold shift
VHF	Very High Frequency

GLOSSARY

Amphipod/a	Crustaceans with no carapace and a laterally compressed body
Anthropogenic	Environmental pollution originating from human activity
Baseline	Information gathered at the beginning of a study which describes the environment prior to development of a project and against which predicted changes (impacts) are measured.
Benthic	Pertaining to the environment inhabited by organisms living on or in the ocean bottom
Benthic/benthos	The ecological region at the lowest level of a body of water such as an ocean, lake, or stream, including the sediment surface and some sub-surface layers
Biodiversity	The variability among living organisms from all terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.
Biomass	The mass of living biological organisms in a given area or ecosystem.
Biota	Living organisms within a habitat or region
Bryozoan	A sedentary aquatic invertebrate of the phylum Bryozoa, which comprises the moss animals.
Chlorophyll a	A green pigment, present in all green plants (including algae) and cyanobacteria, which is responsible for the absorption of light to provide energy for photosynthesis.
Community	In ecology, a community is a group or association of populations of two or more different species occupying the same geographical area and in a particular time.
Community composition	The number of species in that community and their relative numbers.
Crustacea/n	Generally differ from other arthropods in having two pairs of appendages (antennules and antennae) in front of the mouth and paired appendages near the mouth that function as jaws.
Cumulative impacts	Direct and indirect impacts that act together with current or future potential impacts of other activities or proposed activities in the area/region that affect the same resources and/or receptors.
Diatoms	A type of phytoplankton group that form a silica-based cell wall.
Dinoflagellate	A type of flagellate phytoplankton. Some produce toxins that can accumulate in shellfish, resulting in poisoning when eaten.
Ecological function	The potential of an ecosystem to deliver a service that is itself dependent on ecological processes and structures.
Ecology	The relations of organisms to one another and to their physical surroundings.
Environment	The external circumstances, conditions and objects that affect the existence of an individual, organism or group. These circumstances include biophysical, social, economic, historical and cultural aspects.
Faunal community	A naturally occurring group of native animals that interact in a unique habitat.
Filter feeding	(Off an aquatic animal) feeding by filtering out plankton or nutrients suspended in the water.
Geomorphology/ical	Relating to the physical features of the surface of the earth and their relation to its geological structures.
Impact	A change to the existing environment, either adverse or beneficial, that is directly or indirectly due to the development of the project and its associated activities.

Important Bird and Biodiversity Area	An area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations.
Invertebrate	An animal without a backbone (e.g., a starfish, crab, or worm)
Isopod/a	An order of freshwater, marine, or terrestrial crustaceans of the order or suborder Isopoda, with seven pairs of legs and a dorsoventrally flattened body.
Macrofauna	Animals larger than 0.5 mm.
Macrophyte	An aquatic plant large enough to be seen by the naked eye.
Mean Sea Level	An average level of the surface of the oceans from which heights such as elevation may be measured. MSL is a type of vertical datum (a standardised geodetic datum).
Megafauna	Large marine species such as sharks, rays, marine mammals and turtles. These animals are key components of marine ecosystems but, as they are long-lived and have low reproductive rates, their populations are usually the first to be reduced by human pressures.
Mitigation measures	Design or management measures that are intended to minimise or enhance an impact, depending on the desired effect. These measures are ideally incorporated into a design at an early stage.
Mollusc/a	Invertebrate with a soft unsegmented body and often a shell, secreted by the mantle.
Operational phase	The stage of the works following the Construction Phase, during which the development will function or be used as anticipated in the Environmental Authorisation.
Physico-chemical	Dependent on the joint action of both physical and chemical processes.
Phytoplankton	Ocean dwelling microalgae that contain chlorophyll and require sunlight in order to live and grow.
Plankton	Organisms drifting in oceans, seas, and bodies of fresh water. The word zooplankton is derived from the Greek zoon, meaning "animal", and planktos, meaning "wanderer" or "drifter". Typically comprised of phytoplankton and zooplankton, as well as the eggs, larvae and juveniles of larger animals.
Polychaete/a	Also known as the bristle worms. A paraphyletic class of annelid worms, generally marine. Each body segment has a pair of fleshy protrusions called parapodia that bear many bristles, called chaetae, which are made of chitin.
Specialist study	A study into a particular aspect of the environment, undertaken by an expert in that discipline.
Species	A category of biological classification ranking immediately below the genus, grouping related organisms. A species is identified by a two-part name; the name of the genus followed by a Latin or Latinised un-capitalised noun.
Species richness	The number of different species represented in an ecological community. It is simply a count of species and does not take into account the abundance of species.

1 INTRODUCTION

Trans Atlantic Diamonds (Pty) Ltd (hereafter referred to as TAD) is applying for a prospecting right for Concession Area 10B, offshore of the Western Cape and Northern Cape coastlines. Anchor Environmental Consultants (Pty) Ltd (AEC) were appointed as the Environmental Assessment Practitioner (EAP) to undertake the required Basic Assessment Process and support TAD with this application. AEC has inhouse marine and fisheries specialist expertise and also undertook the Marine Specialist Impact Assessment Study.

1.1 Terms of Reference

This Marine Specialist Study was required to identify and assess potential impacts that the proposed prospecting activities could have on the marine environment and other user groups. The Terms of Reference included requirements for the following:

- A project description adequate for the purposes of the marine impact assessment study;
- A description of the marine ecology within and surrounding the affected area;
- The identification and description of potentially sensitive habitats and species receptors of impacts (e.g. endangered, threatened and protected species, important feeding, breeding or migration routes, sensitive habitats, etc.);
- The identification of other user groups and potential user conflict based on area of overlap and regional importance of the concession area (including fisheries, commercial and recreational vessel traffic, other marine mining activities);
- The identification of potential direct, indirect and cumulative impacts resulting from the proposed prospecting activities;
- An assessment of identified impacts and cumulative impacts using an objective, and consistent methodology that meets the National South African legislative requirements (National Environmental Management Act No. 107 of 1998, as amended); and
- The identification of mitigation measures to avoid/minimise/reduce impacts and enhance benefits.

1.2 Diamond mining in South Africa

1.2.1 Background

The first discovery of diamonds originating from marine deposits was in 1908 on the Namibian coastline near Lüderitz (Levinson 1983; Penney *et al*. 2007). This led to the discovery of vast diamond deposits along the west coast of southern Africa; extending from Hottentot Bay (Namibia) in the north, southwards to the Olifants River in South Africa (Gurney *et al*. 1991; Penney *et al*. 2007). The primary source of diamonds is kimberlite – igneous intrusions or "pipes" projecting through the Earth's crust (Gurney et al. 1991; Penney et al. 2007). These diamondiferous kimberlites have been eroded extensively since their formation and diamonds have been exposed to various transport mechanisms. Sediment transportation from kimberlites in the interior part of Southern Africa is largely confined to the Orange River drainage system (Dingle & Hendry 1984). For the past 80 million years, sediment has been transported from the continental interior to the Atlantic Ocean via two main river courses; the Orange and Olifants River (Gurney et al. 1991). These rivers are believed to be the major westward transport mechanisms responsible for deposition of diamondiferous sediments along the west coast of Southern Africa and southern Namibia (Gurney et al.1991; Penney et al. 2007). Some diamonds were deposited in gravel terraces along riverbanks, but the majority were carried down to the coast and deposited in the sea. With the influence of currents, swell and tidal action, diamonds gradually accumulated on gravel beaches along the coast (Penney et al. 2007). Today, these deposits extend from the coast down to 150 m depth (approximately 50–60 km offshore) where they are found in gullies and potholes which have been covered with sediment over time. It is this marine diamondiferous gravel which is of interest to the modern marine diamond mining industry (Penney et al. 2007).

Sea Concession 10B will likely host diamonds and other heavy minerals in bedrock depressions, palaeo-channels and wave-cut platforms on the Precambrian inner shelf bedrock surface. The offshore portion of Concession 10B will likely be typified by storm lag beach deposits at various sea levels below current sea level that are known to contain mineralised gravels containing diamonds and other heavy minerals and metals. These favourable mineralised sea silt sand levels have been well documented in various other sea concessions along the South African west coast. Years of erosion and natural forces (wind, rain, water currents) wash gemstones and other valuable minerals from their primary deposits in kimberlite pipes to beaches where they are typically deposited. TAD intends to undertake geophysical exploration (seismic survey) and sampling to detect the presence of Paleo-beach deposits, which are known from other concessions to contain diamondiferous gravels and precious metals, at different submerged sea levels.

1.2.2 Marine Concession Areas in South Africa

Diamond-mining concession areas in South Africa are grouped into three categories: Land, Surf-Zone and Marine (offshore) Concession Areas (Figure 1.1; Clark *et al.* 1999; Penney *et al.* 2007). The Land and Surf-Zone concessions areas are considered as “onshore mining” operations with mines located between the Orange River mouth and slightly south of the Olifants River in South Africa. While most of the diamond production in South Africa are large-scale land-based mining operations, marine and coastal diamond mining operations are rapidly increasing.

Marine Concession Areas are those allocated offshore and extend southwards from the border of Namibia to an area just south of Saldanha Bay (Clark *et al.* 1999). These concession areas are further divided into four sub-areas (Figure 1.1 and Figure 1.2): the A concession extends 31.5 m west of the low-water mark to 1000 m west of the high water mark, the B concession extends from this boundary to 5 000 m west of the high water mark offshore from the western boundary of A, the C concession extends westward of this point to the 200 m isobaths, and the D concession extends offshore to the 500 m isobath. Diamond mining concession areas in South Africa were mapped according to their licence (Figure 1.2). The exploration, prospecting and mining rights allocations (prior to 2018) are indicated in the inset map in Figure 1.2.

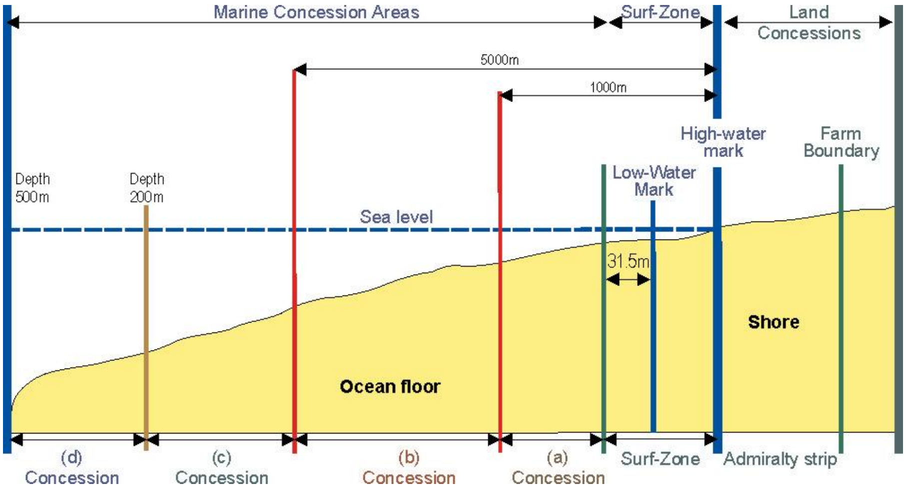


Figure 1.1. Diagram of the onshore and offshore boundaries of the South African marine diamond mining concession areas (from Penney *et al*. 2007)

A range of different techniques are used to access diamond resources in the marine environment. Typical onshore operators in the coastal environment use cofferdam and seawall mining techniques. Other methods for accessing resources in shallow subtidal gullies and small bays include, depending on the depth of the resource and access to the shoreline, shore and boat-based diving operations. Lastly, diamond mining operations also occur in the offshore environment where tools such as crawlers and drilling rigs are deployed from vessels to extract diamond-rich gravel from the seafloor.

1.3 Description of the proposed activity

The proposed prospecting programme will be completed within 5 years and includes a combination of non-invasive and invasive activities. The non-invasive activities are mostly related to geophysical exploration, data acquisition and analysis. The invasive activities are those related to sampling (collection of core, grab, and drill samples). Should a prospecting right be approved, it will allow TAD to determine if diamond mining within concession area 10B is economically viable. It is understood that the Prospecting Right will not provide the required environmental authorisation for mining activities to be undertaken. As such, any future intention to undertake mining within the application area would require a further application, specialist investigation and public consultation process.

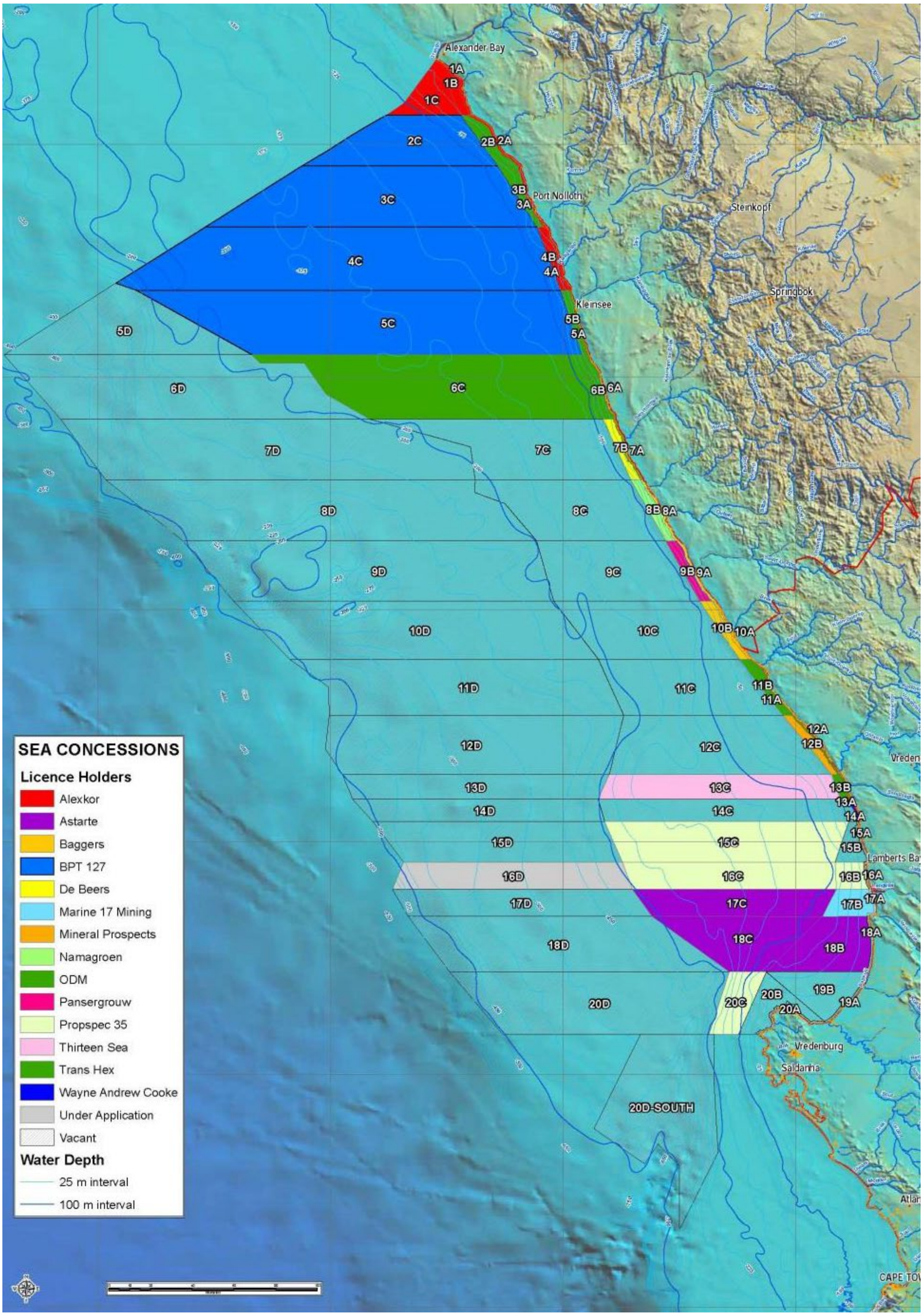


Figure 1.2. **The offshore diamond mining lease areas in South African waters. The coastal shelf waters have been divided into 20 contiguous, parallel strips which have been further subdivided into the onshore and offshore concession areas (A, B, C, D).**

1.3.1 Concession 10B

TAD is applying for a Prospecting Right to undertake geophysical surveying and sampling to target (potentially) diamondiferous and gemstone deposits in addition to other heavy minerals, industrial minerals, precious metals, as well as ferrous and base metals that may exist within Sea Area 10B, in terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002, as amended) (MPRDA). Concession 10B is an area of sea covering 11 040 ha offshore of the Northern and Western Cape coastlines of South Africa (Figure 1.3). It is located approximately 13 km south-west of Lepelsfontein and extends for approximately 31.5 km of the coastline. The inshore boundary of this concession area is located 1 km west of the high water mark and the outer boundary is about 5 km offshore. Water depth across the concession area ranges from approximately 15 m to 95 m (Figure 1.4).

The proposed prospecting programme will be completed over approximately 40-80 days depending on the number of resource development areas identified, and includes a combination of non-invasive and invasive activities. The non-invasive activities are mostly related to geophysical exploration, data acquisition and analysis. The invasive activities are those related to sampling (collection core, grab, and drill samples).

1.3.2 Geophysical/Seismic Exploration

It is proposed that geophysical surveying be conducted using a dedicated survey vessel with a hull-mounted multibeam echo sounder (MBES) and Topas sub-bottom profiler system designed to collect high-resolution acoustic data along lines 100 m to 1000 m apart, throughout the concession area. The use of this geophysical survey equipment allows the operator to produce a digital terrain model of the seafloor. These findings will ultimately allow the applicant to identify prospecting targets within the concession area and would also provide an indication of what drilling method should be used. Further to this, geophysical survey results would also enable the identification of potentially sensitive benthic habitats, therefore providing an opportunity to minimize any anticipated environmental impacts.

The MBES provides depth sounding information on either side of the vessel's track across a swath width of approximately two times the water depth, while the Topas sub-bottom profiler generates profiles up to 60 m beneath the seafloor, thereby giving a cross section view of the sediment layers. The source sound level of the MBES is variable but will be a maximum of 221dB re 1µPa @ 1m, with a frequency range of between 200 and 400 kHz. The sub-bottom profiler (Topas system) uses shallow (35 to 45 kHz) and medium penetration (1 to 10 kHz) "Chirp" seismic pulses. This equipment has a variable power output and can therefore have the power ramped up in accordance with survey requirements and be contained within acceptable environmental noise levels. As a result, it is also capable of "soft starts". The use of a magnetometer to detect magnetic signatures will also be required.

Low frequency seismic sources travel the greatest distance in the marine environment. Conversely, high frequency sources have greater attenuation over distance. Due to the higher frequency emissions of the MBES equipment, noise levels tend to dissipate over a relatively short distance, whereas the mid-frequency Topas chirp system will generate noise that will travel a greater distance. The acoustic footprint of the intended survey equipment is much lower than that of airgun arrays. It should be noted that a decibel is a logarithmic scale for noise where each unit of increase represents a tenfold increase in the quantity being measured.

TAD will be using the IMD SA survey vessel DP Star to conduct the geophysical acoustic surveys. This vessel is regularly used for similar survey work along the west coast of southern Africa. This type of survey typically does not require the vessel to tow any cables, however, it will be "restricted in its ability to manoeuvre" during the survey due to the operational nature of this work. Geophysical surveying will be undertaken over a two-month period of suitable, calm sea and weather conditions (the survey speed of the DP Star is typically 100 km/day and it is estimated that this would take approximately 10 days). The bathymetry of 10B will be modelled using processed seismic survey data before sampling can take place – this is a desktop exercise and it is estimated that this would take approximately one month.

1.3.3 Sampling activities

Sampling will be undertaken in targeted areas identified through the analysis of the acoustic survey data. A Van Veen grab with a sampling capacity of approximately 50 kg will be used to collect baseline environmental data on sediment and benthic macrofauna at 20-50 sites prior to geophysical sampling. Total volume of the grab is 0.03 m^3 and it will disturb an area covering approximately 0.2 m^2. The total area expected to be disturbed by the Van Veen grab will be approximately 10m^2, and the total volume of all grab samples (assuming 50 grabs are taken) is 1.5 m^3. Four potential methods of collecting geophysical samples from the seabed are being considered.

Geotechnical samples to assist in understanding the sea floor geology and resource evaluation will be collected at 100-200 sites using either vibracoring, gravity coring or sonic coring. The latter is an advanced form of drilling that employs high-frequency, resonant energy generated inside the Sonic head to advance a core barrel or casing into subsurface formations, i.e., can penetrate some subsurface rock, whilst gravity and vibracoring can only sample unconsolidated material. The diameter of core samples will be approximately 10 cm, length of 3m, and can penetrate to depths of 3–5 m and the material brought to the surface for analysis. The surface area of each core will be 0.0079 m^2. The volume per core is calculated at 0.024 m^3. The total volume for the 200 cores is calculated at 4.71 m^3. The 200 cores will cover a total surface area of 1.57 m^2, although the core might impact a surface area slightly larger than this. The area over which the coring will span is 11 040 ha rendering the total coring area inconsequential. The core samples do not require onboard processing (i.e. no sediment spill in the ocean) as all material collected will remain intact within core tubes which are to be analysed on land. It is estimated that core samples will be sampled at a rate of approximately ten cores per day which would amount to a total of twenty days' work.

Prospective target areas will then be surveyed using a uniquely designed drill tool that can dredge gravel from the seabed. Pending the final tool design, the drill bit footprint is estimated to be between 3 and 5 m^2 diameter. The expected average hole depth will be 3 m. Sample volumes are anticipated to be in the range of 9-15 m^3 per sample. This does not constitute bulk sampling in terms of the Mineral and Petroleum Resources Development Act, Act 28 of 2002 (pers comms DMRE), as the material is for prospecting purposes only, not commercial gain, nor are large sections of the seafloor being dredged out. Although this is not defined as bulk sampling by the DMRE, it is the professional opinion of the marine specialist that this is destructive prospecting as considered in Marine Spatial Planning documents (Harris et al. 2022). The drilling phase will constitute three steps:

- Step 1: A total of 150 samples will be collected at an initial sample density of 0.06 samples/ha. The 150 samples will cover a surface area of 750 m^2 (based on a drill size of 5 m^2), and the total volume of material removed will be 2250 m^3. Samples will be spaced at roughly 300 m apart from north to south. A sampling rate of 30 samples per day would equate to a period of approximately five days (this does not consider weather delays).
- Step2: Follow-up sampling will require an additional 150 samples. These 150 samples will also cover a surface area of 750 m^2 (based on a drill size of 5 m^2), and the total volume of material removed will be 2250 m^3. Samples will be spaced at roughly 300 m apart from north to south. A sampling rate of 30 samples per day would equate to a period of approximately five days (this does not consider weather delays).
- Step 3: Should these follow-up samples indicate that there could be a potential resource, only then will resource development commence. A potential resource area of not larger than 500 m x 300 m will then require an additional 60 samples spaced on a 50 m grid. Approximately 20 resource development areas will be required. This equates to 1 200 samples covering a surface area of 6 000 m2 (based on a drill size of 5 m^2), and a total volume of 18 000 m^3. A sampling rate of 30 samples per day would equate to a period of approximately 40 days.

In total, this drilling could impact an area of 7500 m^2 (0.75 ha), accounting for 0.0068% of the total concession area of 11 040 Ha, and lead to the removal of 22500 m^3 of sediment. The material will be processed onboard by a processing plant and tailings will be discarded overboard in a designated area to avoid sensitive habitats, reefs and important fishing areas. The formation and persistence of sediment plumes in the water column, as a result of the discarding of tailings, is largely dependent of the sediment particle size and prevailing oceanographic conditions. Discarded material that consists mostly of sand has a minimal suspension time (plumes will settle quickly), whilst muddy sediments form longer lasting plumes.

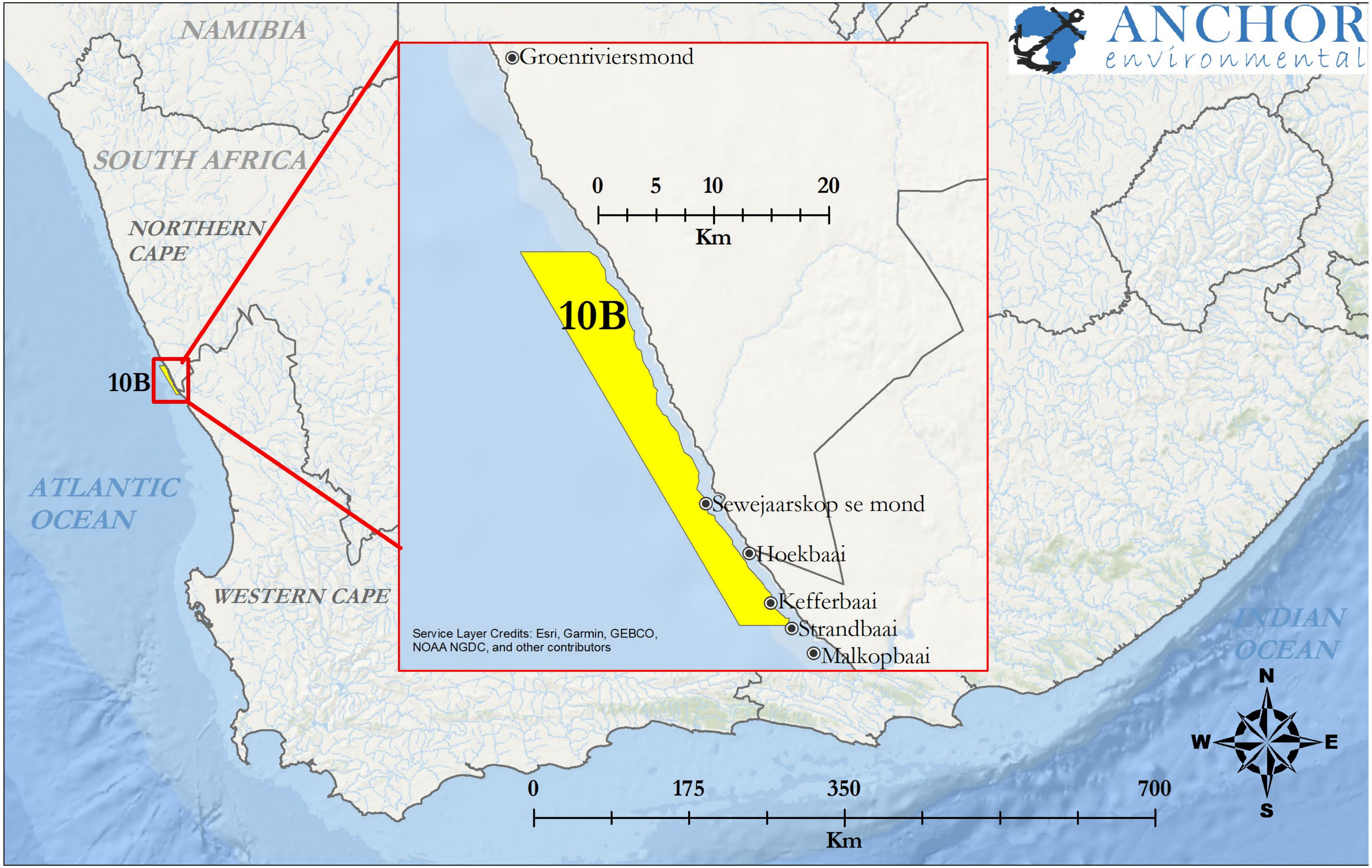
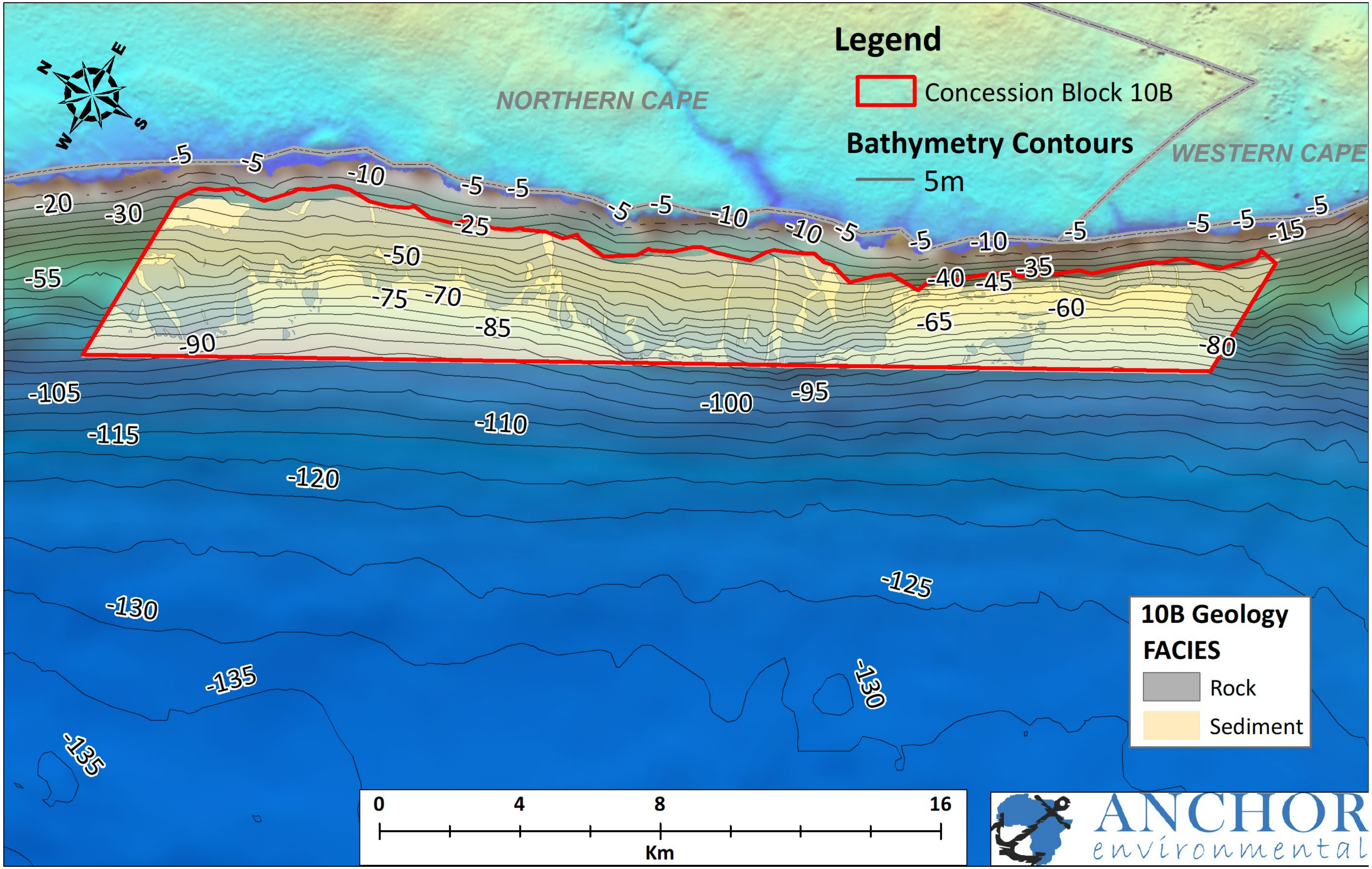


Figure 1.3. Location of the concession area 10B off the Western Cape Coast. The inshore boundary of this concession area is located approximately 1 km offshore and the outer boundary is about 5 km offshore.



Legend
Concession Block 10B
Bathymetry Contours
5m
NORTHERN CAPE
WESTERN CAPE
N
E
S
W
10B Geology
FACIES
Rock
Sediment
0
4
8
16
Km
ANCHOR
environmental

2 DESCRIPTION OF THE AFFECTED ENVIRONMENT

2.1 Regional oceanography

The Benguela system is influenced predominantly by the wind-driven upwelling of deep nutrient rich water close to the coast. Wind is the primary driver of life in the system, strongly influencing both water temperature and inorganic nutrient levels, and in turn, primary production. The prevailing south-easterly winds displace surface water offshore during the summer, and cause cold, nutrient rich water to rise from deeper water masses to replace this surface water. These upwelling events are the trigger for minimum temperatures and maximum nutrient levels (Branch and Griffiths 1988). The oceanic primary producers, phytoplankton, bloom when upwelled inorganic nutrients become available for photosynthesis in the presence of sunlight. These are consumed by zooplankton, which are in turn consumed by small pelagic fish species, such as anchovy and sardine. The Benguela is one of the world's most productive systems, supporting rich fishing grounds and attracting large colonies of sea birds and seals (Branch 1981).

The West Coast is subject to semi-diurnal tides, with each successive high (and low) tide separated by 12 hours. Spring tides occur once a fortnight during full and new moons. Tidal activity greatly influences the biological cycles (feeding, breeding and movement) of intertidal marine organisms, and has an influence on when people visit the coastline to partake in various activities such as bathing and the harvesting of marine resources. The tidal variation on the West Coast usually ranges between 0.28 m (relative to the chart datum) at mean low water springs and 1.91 m at mean high water springs, with the lowest and highest astronomical tide being 0.056 m and 2.25 m, respectively.

The west coast of South Africa typically experiences high wave energy and is dominated by south-westerly swells with a long fetch and a period of 10 to 15 seconds (Branch and Griffiths 1988). Southerly and south-westerly waves frequently exceed 2 m (Figure 2.1 and Figure 2.2). The predominant SW swell direction in this area results in a northward-flowing littoral current that runs parallel to the coast (MacDonald and Rozendaal 1995). The average water temperature during the summer months is cool due to upwelling (approximately 11°C) and slightly warmer during downwelling events, which are caused by westerly winds or occasional Benguela Niños when unseasonal westerly winds result in a breakdown of the upwelling front with movement of warm oceanic water towards the coast (Laird and Clark 2018).

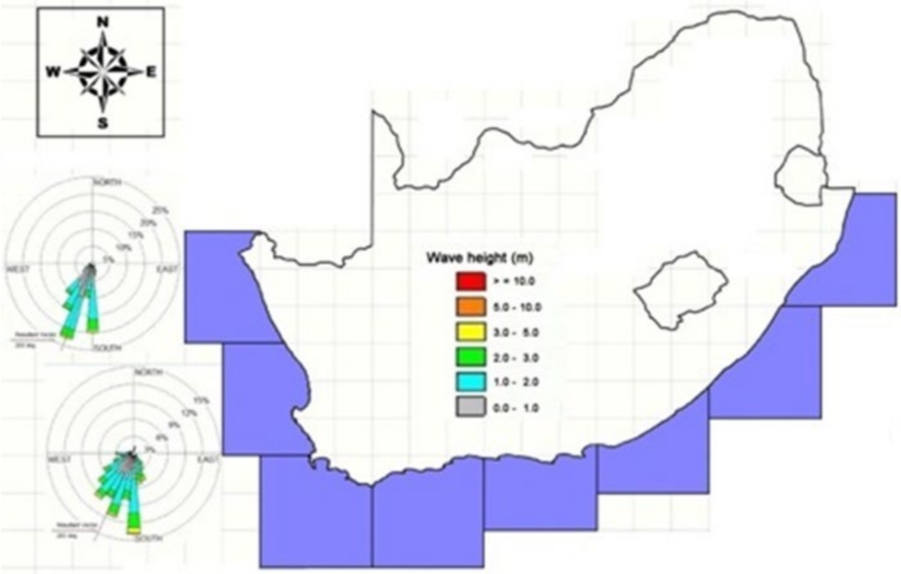


Figure 2.1. Wave roses showing the frequency of significant wave heights and direction on the West Coast (Source: SADCO Voluntary Observing Ships data).

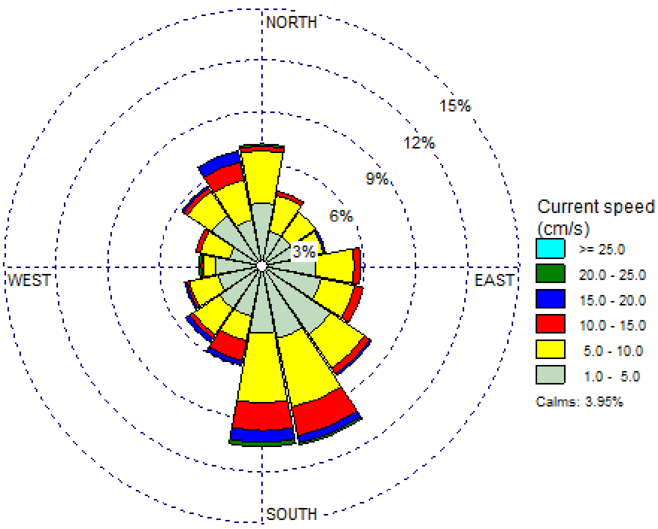


Figure 2.2. Current rose showing current direction and strength data at -12 m water depth approximately 15 km north of the Olifants River Mouth (a short distance inshore and south of concession area 10B). (Source: Laird and Clark 2018).

Concession Area 10B is positioned in the southern section of the Benguela Current System (BCS), which extends along the west coast of southern Africa between Cape Agulhas and Angola. The area spans the Namaqua inner shelf and Southern Benguela outer shelf ecozones, which is nested within the Southern Benguela Ecoregion as defined by Sink *et al*. (2012) (Figure 2.3).

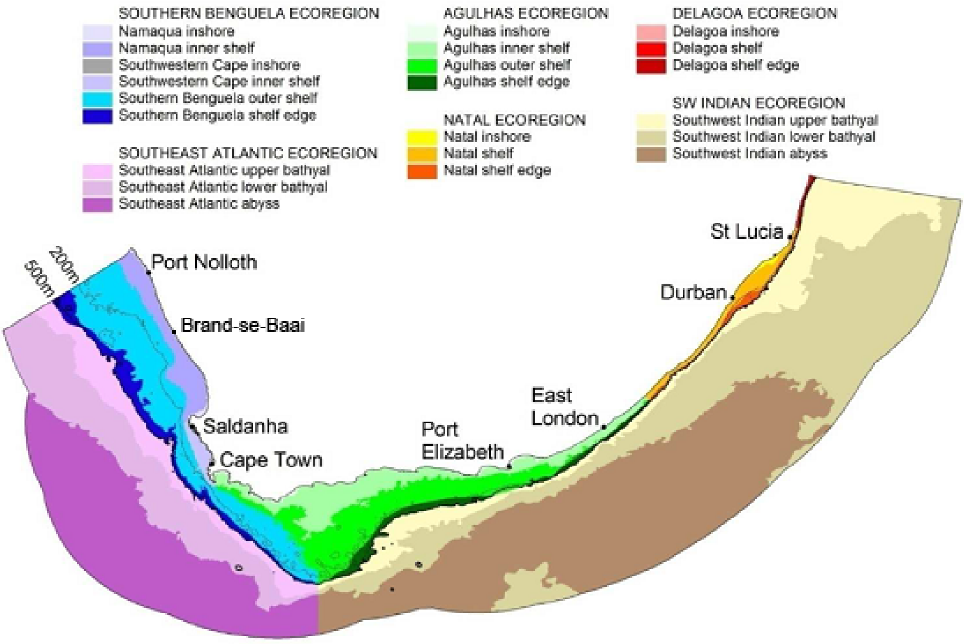


Figure 2.3. Six marine ecoregions with 22 ecozones incorporating biogeographic and depth divisions in the South African marine environment as defined by Sink *et al*. (2012).

As discussed above, wind-driven coastal upwelling is the predominant physical driver that shapes the high levels of biological productivity in the southern Benguela, providing nutrients for primary producers, and food for diverse fauna, such as pelagic (pilchards, anchovy) and demersal (hakes, kingklip) fish stocks, near shore fisheries (linefish, rock lobster), mammals (seals and whales) and seabirds (penguins, gannets, cormorants etc.). There are three broad marine habitats within or adjacent to the 10B Concession Area. These include sandy benthic habitat, rocky reefs and the water column or pelagic habitat.

2.3.1 Subtidal sandy benthic habitat

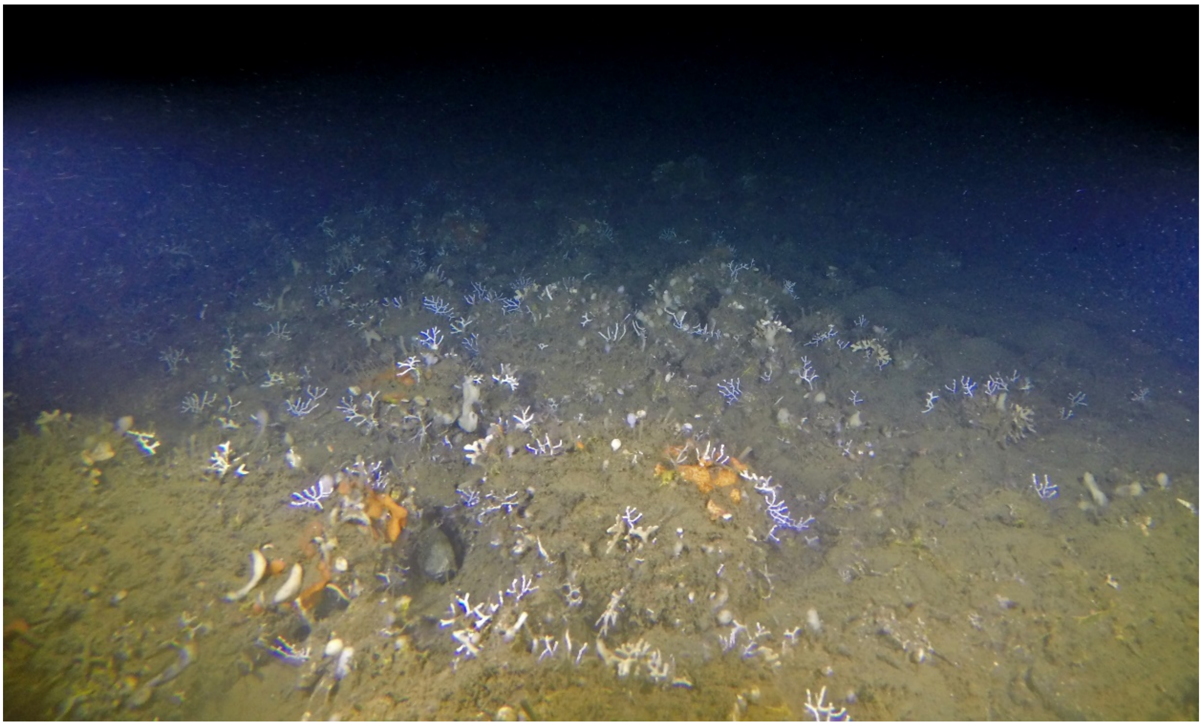
Fauna and flora that inhabit the surfaces of subtidal sand are called benthic epifauna, while those that burrow or dig into the soft sediments are called benthic infauna (Castro and Huber 1997). The distribution of infauna and the depth at which organisms can live in the substrate is largely dependent on sediment particle size. More porous, larger grained substrates allow for greater water circulation through the sediment, thereby replenishing the oxygen that is used up during the decomposition processes.

Much of the benthic infauna on the west coast of South Africa are deposit feeders (e.g., worms), which either ingest sediments and extract organic matter trapped between the grains, or actively collect organic matter and detritus (Castro and Huber 1997). Suspension feeders eat drifting detritus and plankton from the water column (e.g., seapens and some species of crabs), while filter feeders actively pump and filter water to extract suspended particles (e.g., bivalves and some species of amphipods and polychaetes). Predators in soft bottom habitats either burrow through sediments or catch their prey on the surface (Castro and Huber 1997). Most bottom-dwelling fish in soft bottom habitats are predators that scoop up prey (e.g., rays and skates), while flat fish (e.g., monk fish and sole) lie camouflaged on the bottom. Predators such as crabs, hermit crabs, lobsters and octopuses, which inhabit rocky areas, may move to sandy benthos to feed (Castro and Huber 1997). Similarly, reef-associated fish also rely on sandy substrate for food. Macrofauna living within benthic substrata play an important role in the reworking of sediments. These organisms assist in promoting the exchange of oxygen and nutrients within the substrate by enhancing sediment porosity. Macrofaunal communities also provide an important food source for fish and other invertebrate species.

Benthic macrofauna are the biotic component most frequently monitored to detect changes in the health of a marine environment as they are short-lived, and their community composition responds rapidly to environmental change (Warwick 1993). They also tend to be directly affected by pollution, are easy to sample quantitatively, and are scientifically well-studied compared to other sediment-dwelling components. Anthropogenic physical disturbance will negatively affect benthic macrofauna and is likely to result in the proliferation of opportunistic pioneer species following a disturbance event. Harmer *et al*. (2013) showed that polychaetes are generally most abundant, followed by amphipods and gastropods. The soft sediment infauna of the Namaqua inner shelf ecozone of the west coast of South Africa is moderately well studied. Benthic sampling undertaken by Anchor Environmental Consultants in concessions 1B, 1C and 2C (similar depth range and biogeographical zone as 10B) yielded a benthic macrofaunal community consisting of 45 species with an average biomass of 85.9 g/m^2 (1B), 31.8 g/m^2 (1C) and 38.9 g/m^2 (2C) respectively (Mostert *et al*. 2016 and Biccard *et al*. 2020a). This is much lower than the diversity and biomass of macrofaunal communities found in the shallower, sheltered and retentive bays along the west coast (diversity: >150 species; biomass: St. Helena Bay = 846.53 g/m^2, Saldanha = 970.78 g/m^2) (Biccard *et al*. 2020c; Clark *et al*. 2020). Available evidence suggests that the macrofaunal communities of Concession 10B are more similar to those found in the offshore, open coast areas such as 1C and 2C than the sheltered, productive west coast bays, but this will be confirmed during the proposed baseline sampling.

2.3.2 Offshore rocky reefs

The offshore environment is divided into six areas: the inner and outer shelf, the shelf edge, the upper and lower bathyal zones, and the abyssal zone. According to the National Biodiversity Assessment (NBA), offshore benthic habitat types include six broad ecosystem groups: rocky shelf, rocky shelf edge, seamounts and unconsolidated shelf, unconsolidated shelf edge and deep-sea sediments (Sink *et al*. 2012). Concession 10B lies within what is mostly classified as sandy inner shelf habitat interspersed with rocky outcrops (Figure 2.4). The sandy inner shelf habitat type has the greatest extent within our Exclusive Economic Zone (EEZ), with muddy, gravel and mixed sediment habitat types constituting smaller areas (Sink *et al*. 2012). These offshore rocky reefs are colonised by a range of epifauna including bryozoans, encrusting and upright sponges, solitary and colonial ascidians, sea anemones and cold-water coral colonies – the latter being slow-growing and taking many years to become established (Biccard *et al*., 2020b). Studies undertaking assessments of prospecting and mining-related impacts on these habitats in this region are relatively new and the time taken for disturbed epifaunal communities inhabiting offshore rocky reefs to recover has not yet been determined (Biccard *et al*., 2020b).



Offshore reefs within Concession area 10B should be visually assessed (by means of drop camera deployments or remotely operated underwater vehicle) during the baseline environmental survey with regular repeat surveys following mining operations in the area – offshore reefs may not be directly impacted (mined) but are at risk of being indirectly impacted by tailings disposal.

2.3.3 Pelagic habitat

This habitat type constitutes the largest of all habitats and is loosely defined as the water column of the open ocean, which can be further divided into regions by depth. Pelagic communities are largely defined by the physical properties of the water column. Main physical drivers include temperature, turbidity, dissolved oxygen, nutrient levels and light. These parameters vary with depth and play a large role in shaping the structure of pelagic communities. The major oceanic currents on the east and west coast of South Africa differ in terms of these parameters, and as such, harbour different pelagic communities. Where the Agulhas and Benguela current meet, off the southern coast of South Africa, these different communities merge and interact over several hundred kilometres resulting in rich pelagic biodiversity. In contrast to demersal and benthic biota that are associated with the seabed, pelagic species live and feed in the open water column. Pelagic communities are divided into plankton and fish, and their main predators, seabirds, marine mammals (seals, dolphins and whales) and turtles.

2.3.3.1 Planktonic communities

The ecology of the open water pelagic habitat within Concession 10B is typical of the Benguela upwelling region and the Namaqua inshore ecozone. Pulsed inputs of nutrients (nitrates, phosphates and silicates) due to wind driven upwelling result in high primary productivity with phytoplankton communities dominated by dinoflagellates and diatoms. Phytoplankton are consumed by a variety of zooplankton that typically consist of crustacean copepods, euphausiids, mysids and a myriad of eggs and larvae from almost all marine phyla. For example, ichthyoplankton in the southern Benguela are composed mainly of small pelagic anchovy and sardine fish eggs and larvae, with some hakes and mackerel (Shannon and Pillar 1986). Zooplankton are in turn the food source for large numbers of small pelagic fish, particularly sardine *Sardinops sagax*, anchovy *Engraulis encrasicolus,* red eye round herring *Etrumeus whiteheadi* and maasbanker, *Trachurus capensis*. These small pelagic fish exert a controlling influence on the abundance of both their zooplankton prey and their predators that include commercially important fish species such as snoek *Thyristes atun*, yellowtail *Seriola lalandi* and hake *Merluccius* sp. (Cury *et al.* 2000; Shannon *et al.* 2020).

2.3.3.2 Seabirds

Fourteen species of seabirds breed in southern Africa; Cape Gannet, African Penguin, four species of Cormorant, White Pelican, three Gull and four Tern species (Table 2-1). Species listed as endangered on the IUCN red data list include the African penguin, Cape cormorant and the bank cormorant. Breeding areas are distributed around the coast with islands being particularly important. The number of successfully breeding birds at each breeding site varies with the abundance of food. Most of the breeding seabird species forage for small pelagic fish at sea with most birds being found relatively close inshore (within 30 km of the coast). Of the diving birds that occur along the coast, only *Morus capensis*, the Cape gannet, regularly feeds from the inshore environment as far as 100 km offshore and African penguins have also been recorded as far as 60 km offshore. Most of the species listed here are likely to be encountered in concession 10B (the inner margin is located only 1 km offshore - Figure 1.3 and Figure 1.4).

Table 2-1. Breeding seabirds present on the west coast of South Africa (adapted from Pulfrich 2021).

Common name	Species name	Global IUCN Status
African Penguin	*Spheniscus demersus*	Endangered
Great Cormorant	*Phalacrocorax carbo*	Least Concern
Cape Cormorant	*Phalacrocorax capensis*	Endangered
Bank Cormorant	*Phalacrocorax neglectus*	Endangered
Crowned Cormorant	*Phalacrocorax coronatus*	Near Threatened
White Pelican	*Pelecanus onocrotalus*	Least Concern
Cape Gannet	*Morus capensis*	Vulnerable
Kelp Gull	*Larus dominicanus*	Least Concern
Greyheaded Gull	*Larus cirrocephalus*	Least Concern
Hartlaub's Gull	*Larus hartlaubii*	Least Concern
Caspian Tern	*Hydroprogne caspia*	Least Concern
Swift Tern	*Sterna bergii*	Least Concern
Roseate Tern	*Sterna dougallii*	Least Concern
Damara Tern	*Sterna balaenarum*	Near Threatened

Pelagic seabirds such as albatross, petrels and shearwaters are also likely to be encountered in the offshore waters of 10B. A large number of these seabirds are supported by the small pelagic fish stocks of the Benguela system. The area between Cape Point and the Orange River is said to support 38% and 33% of the overall population of pelagic seabirds in winter and summer, respectively (Baker and Arnott 2021). Pelagic seabirds classified as being common in the southern Benguela are listed in Table 2-2. Species listed as endangered include the black-browed albatross and yellow-nosed albatross. Most of the species in the region reach highest densities offshore of the shelf break (200 – 500 m depth) (Baker and Arnott 2021), mostly offshore of concession 10B.

Table 2-2. Pelagic seabirds common to the southern Benguela region (Crawford *et al*., 1991).

Common Name	Species name	Global IUCN
Shy albatross	*Thalassarche cauta*	Near Threatened
Black browed albatross	*Thalassarche melanophrys*	Endangered
Yellow nosed albatross	*Thalassarche chlororhynchos*	Endangered
Giant petrel sp.	*Macronectes halli/giganteus*	Near Threatened
Pintado petrel	*Daption capense*	Least concern
Greatwinged petrel	*Pterodroma macroptera*	Least concern
Soft plumaged petrel	*Pterodroma mollis*	Least concern
Prion spp.	*Pachyptila spp.*	Least concern
White chinned petrel	*Procellaria aequinoctialis*	Vulnerable
Cory's shearwater	*Calonectris diomedea*	Least concern
Great shearwater	*Puffinus gravis*	Least concern
Sooty shearwater	*Puffinus griseus*	Near Threatened
European Storm petrel	*Hydrobates pelagicus*	Least concern
Leach's storm petrel	*Oceanodroma leucorhoa*	Least concern
Wilson's storm petrel	*Oceanites oceanicus*	Least concern
Blackbellied storm petrel	*Fregetta tropica*	Least concern
Skua spp.	*Catharacta/Stercorarius spp.*	Least concern
Sabine's gull	*Larus sabini*	Least concern

2.3.3.3 Marine mammals

The marine mammal fauna occurring off the southern African coast includes several species of baleen whales, toothed whales, beaked whales, dolphins and one resident seal species. Based on the available literature we have identified thirty-six marine mammals that may occur in the proposed survey area (Table 2-3); each of these have been placed into marine mammal hearing groups as per Southall *et al*. (2019). Various research papers and reports were used to ascertain the relative likelihood of occurrence within the proposed survey area – Table 2-3 (Lane and Carter 1999; Penney *et al.* 2007; Child et al. 2016; Biccard *et al*. 2018; Baker and Arnott 2021; Pulfrich 2021). Conservation status from the IUCN (2021) red data list is provided. Of the species listed, the blue whale is considered 'Critically endangered', fin and sei whales are 'Endangered' and two (humpback and sperm whale) are considered vulnerable (IUCN Red Data list Categories). Altogether 10 species are listed as "data deficient" underlining how little is known about cetaceans, their distribution and population trends. Current information on the distribution, population sizes and trends of most cetacean species occurring on the west coast of southern Africa is lacking (Pulfrich 2021). Our knowledge on the smaller cetaceans that occupy deeper waters is particularly poor and it is recommended that caution be applied when considering possible encounters with cetaceans in the area of interest (Pulfrich 2021). The most abundant baleen whales in the Benguela are humpback whales and southern right whales (Figure 2.5). During the last decade, the prevalence of both species on the West Coast of South Africa outside of the usual June-November whale season has increased with feeding behaviour observed in upwelling zones off Kommetjie, Saldanha and St Helena Bay (Barense *et al*., 2011; Mate *et al*., 2011). Increasing numbers of summer records of both species from the southern half of Namibia suggest that animals may also be feeding in the Lüderitz upwelling cell (NDP unpublished. data) and will therefore occur in, or pass through the area of interest (Pulfrich 2021).

Table 2-3. Marine mammals thought to occur within the proposed survey area. Each species listed has been placed into a marine mammal hearing group as defined by Southall *et al.* 2019. The relative abundance and likelihood of occurrence within the proposed survey area during the survey period in late summer is indicated for each species. Conservation status from the IUCN (2021) red data list is indicated.

Marine Mammal hearing group (Southall *et al.* 2019)	Species	Shelf/Offshore	Likely encounter frequency in 10B and seasonality in parentheses	IUCN Conservation status
Low frequency cetaceans (Baleen whales) Generalised hearing range: 7 Hz to 35 kHz	*Balaenoptera bonaerensis* (Antarctic minke whale)	Shelf and offshore	Monthly (winter)	Least concern
	B. acutorostrata (Dwarf minke whale)	Shelf and offshore	Occasional (year-round)	Least concern
	B. physalus (Fin whale)	Shelf and offshore	Occasional (rarely in summer)	Endangered
	B. musculus (Blue whale)	Offshore	Unlikely (seasonality unknown)	Critically Endangered
	B. borealis (Sei whale)	Shelf and offshore	Occasional (winter)	Endangered
	B. brydei (offshore Bryde's whale)	Shelf and offshore	Occasional (summer)	Not assessed
	B. brydei (subspp) (inshore Bryde's whale)	Shelf and offshore	Occasional (year-round)	Vulnerable
	Eubalaena australis (Southern right whale)	Shelf	Daily (year-round, higher in early spring & summer)	Least concern
	Megaptera novaeangliae (Humpback whale)	Shelf and offshore	Daily (year-round, higher in summer)	Vulnerable
High frequency cetaceans (Dolphins, toothed whales, beaked whales)	*Lagenorhynchus obscurus* (Dusky dolphin)	Shelf (0-800 m)	Daily (year-round)	Data deficient
	Cephalorhynchus heavisidii (Heaviside's dolphin)	Shelf (0-200 m)	Daily (year-round)	Near threatened
	Tursiops truncates (Common bottlenose dolphin)	Shelf and offshore	Monthly (year-round)	Least concern

Marine Mammal hearing group (Southall *et al.* 2019)	Species	Shelf/Offshore	Likely encounter frequency in 10B and seasonality in parentheses	IUCN Conservation status
Generalised hearing range: 150 Hz to 160 kHz	*Delphinus delphis* (Common short beaked dolphin)	Shelf and offshore	Monthly (year-round)	Least concern
	Lissodelphis peronii (Southern right whale dolphin)	Shelf and offshore	Occasional (year-round)	Least concern
	Stenella coeruleoalba (striped dolphin)	Offshore	Unlikely (unknown)	Least concern
	S. attenuate (Pantropical spotted dolphin)	Shelf edge and offshore	Unlikely (year-round)	Least concern
	Globicephala melas (Long-finned pilot whale)	Shelf edge and offshore	Monthly (year-round)	Least concern
	G. macrorhynchus (Short-finned pilot whale)	Unknown	Unlikely (unknown)	Least concern
	Steno bredanensis (Rough-toothed dolphin)	Unknown	Unlikely (unknown)	Least concern
	Orcinus orca (Killer whale)	Shelf and offshore	Occasional (year-round)	Data deficient
	Pseudorca crassidens (False killer whale)	Shelf and offshore	Monthly (year-round)	Least concern
	Feresa attenuate (Pygmy killer whale)	Offshore	Occasional (unknown)	Least concern
	Grampus griseus (Risso's dolphin)	Shelf edge and offshore	Occasional (unknown)	Least concern
	Kogia breviceps (Pygmy sperm whale)	Shelf edge and offshore	Occasional (year-round)	Data deficient
	K. sima (Dwarf sperm whale)	Shelf edge	Unlikely (unknown)	Data deficient
	Physeter macrocephalus (Sperm whale)	Shelf edge and offshore	Occasional (year-round)	Vulnerable
	Ziphius cavirostris (Cuvier's beaked whale)	Offshore	Occasional (year-round)	Data deficient
	Beradius arnouxii (Arnoux's beaked whale)	Offshore	Occasional (year-round)	Data deficient
	Hyperoodon planifrons (Southern bottlenose beaked whale)	Offshore	Occasional (year-round)	Least concern
	Mesoplodon layardii (Layard's beaked whale)	Offshore	Occasional (year-round)	Data deficient
	M. mirus (True's beaked whale)	Offshore	Unlikely (year-round)	Data deficient
	M. grayi (Gray's beaked whale)	Offshore	Occasional (year-round)	Data deficient
	M. densirostris (Blainville's beaked whale)	Offshore	Unlikely (year-round)	Data deficient
Phocid carnivores in water (PCW)	*Mirounga leonine* (Southern elephant seal)	Shelf and offshore	Unlikely (unknown)	Least concern
	Hydrurga leptonyx (Leopard seal)	Shelf and offshore	Unlikely (unknown)	Least concern

Marine Mammal hearing group (Southall *et al.* 2019)	Species	Shelf/Offshore	Likely encounter frequency in 10B and seasonality in parentheses	IUCN Conservation status
Other marine carnivores in water (OCW)	*Arctocephalus pusillus* (Cape fur seal)	Shelf	Daily (year-round)	Least concern

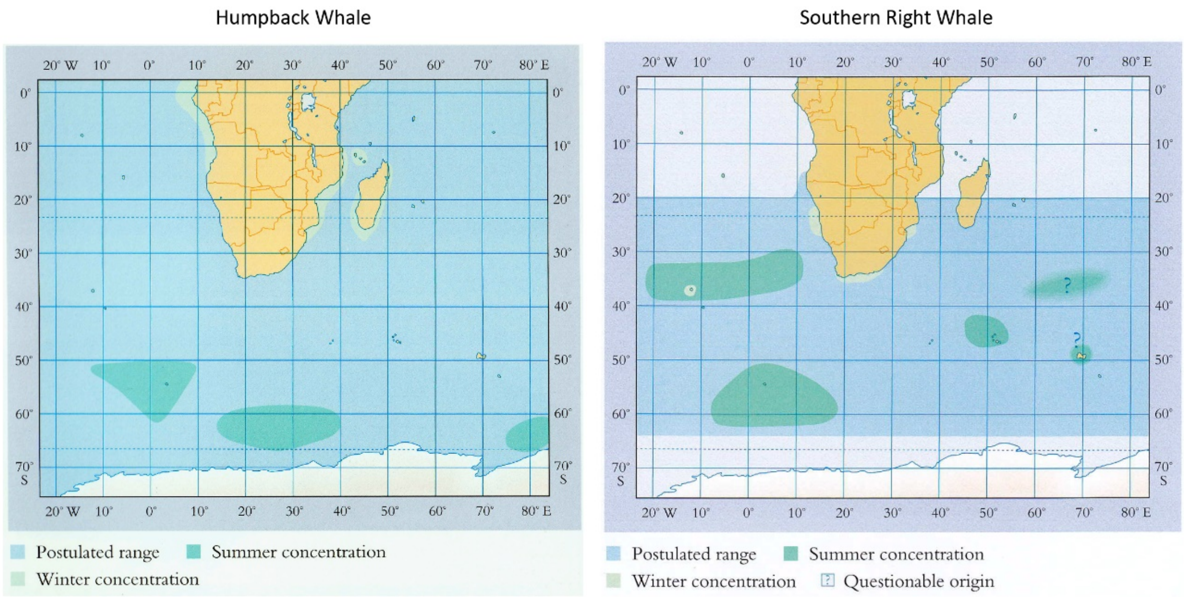


Figure 2.5. Migration routes are inferred from the seasonal distribution of humpback (left) and southern right (right) whales off the coast of southern Africa. Source: Best (2007).

2.4 Sensitivity and significance

The 2018 National Biodiversity Assessment (NBA) for marine benthic and coastal habitat threat status layer is shown in Figure 2.6 together with concession area 10B. This Ecosystem Threat Status developed by SANBI (2018) is an indicator of how threatened ecosystems are, specifically the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function, or composition (Harris *et al.* 2018). Ecosystem types are categorised as “Critically Endangered”, “Endangered”, “Vulnerable”, “Near Threatened” or “Least Concern”, based on the proportion of the original extent of each ecosystem type that remains in good ecological condition relative to a series of biodiversity thresholds. According to the latest available data from the 2018 NBA, the entire area covered by Concession Area 10B is classified as “Least Concern” (Figure 2.6). The surf zone inshore of Concession 10B has, however, predominantly been classified as vulnerable, with a small pockets being considered endangered (Figure 2.6).

In terms of conservation status and protected area status, the 10B concession block is not identified as part of a National Marine Protected Area (MPA). However, the entire area falls within 3.15% of the Namaqua Coastal Ecological and Biologically Significant Area (EBSA) (Figure 2.7), and 100% of the concession falls within critical biodiversity area, which is considered to be in a natural state (Figure 2.8) (Harris *et al.* 2022). Finally, the entirely of 10B falls within the Benguela Upwelling System EBSA.

EBSAs are defined by the Convention on Biological Diversity (CBD) as "geographically or oceanographically discrete areas that provide important services to one or more species/populations of an ecosystem or to the ecosystem as a whole, compared to other surrounding areas or areas of similar ecological characteristics, or otherwise meet the [EBSA] criteria".

The proposed Namaqua Coastal Area EBSA is located from the estuary of the Spoeg River to the estuary of the Sout River in the Namaqua bioregion of South Africa (Sink et al., 2012), and from the dune base to approximately 33-36 km offshore. It consists of Namaqua coastal, inner, mid and outer shelf ecosystem types (Sink et al., 2019). The associated pelagic environment is characterized by upwelling, giving rise to very cold waters with very high productivity/chlorophyll levels (Lagabrielle 2009, Roberson et al., 2017). Altogether, the area includes three estuaries (van Niekerk and Turpie, 2012). A large proportion of the area is characterized by habitat that is in relatively good (natural/pristine) condition due to much lower levels of anthropogenic pressures relative to other coastal areas in the Northern Cape Province. There is a small part of the EBSA (midway along the shore) that was recently declared as a marine protected area that came into effect in 2019. The terrestrial habitat adjacent to the part of the EBSA that stretches between the Groen and Spoeg estuaries is within the Namaqua National Park and is, therefore, also protected.

In summary, the area is highly relevant in terms of the following EBSA criteria: "productivity", "importance for threatened, endangered or declining species and/or habitats" and "naturalness". Since original description, an offshore extension of 7-20 km, has been proposed so that the EBSA now extends 36 km offshore at its widest point. The alongshore extent remains the same as before between the Spoeg and Sout estuaries. The extension was based on better alignment with the features comprising the EBSA, and their condition and threat status, based on the best available information (e.g., Holness et al., 2014; Majiedt et al., 2013; Sink et al., 2012, 2019). This was also based on recent research (Karenyi 2014) that has allowed better ecosystem mapping in the area, thus affording more accuracy in the proposal of a new EBSA boundary rather than following an old (proposed) MPA boundary that was not adopted. New fine-scale mapping of the coast (Harris et al., 2019) also allowed a more accurate coastal boundary to be delineated.

The Benguela Upwelling System (BUS) is one of the four major eastern boundary upwelling systems in the world (Bakun 1996). The proposed BUS EBSA runs along the southwestern African coast, starting from Cape Point in the south and ending to the Angola-Namibia border in the north (UNEP 2014, Figure 2.9). This system is globally recognized as unique due to being the only cold-water upwelling system that is bordered by warm-water systems in the north (Angola current) and in the south (Agulhas current) (Shillington *et al*. 2007). Furthermore, it is greatly characterized by its high primary production output (>1000 mg C/m^2/day); which in turn support abundant pelagic and demersal fish as well as encompassing key spawning and nursey areas for sardine, anchovy and horse mackerel (Hutchings *et al*. 2009). Such productive environments like the BUS can sustain numerous top predator populations such as seabirds; of which many breed in the region; mammals and several cetacean species (Best *et al*. 1997; Best 2007; Crawford 2007; Kemper *et al*. 2007). There are six confirmed coastal Important Biodiversity Areas (IBA's) within this EBSA and an additional 12 IBAs that have been proposed (BirdLife International 2013). In the northern Benguela ecosystem, overfishing and changes in the ecosystem have led to the decline of pelagic species, resulting in a "degraded" state (Roux *et al*. 2013). The latter has been reflected in population declines in the breeding populations of several piscivorous predators. However, the southern Benguela ecosystem appears to be stable due to the implementation of conservative fisheries management strategies. Nonetheless, there have been gradual shifts in the geographical distribution of important prey species, such as sardines, anchovy and west coast rock lobsters moving eastwards, (Roy *et al*. 2007; Cockroft *et al*. 2008; Coetzee *et al*. 2008) which have a negative knock-on effect on the seabirds of west coast of South Africa within the proposed EBSA area (Crawford *et al*. 2008a, 2008b). In summary, the proposed BUS EBSA is relevant in terms of the following criteria: 'Uniqueness or rarity'; 'Special importance for life-history stages of species'; 'Importance for threatened, endangered or declining species and/or habitats' and 'Biological productivity'. The BUS EBSA is approximately 49,676,698 ha (Almost 50 million ha) in size and the total area of 10B is 11 040 ha (0.022% of the entire EBSA; Figure 2.9). Numerous anthropogenic activities take place within the BUS EBSA that encompasses the entire SA west coast. The proportion of the BUS EBSA represented by 10B is extremely small and it is anticipated that the potential impacts of the proposed exploration and prospecting activities on species and ecological processes the BUS EBSA aims to protect are virtually negligible. Potential Impacts on the BUS EBSA are therefore not assessed (screened out).

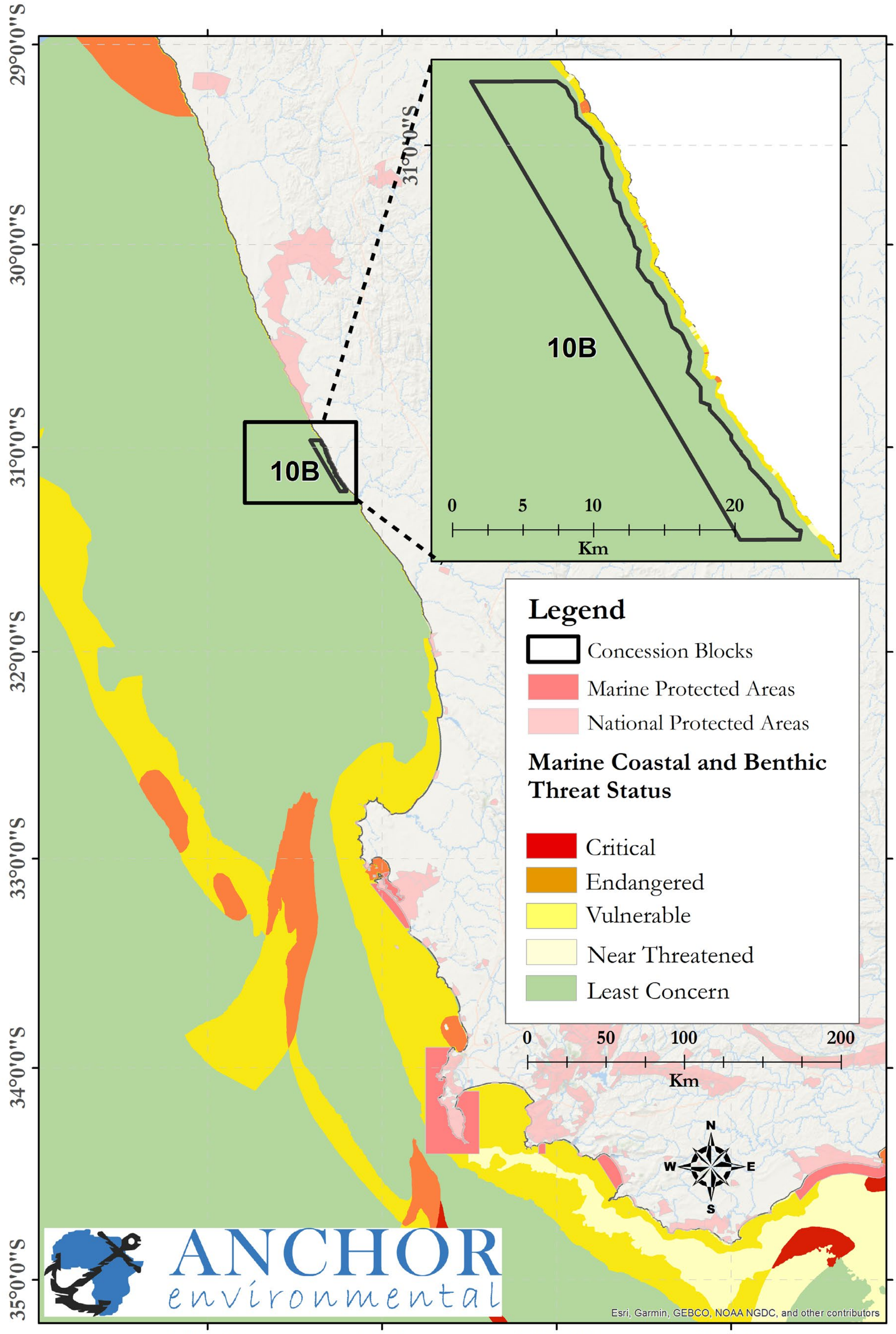


Figure 2.6. SANBI Ecosystem Threat Status and location of concession area 10B. Source: https://bgis.sanbi.org/

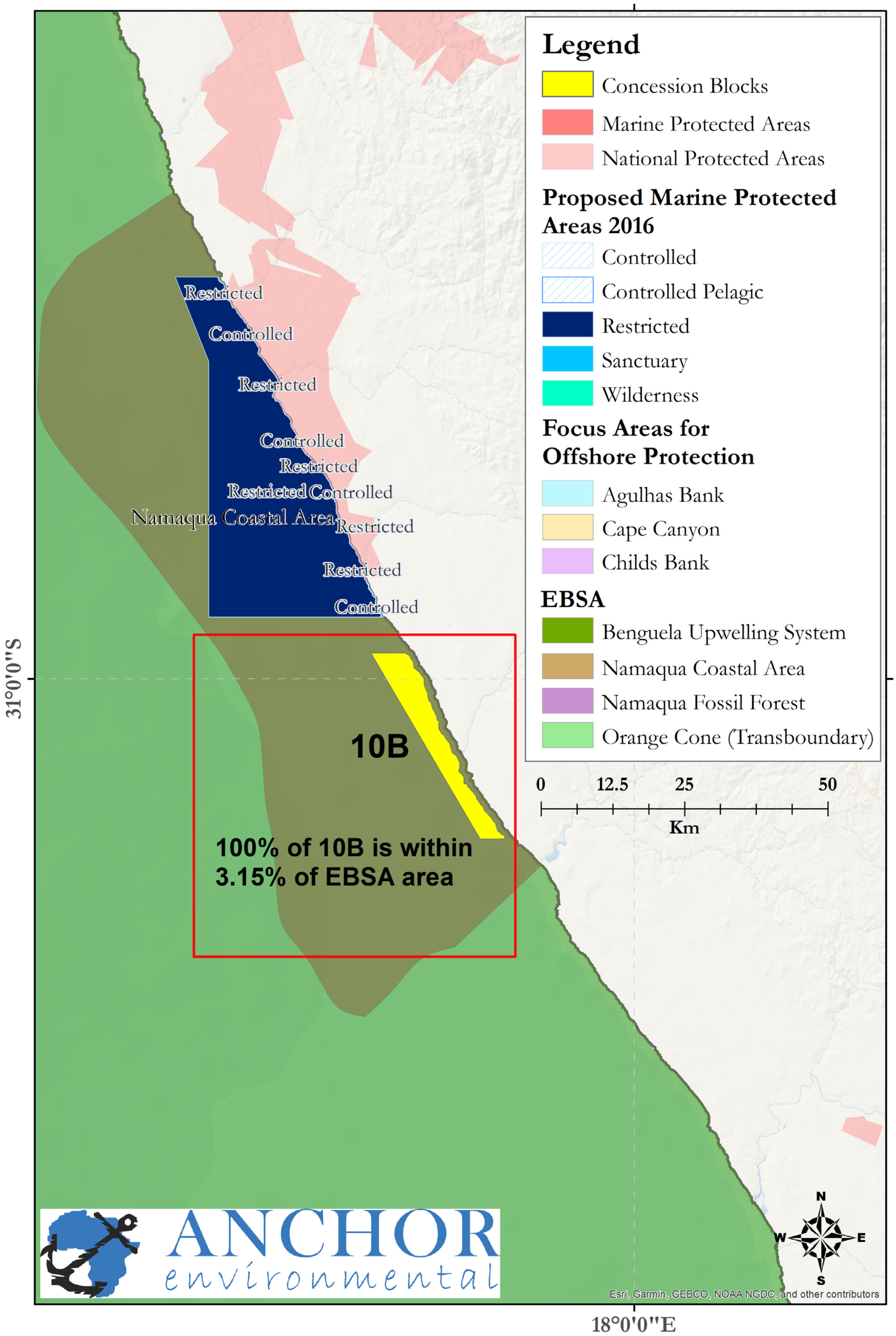


Figure 2.7. **Marine protected Areas (dark blue), proposed EBSA's and the location of concession area 10B. Source: [https://bgis.sanbi.org/.](https://bgis.sanbi.org/)**

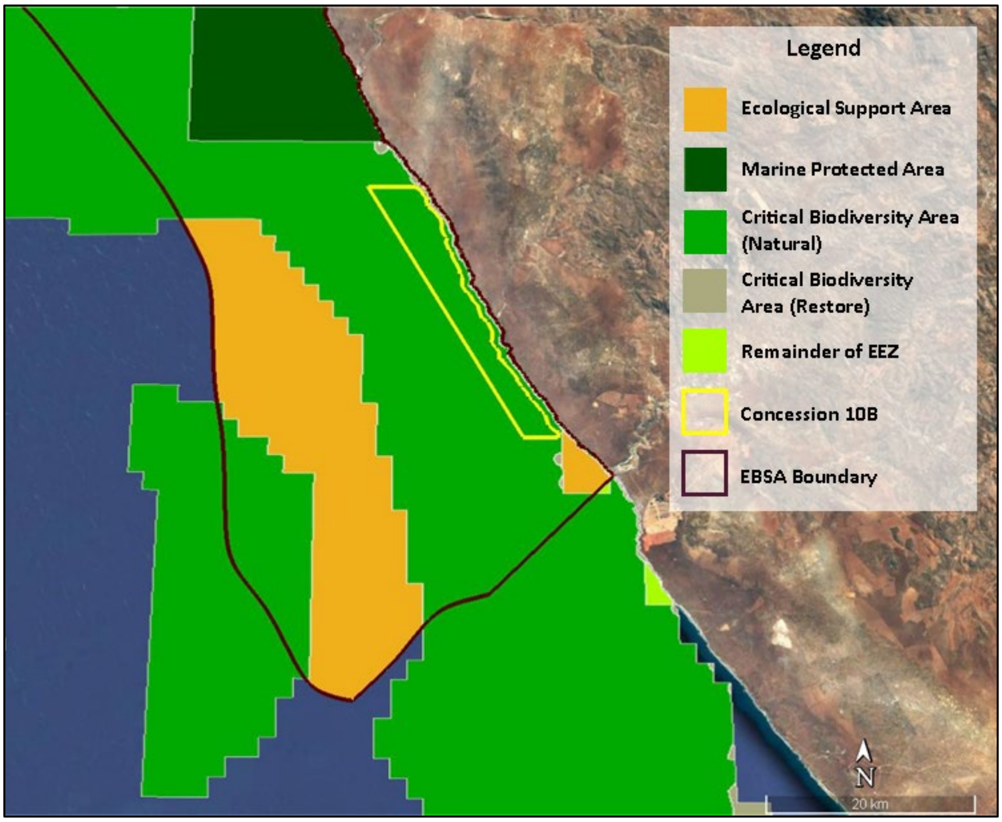


Figure 2.8. **Concession 10B with respect to Critical Biodiversity Areas and the Namaqua Coastal Area EBSA (Harris *et al*. 2022)**

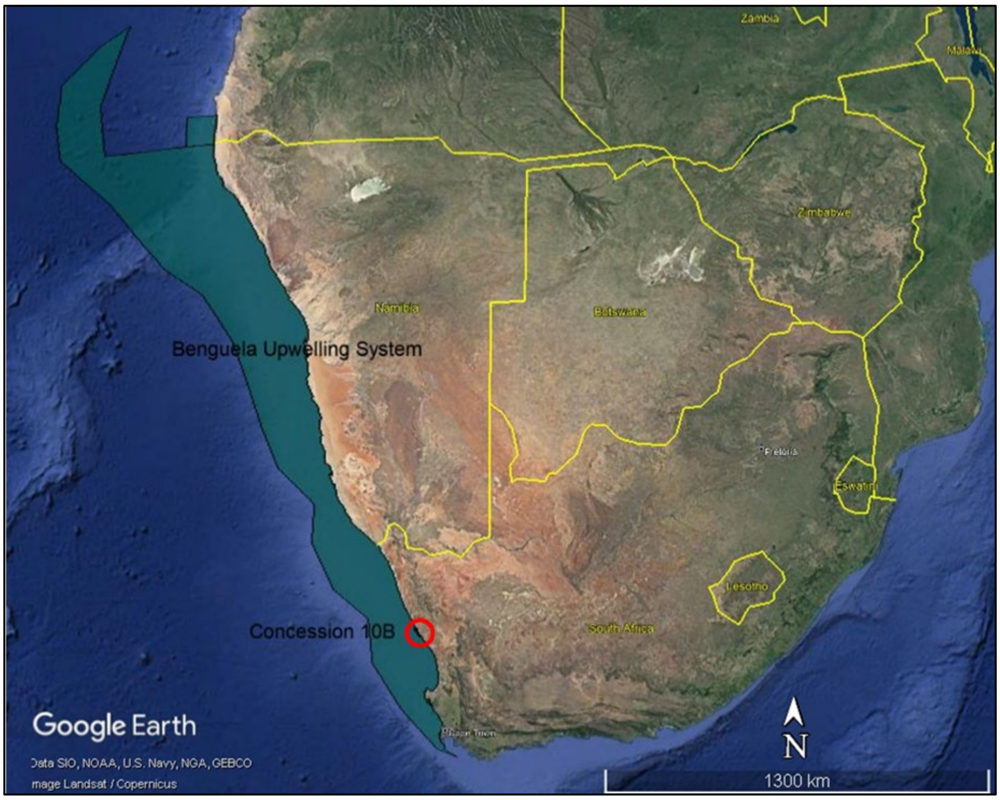


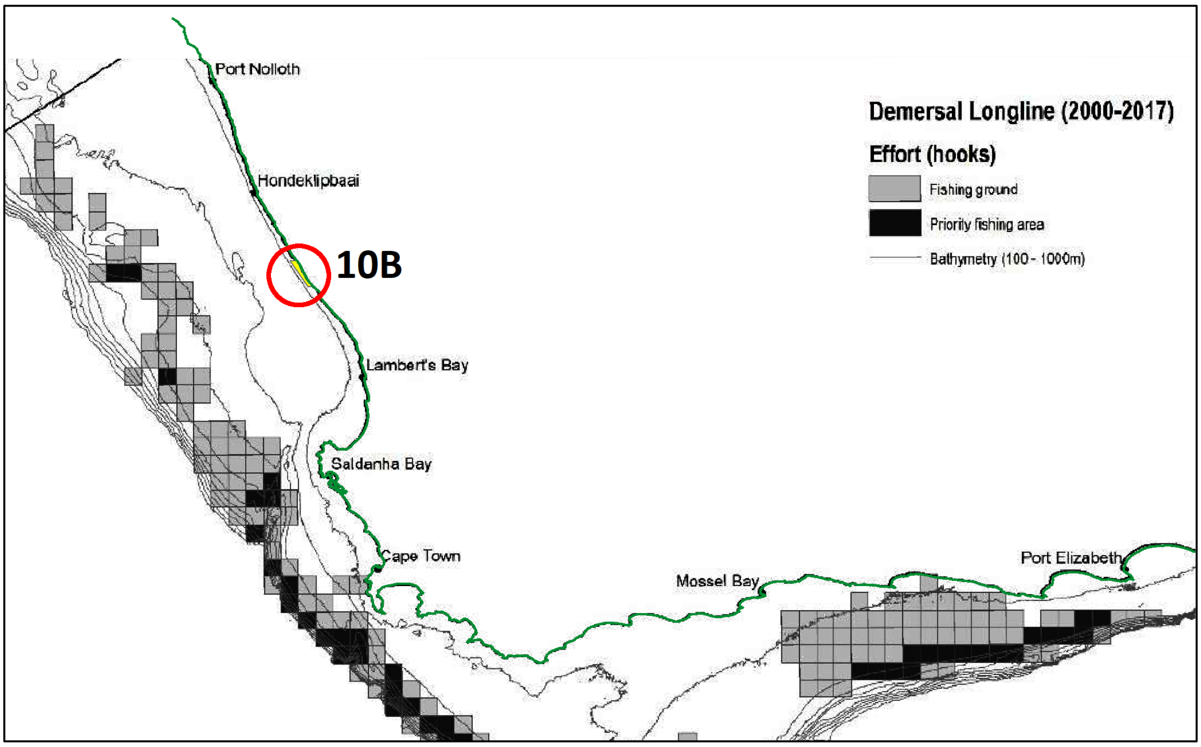
Figure 2.9. **Concession area 10B (within red ring) in relation to the Benguela Upwelling System (light green). Source: https://www.benguelacc.org/**

User groups

The main users of the sea space in Concession 10BC are the commercial shipping, mining, and fishing industries. The wave exposed and linear nature of the coast and lack of nearby ports suitable for large vessels means that most merchant shipping would travel offshore of the concession area along the continental shelf edge. Most shipping vessels crossing the Concession area would be fishing vessels and other prospecting or mining vessels. This marine specialist report covers the potentially affected fisheries, whilst potential impacts on the other identified user groups (shipping, mining, oil and gas) are covered in the Basic Assessment Report. Marine research activities that may interact with the proposed prospecting on concession 10B include the annual demersal biomass survey conducted in January or February and the bi-annual small pelagic acoustic surveys conducted in May/June and November by the Department of Forestry, Fisheries and the Environment (DFFE). These surveys are conducted at a national level and the probability of an overlap in space and time with the relatively short duration of planned prospecting activities in concession 10B is considered very low. Despite the low probability of an interaction, should the planned prospecting and fisheries survey vessels happen to coincide within the concession 10B, this could be easily managed through consultation with the research managers at DFFE to ensure that the survey vessels do not hinder each other (i.e., adjustment of the prospecting programme) and implementation of standard marine safety/navigation protocols. Implementation of this simple mitigation would result in NO impacts of prospecting on the research activities (i.e., screened out).

The potential spatial overlap of commercial fisheries with the Concession Area 10B was investigated based on the most recently available published reports, specifically Norman *et al*. 2018, the Fishing Rights Register (2018), available commercial linefish catch and return data (DFFE 2011), and other EIA reports for the region (SLR 2021a, b). Current fisheries data (up to January 2022) were requested from the Department of Forestry, Fisheries and the Environment in February 2022, however, they were not made available within the timeframe of this Basic Assessment Process. Key fisheries have been identified as active within the region and are discussed in the following paragraph.

The demersal hake longline, demersal trawl, and tuna pole and line commercial fishing sectors that are active along the west coast, however, all operate far offshore of the 10B Concession Area and are therefore screened out (Figure 2.10, Figure 2.11). The traditional linefish sector does not operate in the waters within, or in the vicinity of, Concession 10b, and is therefore screened out (Figure 2.12). The West Coast Rock Lobster commercial and interim relief nearshore and fishery typically operates inshore, in water shallower (15-30 m) than the concession area, however, since 10B is remote from launch sites and has no known overlap with lobster fishing grounds and local coastal settlements, it has also been screened out (Figure 2.13) (DEFF 2020, Norman *et al*. 2018). Finally, Small scale fishers, including interim relief west coast rock lobster and line fish right holders may, on rare occasions, fish within the inshore areas of concession 10B, however, due to the limited range of small scale fishing vessels (typically 20 km from the harbour), coupled with the absence of any fishing settlements adjacent or close to Concession 10B, the probability of such encounters is negligible. Due to the very low probability of interaction with small scale fishers, the low intensity, small spatial scale, and the very short duration, the proposed prospecting activities are expected to have NO impact on small scale and interim relief fishers (i.e., screened out). The gill net fishery that targets mullet *Chelon richardsonii* in near shore waters (<50m depth) in some west-coast areas is not present in 10B due to the absence of any net fishing rights holders in the surrounding area and the lack of any coastal harbours on/ near the adjacent coastline (DFFE 2018), whilst kelp collection concessions are restricted to kelp beds or drift cast collected from the intertidal zone. No ranching rights for Abalone *Haliotis midae* have been given for this stretch of coastline and, therefore, it is also screened out. The small pelagic purse seine fishery is discussed in more detail in the following paragraphs.



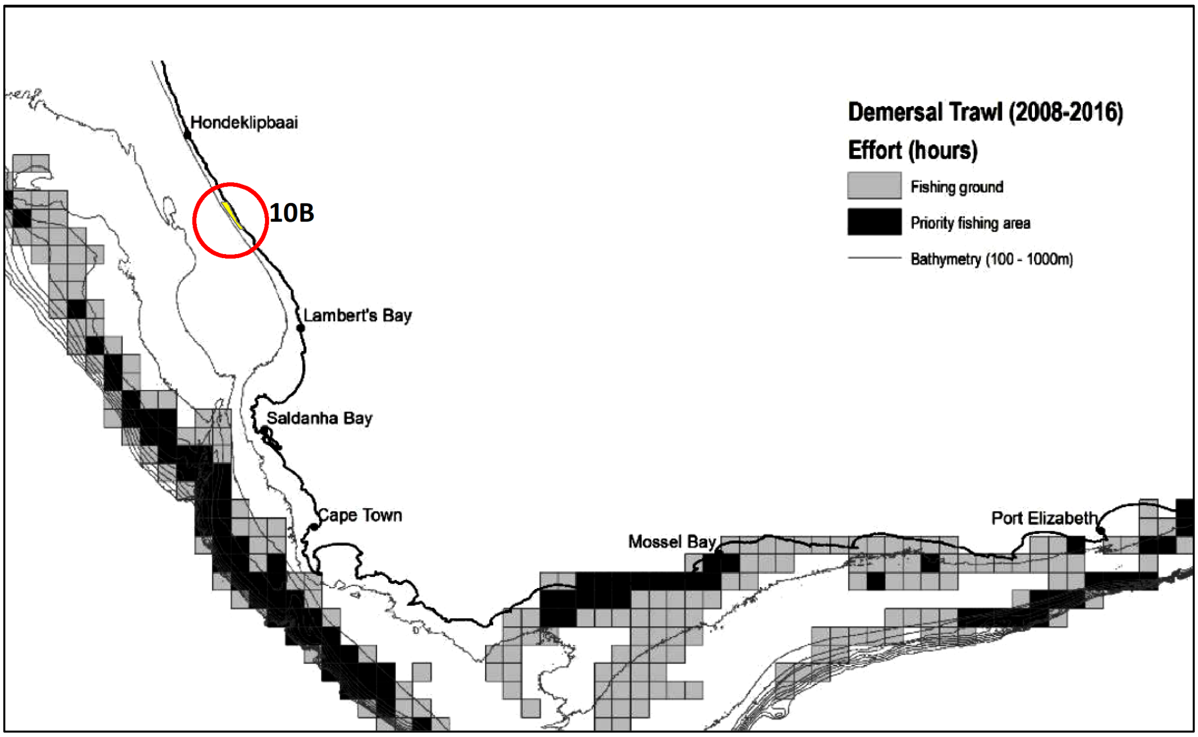
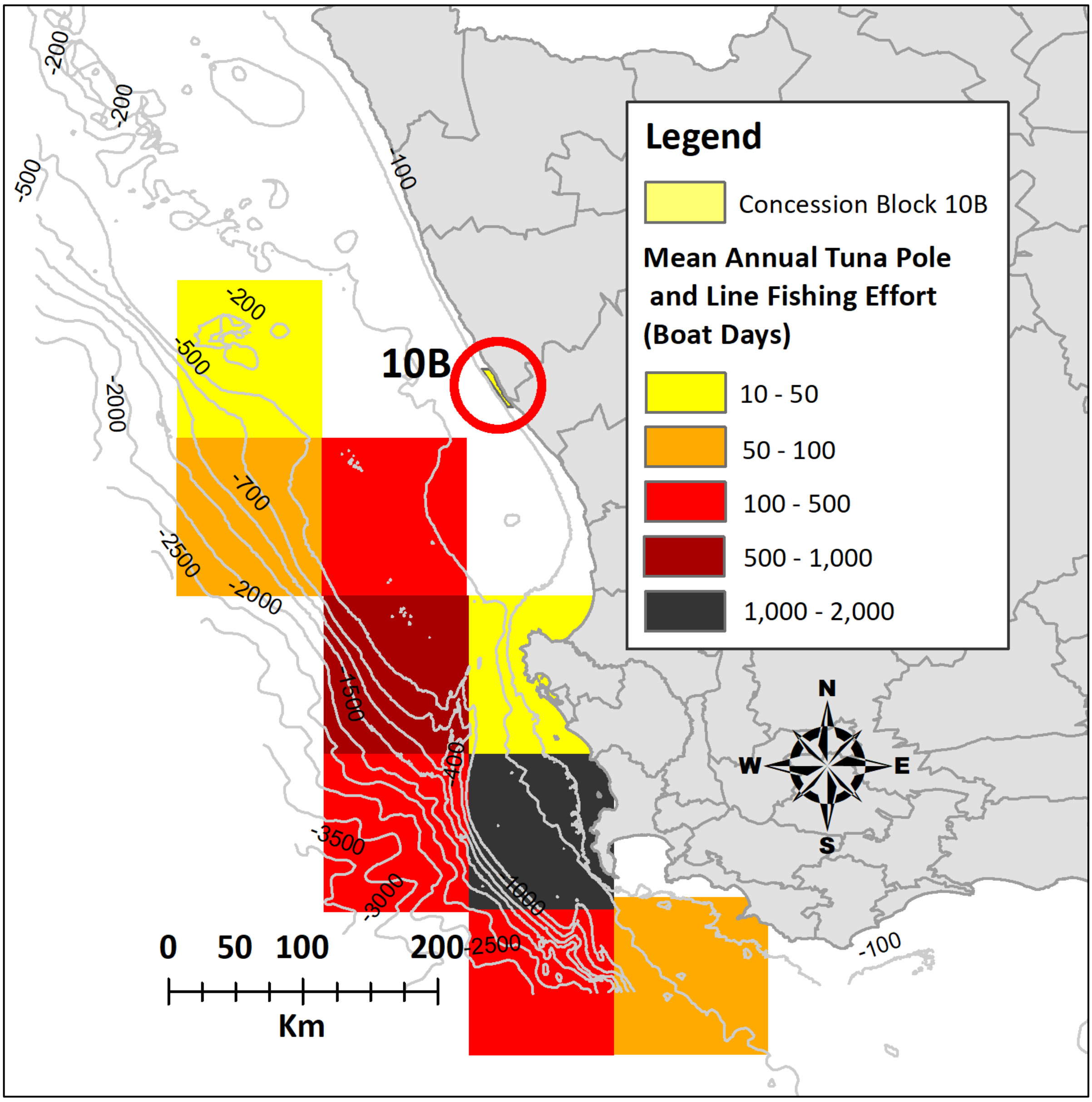


Figure 2.10. Distribution of demersal longline (top) and trawl (bottom) fishing effort in relation concession area 10B. (Source: Norman et al 2018).


Legend
Concession Block 10B
Mean Annual Tuna Pole and Line Fishing Effort (Boat Days)
10 - 50
50 - 100
100 - 500
500 - 1,000
1,000 - 2,000
10B
N
E
S
W
0 50 100 200
Km

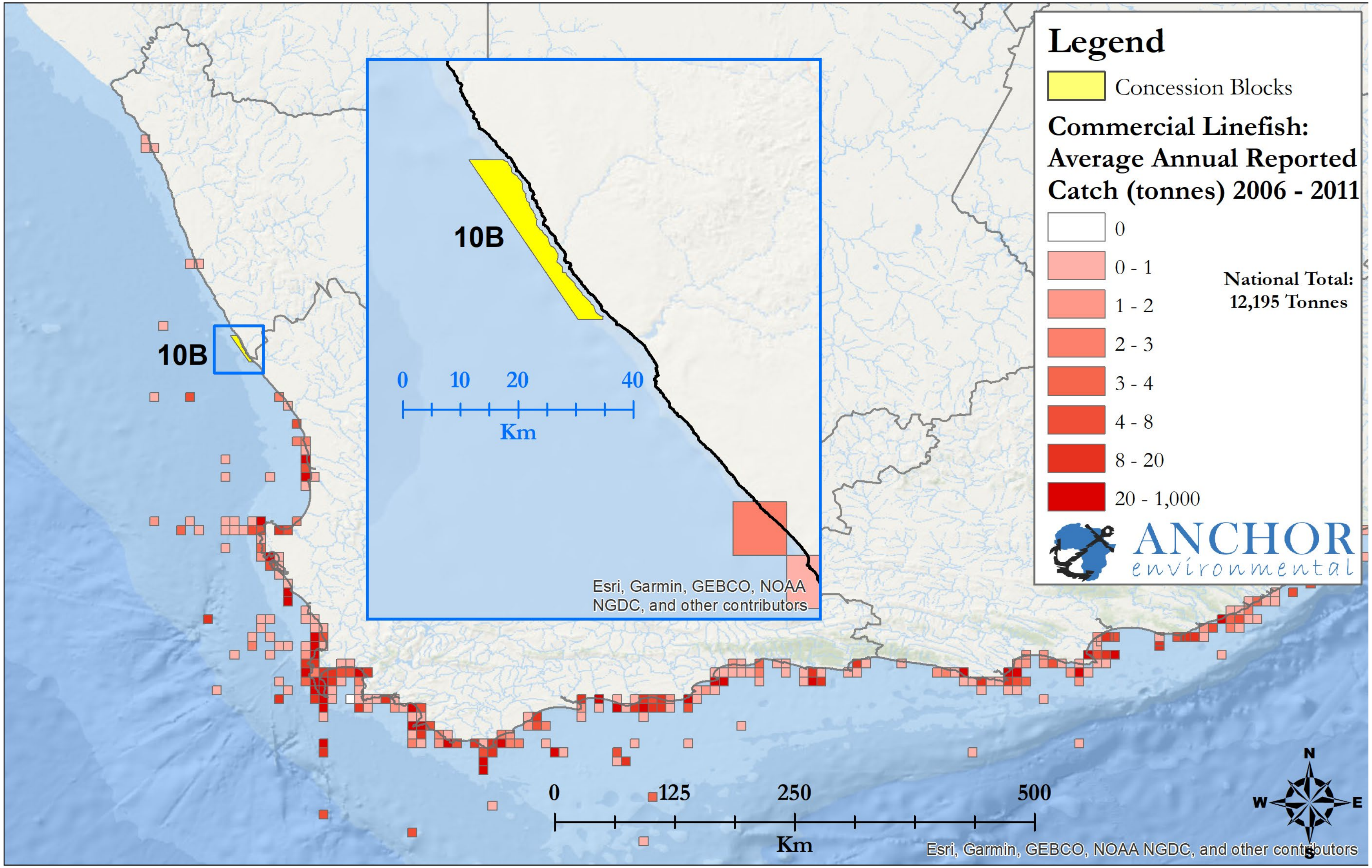


Figure 2.12. **Reported annual commercial line fishing catch the calculated proportion of the average national total catch made within Concession Area 10B (Data source: DFFE).**

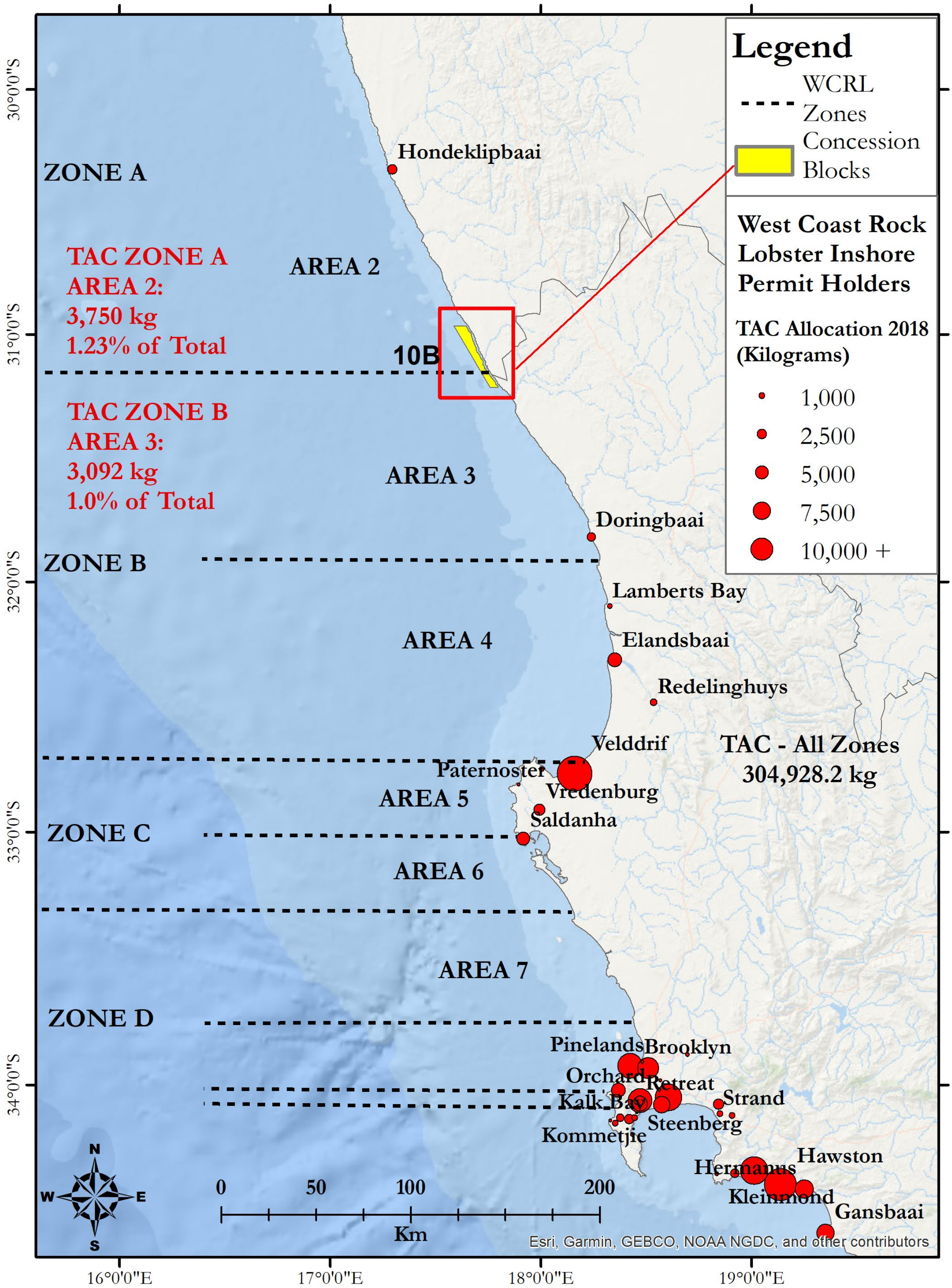


Figure 2.13. **Map showing the proportion of the spatial distribution of quota in the west coast rock lobster nearshore sector by right holders given residential address (Source: DFFE, Fishing Right Register for all Commercial Fishing Sectors 2017).**

2.4.1 Small Pelagic Purse Seine

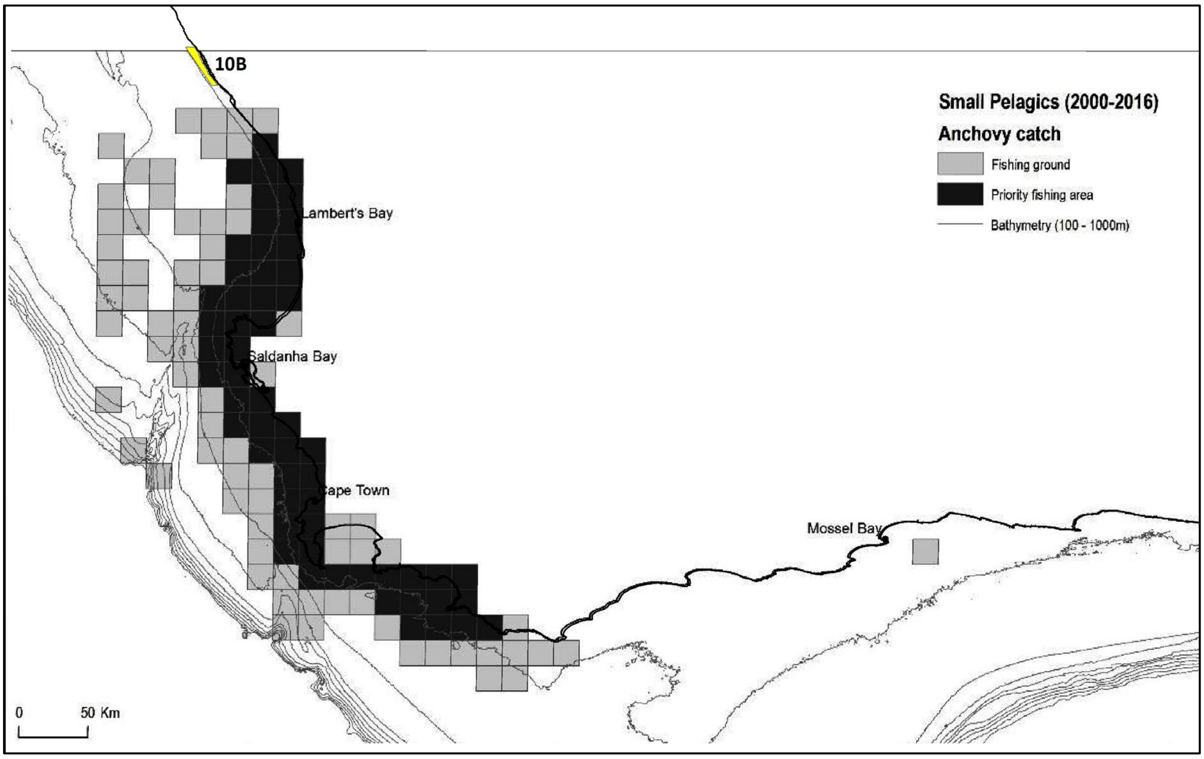
The South African small pelagic fishery developed in the 1940s with sardines *Sardinops sagax* primarily targeted along the west coast. Catches peaked in the early 1960s at around 400 000 tonnes but collapsed thereafter, thought to be a direct result of overfishing. The industry switched to smaller nets and began targeting anchovy *Engraulis encrasicolus*, which dominated the catches from about 1964 to the mid-1990s when recovery of the sardine stock was achieved under a stock rebuilding management strategy. Catches of both species have been at similar levels (around 250 000 tonnes) since then, as biomass increased from the mid-1990s until recently when a boom (1997-2004 with an associated eastward movement of the sardine stock) and bust scenario took place (crash in sardine biomass from ~2005 onwards). The fishery also targets red eye *Eutremeus whiteheadi* to a lesser degree, which along with anchovy, is processed into fish meal. The sardine catch is mostly canned with some marketed as fresh fillets or frozen for bait or human consumption. The fishery utilizes wooden, fiberglass or steel hulled purse-seine vessels and most of the large processing factories are located on the west and southwest coast (between St Helena Bay and Gansbaai) where purse seine fishing was historically concentrated.

The small pelagic fishery has the largest catch volume for any of the South African fishery sectors and has the second largest annual catch value, estimated at around R2.164 billion in 2017, which is approximately one fifth of the combined value of South African Fisheries (Japp & Wilkinson 2021). The industry supports around 4 500 full time staff, 2 500 seasonal staff and more than 700 fishers. The support industries support a further 2 400 jobs. The small pelagic fishery is managed using an Operational Management Plan (OMP) that involves a trade-off between maximizing overall sardine and anchovy catches, whilst minimizing the risk of resource collapse. This trade-off is required as juvenile anchovy (which form the bulk of the anchovy catch) and juvenile sardine shoal together for much of the year. Allowance is therefore made for a sardine total allowable by-catch (TAB) of juvenile sardine in both the early and late anchovy allocations as well as a fixed TAB for adult sardine in the round herring directed fishery. The OMP is tuned to minimize risk of resource collapse which is defined as the probability of adult biomass falling below defined historical levels at least once during the simulation model projection period of 20 years. Until recently the stock status of anchovy and round herring was considered optimal, whilst sardine stocks are considered depleted (DAFF 2020). The 2019 and 2020 OMP, however, required implementation of "exceptional circumstances" allowing large or rapid declines in Total Allowable Catch (TAC) for both sardine and anchovy due to low biomass estimates. Total pelagic catches in 2019 were 226 872 tonnes which was well below the long-term average of around 334 000 tonnes.

The small pelagic purse-seine fishery operates between the Orange River and East London, mostly in nearshore waters (within 10 km of the coast). The 10B Concession Area does not overlap with identified priority fishing areas for anchovy and with the sardine directed fishing ground (Figure 2.14), however, there is some overlap with the reported small pelagic catch distribution (Figure 2.15) (Norman *et al*. 2018, DFFE 2011). Small pelagic fishing activity in the vicinity of 10B takes place in the late summer mainly during the months of February to July (SAPFIA pers. comm).

A quantitative spatial analysis using commercial catch return data (all small pelagic species combined) for the period 2006-2011, shows that Concession Area 10B partially overlaps with one small pelagic reporting grid blocks where an annual average of 1.75 tonnes of fish were landed over the 2006-2011 period which is equivalent to about 0.0027% of the national total catch (Figure 2.15). Assuming small pelagic catches are randomly and evenly distributed within the grid block, the area of direct overlap will account for average annual catches of approximately 0.088 tonnes within concession 10B, equivalent to ~ 0.00001 % of the average national total for this period (Figure 2.15). This is an insignificant proportion of the national catch, but potential impacts of prospecting within this small pelagic fishing area may be significantly negative at the individual vessel or right holder level. However, since the target species are pelagic, and their distribution is variable, these fishers are unlikely to be significantly negatively affected by small temporary closures/exclusion zones around survey vessels and geotechnical survey sites.

The 10B concession area does lie within the important west coast nursery ground that is utilised by several small pelagic fish species including sardine, horse mackerel (*Trachurus capensis*) and anchovy that utilise Agulhas Bank and west coast spawning grounds (Hutchings et al 2002). The west coast nursery area extends along much of the west Coast shelf and is bookended by the Cape Columbine upwelling cell in the south to Luderitz upwelling cell in the north (Hutchings et al 2002). Spawning of anchovy and sardines mostly takes place during the Spring and Summer months with recruits reaching the west coast via general north-westerly drift of Agulhas Bank surface waters and a coastal jet current off Cape Point and Cape Columbine. Models of egg and larval dispersal estimate that most recruits would reach the west coast within 1-3 weeks of spawning i.e., December to May would see the greatest abundance of juvenile small pelagic fish in West Coast nursery grounds (Hutchings et al 2002). The 10B concession overlaps with one of several areas of high juvenile anchovy abundance, with much of the west coast between St Helena Bay and Port Nolloth constituting the anchovy recruitment habitat (Figure 2.16).



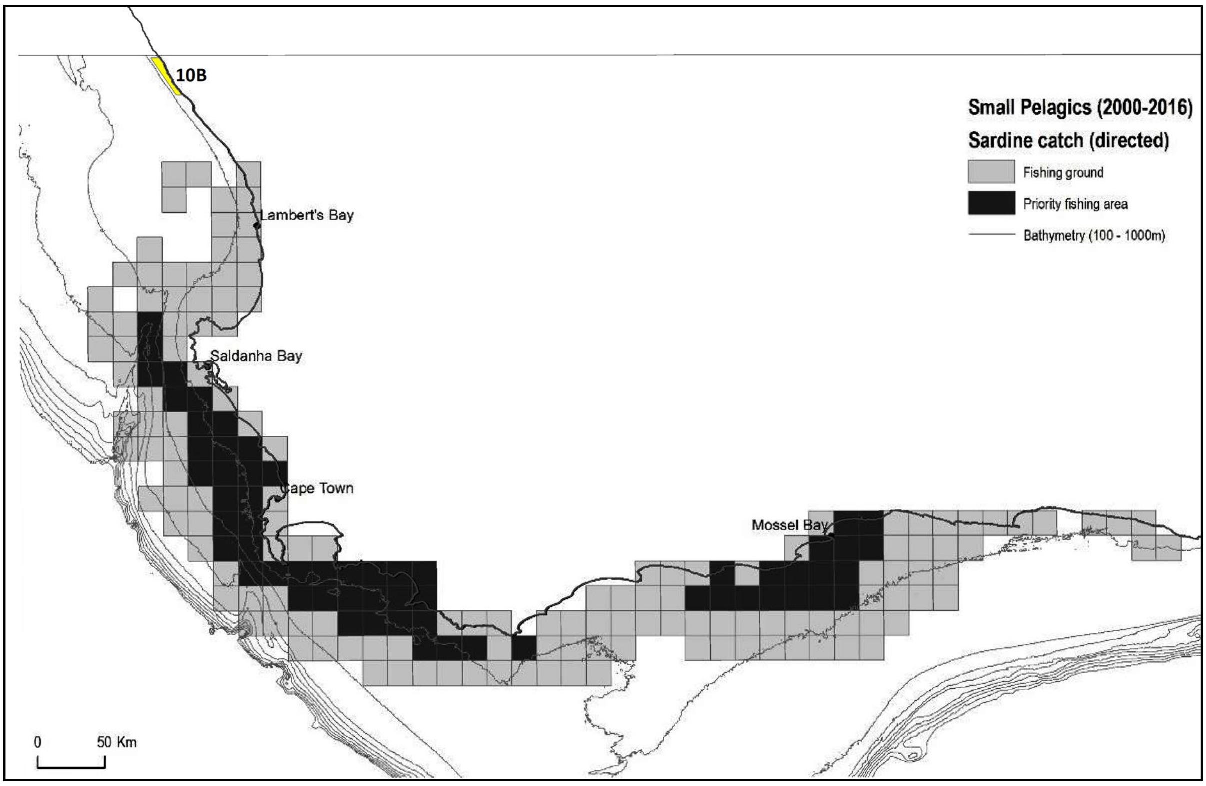


Figure 2.14. Spatial distribution of anchovy (top) and sardine (bottom) purse seine catch (2000-2016) with identified priority fishing areas (Source: Norman et al. 2018).

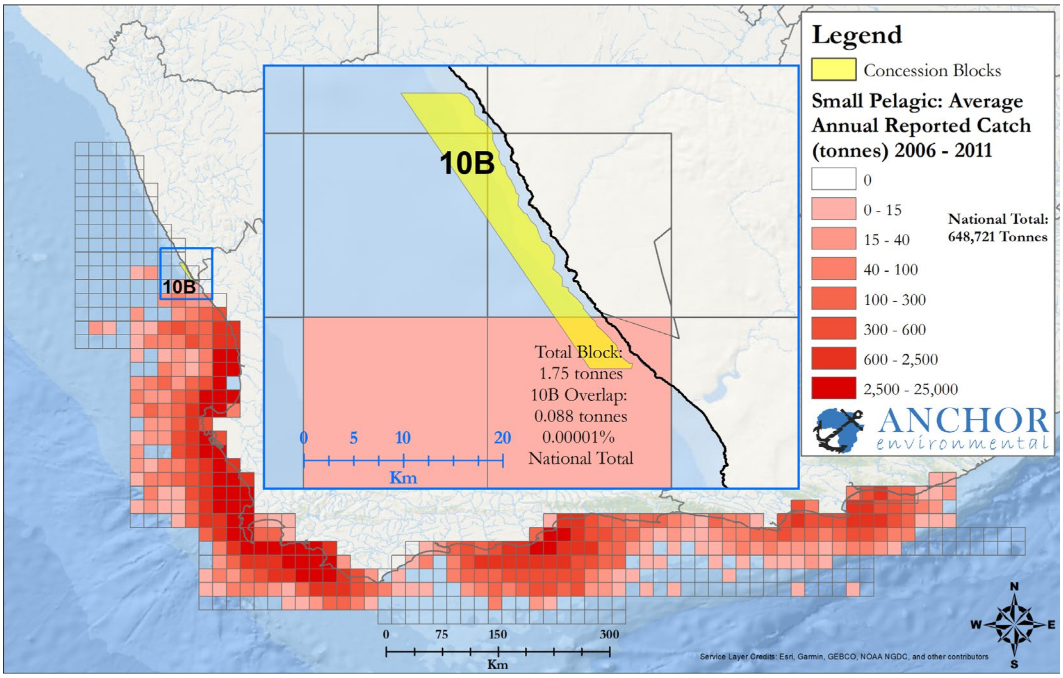


Figure 2.15. **Average annual reported small pelagic catch 2006-2011 (tonnes) and the calculated proportion of the average national total catch made within Concession Area 10B (Data source: DFFE).**

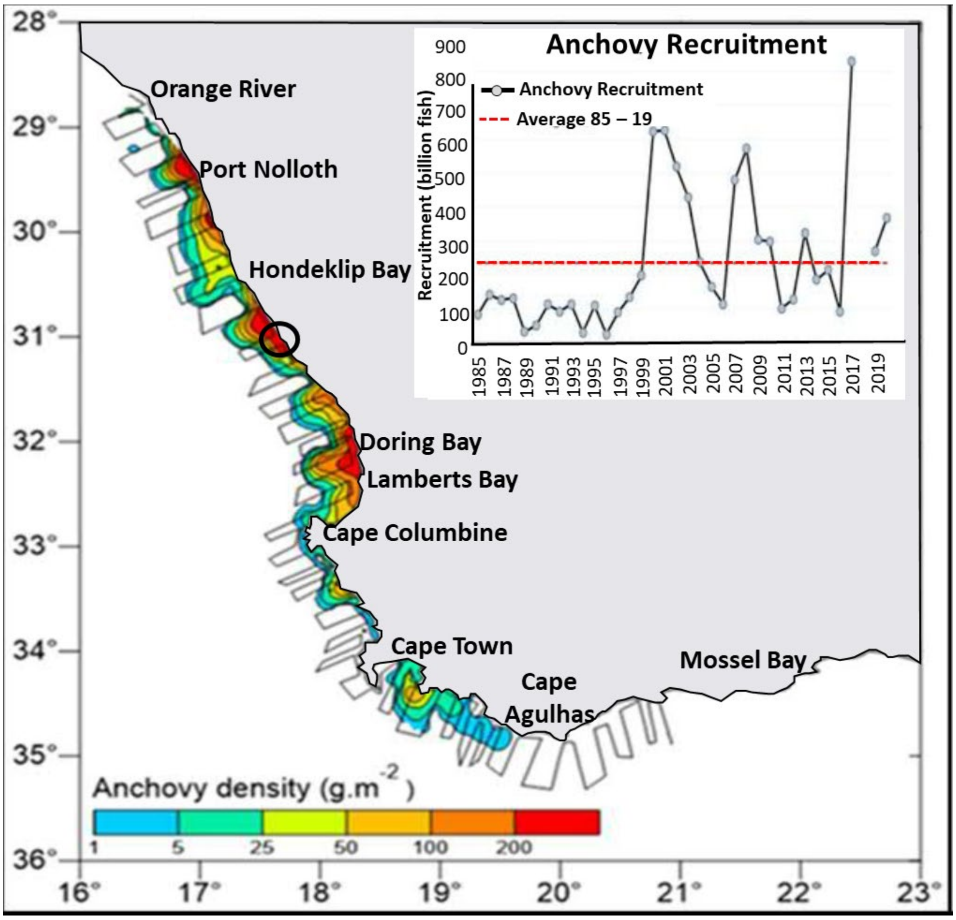


Figure 2.16. **Recruitment survey results (May 2020) for anchovy density (Concession 10B is found within the black circle) and recruitment trend (inset). The red dotted line is the running average level of recruitment since 1985 (information and figure provided by J. Coetzee and D. Merkel of DFFE; Source: SLR 2021**

3 IMPACT ASSESSMENT

Potential impacts were identified for exploration and prospecting in marine diamond mining Concession 10B. Potential impacts were assessed in terms of their nature, extent, duration, intensity, probability of occurrence, potential for mitigation, cumulative effects and overall significance (Appendix 1).

3.1 Identification of impacts

Potential impacts to the marine environment as a result of exploration and prospecting are identified based on available literature, previous EIA and monitoring reports (Lane and Carter 1999; Penney *et al.* 2007; Pulfrich 2016, 2017, 2021; Biccard *et al*. 2018; Baker and Arnott 2021) and the specialist's own knowledge. It is assumed that a vessel with dynamic positioning will be used for all survey and sampling activities and potential impacts of anchoring on the seabed are therefore not assessed. Should this not be the case the potential impacts of anchoring must be assessed, and appropriate mitigation included in a revised EMPr. Identified potential impacts include:

- Seismic disturbance to marine fauna;
- Marine megafauna collisions with survey vessels;
- Direct impact of seabed excavation and tailings disposal during drill sampling on benthic habitats e.g., soft sediments and/or reefs and associated infaunal and epifaunal communities;
- Impact on surrounding benthos and water column via fine sediment plume;
- Waste discharges during vessel operations
- Impact on the Namaqua Coastal Area EBSA and CBA; and
- Impacts on fisheries (and livelihoods of those who depend on these fisheries) due to exclusion zones around survey vessels and direct potential impacts on target species and supporting ecosystems.

3.1.1 Cumulative Impacts

Coastal and marine mining is well-established along South Africa's west coast between St Helena Bay and the Orange River mouth (Figure 2.16). There are prospecting and mining permits allocated for most of the nearshore, land based and surf zone coastal concessions between the Olifants and Orange River mouths (Figure 2.16). These mines are largely extracting diamondiferous gravels. In the vicinity of the 10B concession, TAD has also submitted an application for prospecting rights for concession 11C. Between the Olifants estuary mouth and Brand se Baai, mineral sands are extracted by Tormin and Tronox mines in intertidal and land based coastal operations respectively. There are also offshore oil and gas production and prospecting licenses with additional exploration applications currently underway (Figure 2.16). The prospecting and exploration methods for oil and gas exploration (seismic surveys and core/drill sampling) are similar (although normally of greater intensity as the oil and gas reserves are typically deeper and located in pockets of sedimentary rock below the sea floor) to those used for offshore diamond and other mineral exploration. There has been a recent increase in applications for prospecting and exploration rights along the west coast and increased prospecting/survey activity in the short term and marine mining in the long-term is anticipated.

This means that cumulative impacts of marine prospecting and mining must be considered at a broader spatial scale in a strategic manner for each potential impact identified. Obtaining detailed information on the scale, extent, methodology (and hence intensity) of various current and pending applications is, however, not possible within the prescribed timeframes of a Basic Assessment Process for a single application (such as this one). This requires a revised strategic level Environmental Impact Assessment to assess cumulative impacts with a medium to high level of confidence. The last strategic level EIA that assessed marine and coastal diamond mining impacts in the region was a Benguela Current Large Marine Ecosystem Programme (BCLME) study undertaken over the period 2004–2007 (Penney *et al*. 2007).

It is, however, logical and reasonable, to anticipate that many of the potential impacts assessed for this project would continue together with other projects that are ongoing or scheduled to come on-line. The result is that the spatial extent of many impacts would change from “local” to “regional”, whilst the duration would change from “short-term” (<2 years) to at least “medium term” (2–15 years) or even “long-term” (>15 years, mostly reversible in the case of prospecting, but not always for mining). The intensity of impacts is anticipated to remain as they are assessed here for operations of this nature but may be higher for other sea-based mineral and energy projects in different areas with different objectives. The cumulative effect of each of the identified impacts is therefore provided in the Impact Assessment tables below using this precautionary approach (assumption of simultaneous / consecutive prospecting and mining activities in the region). These cumulative impacts are assessed “after mitigation”. The assessment of cumulative impacts has a “low confidence” rating due to the uncertainty of the timing and location of other anthropogenic activities in the region.

It is recommended that a strategic level Environmental Impact Assessment (EIA) process based on marine spatial planning principles be undertaken to assess and manage potential cumulative impacts in a holistic manner and to identify and implement regional level mitigation measures. The decision-making authority (DMRE) must take cognisance of this recommendation to do a strategic level EIA in order for Specialists and Environmental Assessment Practitioners to accurately assess cumulative impacts.

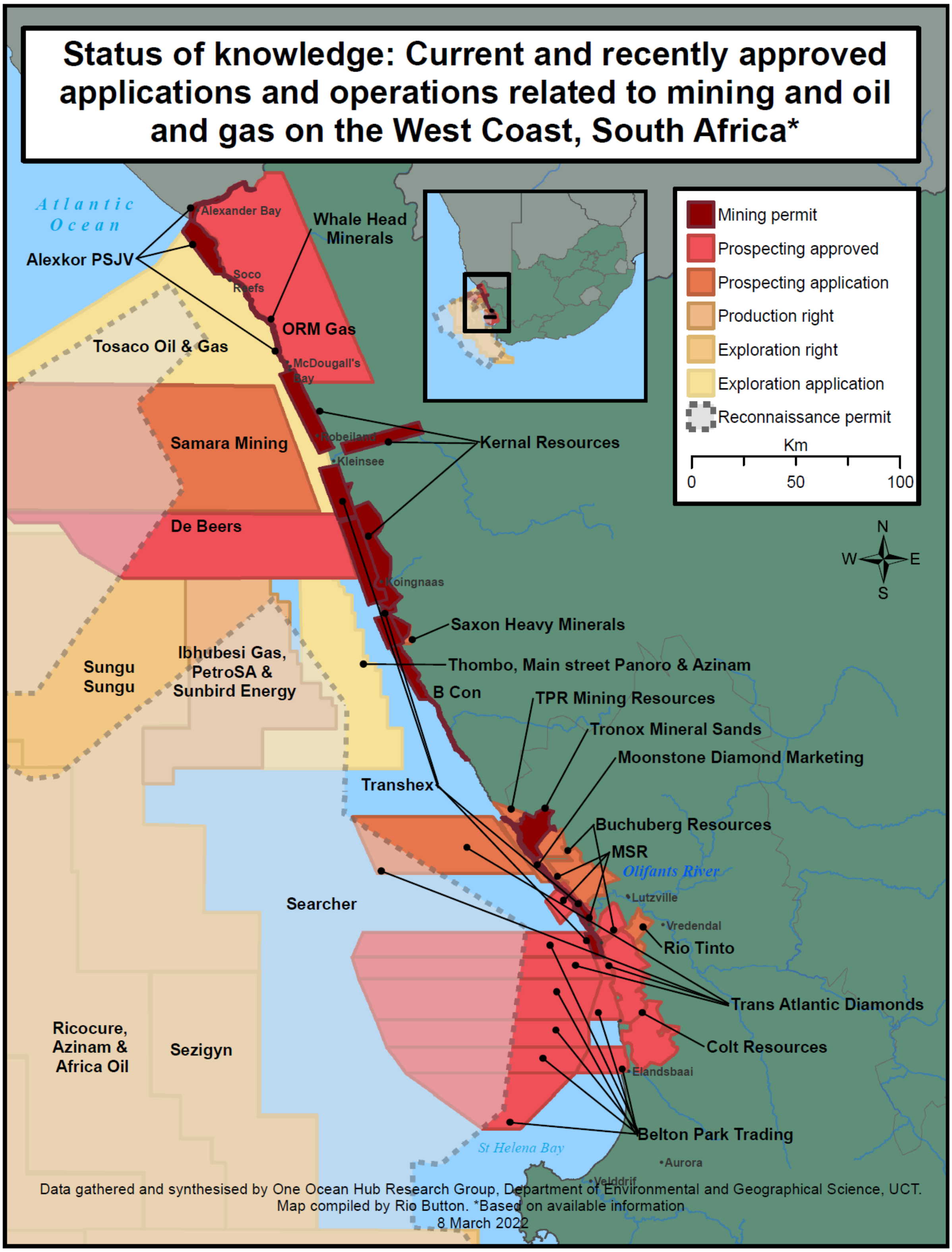


Figure 20. **Extent of prospecting and mining applications and operations within concession areas along South Africa's West Coast (Source: One Ocean Hub Research Group, Department of Environmental and Geographical Science, UCT. Map compiled by Rio Button. *Based on available information 8 March 2022.) (Note that economically viable resources and hence production phase activities are typically restricted to a small portion of offshore concessions).**

3.1.2 Seismic disturbance to marine fauna

It has become increasingly evident that noise from human activities in and around underwater environments can have an impact on marine species. The extent to which intense underwater sound might cause an adverse impact on a species is dependent upon the incident sound level, sound frequency, duration of exposure and/or repetition rate of the sound wave (Hastings and Popper, 2005). As a result, scientific interest in the hearing abilities of aquatic animal species, which may be affected by noise, has increased. These studies are primarily based on evidence from high level sources of underwater noise such as blasting or impact piling, as these sources are likely to have the greatest environmental impact.

Sounds generated by vessels in addition to the noise from seismic surveys have been related to negative impacts on marine animals (Koper and Plön 2012). These negative impacts include direct effects, such as physical injury (i.e., auditory and non-auditory), stress, perceptual interference, behavioural changes, chronic responses, and indirect effects on predator species as a consequence of a change in prey distribution or abundance due to direct effects of sound on the prey (NRC 2003; Koper and Plön 2012). The impacts associated with seismic surveys are not yet fully understood and further research is ongoing.

During prospecting, sounds and vibrations emanating from sampling tools only last a few days but can be intense. Exposure to intense sounds for even short periods of time can lead to permanent hearing damage. Concerns over these disturbing effects have been raised in international literature (Richardson *et al*. 1986; 1990; 1995; Richardson and Malme 1993; Finley *et al*. 1990; Gordon *et al*. 1992; Bauer *et al*. 1993; Maybaum 1993; Bain and Dahlheim 1994; McCauley 1994; Vincent 1996; Richardson and Würsig 1997; Gisiner 1998; Würsig *et al*. 1998; Lesage *et al*. 1999; Terhune and Verboom 1999; Au and Green 2000; McCauley *et al*. 2000; Miller *et al*. 2000; Nowacek *et al*. 2001; 2004; Nowacek and Wells 2001; Erbe 2002; Leung-Ng and Leung 2003). However, the potential effects of diamond prospecting and mining in southern Namibia on marine mammals have been reported to be minimal Findlay (1996).

It should be noted that natural sound sources are also emitted frequently from the ocean to a point where "sea noise" and biological sound sources (baleen whale calls, dolphin echolocation, shrimp snapping etc.) may even overshadow anthropogenic noise (Penney *et al*. 2007; Pulfrich 2017; Au 1993; Richardson *et al*. 1995).

Adverse impacts of underwater sound can be broadly summarised into three categories:

- Physical traumatic injury and fatality;
- Auditory injury (either permanent threshold shift (PTS) or temporary threshold shift (TTS); and
- Disturbance.

Invertebrates

Invertebrates mostly do not possess hearing organs, but many do have tactile organs or hairs that are sensitive to underwater sound pressure (Mason 2017). Some invertebrates have highly sophisticated statocysts, which resemble the ears of fishes. While there is very little published information available about the effects of seismic noise on marine invertebrates, it has been postulated that benthic invertebrates can only hear seismic survey sounds at very close range. This implies that only surveys conducted in very shallow water will have any detrimental effects on benthic invertebrates. The overall impact of seismic disturbance to marine invertebrates in concession 10B is assessed to be VERY LOW (Table 3-1). The greatest concern to invertebrates is the drilling in the resource development phase, which will entail a high density of samples, vibration, and generation of underwater noise that may negatively impact invertebrates. Best practise mitigation includes the minimising the number, or the prohibition of drill samples to reduce the intensity of the impact. For the cumulative impact assessment, the extent increases from local to regional and the duration increases from medium-term to long-term (>15 years). This raises the overall consequence from very low to medium and the overall significance from very low to Medium. However, our confidence for this assessment decreases from medium to low (for reasons stated above).

Table 3-1 Seismic disturbance to invertebrates.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Medium 2	Short-term 1	Very Low 4	Probable	**VERY LOW**	-ve	Medium
Essential Mitigation: The absolute minimum number of 3-5 m^2 drill samples must be used during the resource development phase of prospecting								
With Mitigation	Local 1	Low 1	Short-term 1	Very Low 3	Probable	**VERY LOW**	-ve	Medium
Cumulative impact	Regional 2	Low 1	Long-term 3	Medium 6	Probable	**MEDIUM**	-ve	Low

Fish

The impacts of seismic survey noise on spawning behaviour of fish have not been quantified to date, but it is predicted that if fish are exposed to powerful external forces on their migration paths or spawning grounds, they may be disturbed or even cease spawning altogether, possibly affecting recruitment to fish stocks. The Multibeam Echo Sounder (MBES) to be used in this study is a high-frequency system (frequencies in excess of 10 kHz) and it is known that fish are unable to perceive the high frequencies that characterise these sources (Popper *et al*. 2014; Barham and Mason 2021). The Topas chirp SBP falls within the mid-frequency range from Popper *et al*. (2014) (1 kHz to 10 kHz) which is also mostly inaudible to fish (Mason 2017). Some species, particularly those that possess swim bladders, can suffer serious injury, but the majority of fish are highly mobile and are able to avoid seismic noise at levels that can cause injury (Mason 2017). Popper and Schilt (2008) conclude that as the vast majority of fish exposed to seismic sounds will in all likelihood be some distance from the source, where the sound level has attenuated considerably; only a very small number of animals in a large population will ever be directly killed or damaged by sounds from seismic sources. Possible injury or mortality in pelagic species could occur on initiation of a sound source at full power in the immediate vicinity of fish, or where reproductive or feeding behaviour may override a flight response to seismic survey sounds. Underwater noise from drilling is expected to constitute a disturbance to fish that could interfere with life history behaviours, but this is expected to be temporary and limited to a very small spatial area in close proximity to the drilling sites. The overall impact of the use of the seismic survey equipment on fish is thus assessed to be of INSIGNIFICANT risk and no mitigation is considered necessary (Table 3-2). For the cumulative impact assessment; the extent increases from local to regional and the duration increases from short-term to long-term (>15 years). This raises the overall consequence from very low to medium and the overall significance from insignificant to LOW. However, our confidence for this assessment of the cumulative impacts decreases from medium to low.

Table 3-2 Seismic disturbance to fish.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Short-term 1	Very Low 3	Possible	**INSIGNIFICANT**	-ve	Medium
No mitigation measures required								
Cumulative impact	Regional 2	Low 1	Long-term 3	Medium 6	Possible	**Low**	-ve	LOW

Marine mammals

All marine mammals, through adaptation to the marine environment, have developed broader hearing ranges than are common to land mammals. These broader hearing ranges make them susceptible to acoustic trauma from geophysical survey activity. Such injuries are either temporary (temporary threshold shift – TTS) or permanent (permanent threshold shift – PTS). Injuries are likely to result in a reduction in foraging efficiency, reproductive potential, social cohesion and ability to detect predators (Weilgart 2007). The prevalence of geophysical survey data acquisition has increased across the globe in recent years, and this has prompted scientists to establish noise exposure criteria to predict the onset of auditory effects in marine mammals in order to avoid or mitigate for such impacts (Southall et al. 2019).

To date, extensive seismic surveys have been conducted on the continental shelf on the west and south coasts of South Africa (Branch and Branch 2018). The scientific community have voiced their concern over the potential impacts associated with these seismic surveys on various groups of marine fauna. It is known that migrating whales are frequently encountered on the west coast of southern Africa during the summer months (due to feeding activity) and encounters with odontocetes such as dusky dolphins, Heaviside's dolphin and pilot whales are possible throughout the year. Furthermore, humpback calves are vulnerable during the southern migration which takes place during the months of September and October. The timing of seismic survey activity in concession 10B should be confined to seasons when cetaceans are scarce to ensure minimal disturbance (Gründlingh *et al*. 2006).

There is little information available on the levels of noise that would potentially result in physiological injury to cetaceans, and no permanent threshold shifts (PTS) have been recorded (Mason 2017). Available information suggests that the animal would need to be in close proximity to operating seismic equipment to suffer severe physiological injury (Koper and Plön 2012). As whales are highly mobile, it is assumed that they would avoid sound sources before such injury occurs. Observations show that responses to seismic activity varies between species with smaller odontocetes displaying the strongest avoidance response, while the responses of medium and large odontocetes (killer whales and pilot whales) were less marked (Mason 2017). Baleen whales showed fewer responses to seismic survey activity than small odontocetes, but all baleen whales showed changes in behavioural responses. McCauley *et al*. (2000b) found no obvious evidence that Humpback whales were displaced by seismic surveys and no apparent gross changes in the whale's migratory path could be linked to seismic survey activities, although localised avoidance of survey vessels has been noted. Such avoidance is generally considered of minimal impact in relation to the distances of migrations of the majority of whale species.

Of the proposed seismic survey activities, the Topas sub-bottom profiler system which uses shallow (35-45 kHz) and medium penetration (1-10 kHz) "Chirp" seismic pulses to map the sediment horizon could present a risk to dolphins that are known to occur in the area (mainly dusky and Heaviside's dolphins). Heaviside's dolphins are listed as near threatened on the IUCN red data list, are known to occur in the area, and fall into the category of mid-frequency cetaceans that could be at risk during the proposed seismic survey. Dusky dolphins (listed as "least concern" on the IUCN red data list) are also known to occur in the area and could also be at risk.

A noise modelling study (using marine mammal noise exposure criteria from Southall *et al*. (2019) that was undertaken in Greenland in 50-250 m water depth for a similar MBES and Chirp sub-bottom profiler geophysical survey system predicted worst case scenario impact ranges for HF and LF cetacean hearing groups of less than 100 m for both PTS and TTS (Barham and Mason 2021). That said, it is recommended that a Marine Mammal and Seabird Observer (MMSO) be on duty during the proposed seismic survey activities and as a precaution, the listed mitigation measures are followed. A passive acoustic monitoring (PAM) system should also be used during survey activity to detect cetaceans that could be at risk. Implementation of these mitigation measures should ensure that PTS and TTS impacts arising from the proposed seismic survey activities in concession 10B would be unlikely.

It is likely that cape fur seals *Arctocephalus pusillis pusillis* will be encountered during seismic exploration and sampling/prospecting activities in Concession 10B. Seals are highly mobile animals with a general foraging area covering the continental shelf up to depths of 120 m (approximately 220 km) offshore. In general, seals display considerable tolerance to underwater noise (Richardson *et al*. 1995). This has been confirmed by a study in Arctic Canada in which ringed seals showed only limited avoidance of seismic operations (Lee *et al*. 2005). In another study, ringed seals were shown to habituate to industrial noise (Blackwell *et al*. 2004). It is likely that seals would only suffer significant injury if they were diving directly below the vessel in close proximity to the seismic source. The likelihood of this occurring is considered very low.

Based on the above, impacts to marine mammals was assessed to be of MEDIUM risk and with the implementation of mitigation (see below) this is reduced to VERY LOW risk (Table 3-3) – mitigation measures are expected to reduce the intensity of the impact from high to medium. For the cumulative impact assessment; the duration increases from short-term to long-term (>15 years) and this raises the overall consequence from medium to high and the overall significance from VERY LOW to

MEDIUM. However, our confidence for this assessment of cumulative impact decreases from medium to low (for reasons stated above).

Table 3-3. Seismic disturbance to marine mammals

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional 2	High 3	Short-term 1	Medium 6	Probable	**MEDIUM**	-ve	Medium
Essential mitigation measures: • A designated onboard Marine Mammal and Seabird Observer (MMSO) to ensure compliance with mitigation measures during geophysical surveying. • MMSO to conduct pre-survey visual scans of at least 30 minutes for the presence of cetaceans around the survey vessel prior to the initiation of any acoustic impulses • "Soft starts" should be carried out for equipment with source levels greater than 210 dB re 1 µPa at 1 m over a period of 20 minutes to give adequate time for marine mammals to leave the vicinity. Where this is not possible, the equipment should be turned on and off over a 20 minute period to act as a warning signal and allow cetaceans to move away from the sound source. • Terminate the survey if any marine mammals show affected behaviour within 500 m of the survey vessel or equipment until the mammal has vacated the area. • Avoid planning geophysical surveys during the movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (beginning of June to end of November) and ensure that migration paths are not blocked by sonar operations. • Passive Acoustic Monitoring (PAM) must be incorporated into any survey programme and used to detect cetaceans, particularly during periods of low visibility.								
With mitigation	Regional 2	Medium 2	Short term 1	Low 5	Improbable	**VERY LOW**	-ve	Medium
Cumulative impact	Regional 2	Medium 2	Long term 3	High 7	Improbable	**MEDIUM**	-ve	Low

Seabirds

As with other vertebrates, the assessment of indirect effects of seismic surveys on diving seabirds is limited by the complexity of trophic pathways in the marine environment (Mason 2017). Impacts of seismic pulses to marine birds (diving or resting on water surface) include physiological injury, behavioural avoidance of seismic survey areas and indirect impacts due to effects on prey. The African penguin *Spheniscus demersus*, which is flightless and occurs along the West Coast, is particularly susceptible to impacts from underwater noise. Due to the continuous nature of the intermittent seismic survey pulses, African penguins and other diving birds would be expected to hear the sound sources at distances where levels would not induce mortality or injury and likely avoid the approaching sound source (Mason 2017). This is supported by the findings of Pichegru *et al.* (2016) who have shown that feeding areas within 50 km of seismic surveys are completely avoided by African penguins.

Most of the impacts identified depend on the diet of the bird species concerned and the effect of seismic surveys on the diet species. For example, plunge-diving birds forage on small shoaling fish prey species relatively close to the shore (Mason 2017). Of the diving birds that occur along the coast, only the Cape gannet *Morus capensis* regularly feeds from the inshore environment as far as 100 km offshore. Other seabirds found close inshore that may be impacted along the inner margin of concession 10B include the cape cormorant, various terns and gull species. Pelagic seabirds such as albatross, petrels and shearwaters are likely to be encountered in the offshore waters of 10B and may also be impacted. The overall impact is assessed to be of INSIGNIFICANT risk (Table 3-4). For the cumulative impact assessment, the extent increases to regional and duration increases to long-term (>15 years) and this raises the overall consequence from very low to high and the overall significance from INSIGNIFICANT to MEDIUM. However, our confidence for this assessment decreases from medium to low (for reasons stated above).

Table 3-4. Seismic disturbance to seabirds.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Medium 2	Short-term 1	Very Low 4	Possible	**INSIGNIFICANT**	-ve	High
Essential mitigation measures: • A designated onboard Marine Mammal and Seabird Observer (MMSO) to ensure compliance with mitigation measures during geophysical surveying • MMSO to conduct pre-survey visual scans of at least 30 minutes for the presence of feeding seabirds in the survey area • If spotted wait until all marine life (seabirds, seals, cetaceans and turtles) have cleared an area of 500 m radius of the centre of the seismic source before resuming with seismic survey (initiate soft start procedure when resuming seismic survey). • Terminate the survey, if any seabirds show affected behaviour within 500 m of the survey vessel or equipment, until they have vacated the area. • Record incidences of encounters with marine life (seabirds, turtles, seals, fish) their behaviour and response to seismic survey activity. • Suspend operations if any obvious mortalities or injuries to marine life are observed.								
With mitigation	Local 1	Medium 2	Short term 1	Very low 4	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative impact	Regional 2	Medium 2	Long term 3	High 7	Improbable	**MEDIUM**	-ve	Low

Turtles

The overlap of turtle hearing sensitivity with the higher frequencies produced by seismic survey equipment suggests that turtles may be considerably affected by seismic noise. Recent evidence suggests that turtles only detect seismic survey equipment at close range (< 10 m, possibly linked to visual rather than auditory cues) or are not sufficiently mobile to move away from approaching survey vessels (particularly if basking). Initiation of a sound source at full power in the immediate vicinity of a swimming or basking turtle could therefore result in physiological injury. Injured turtles are less mobile than other large marine fauna, and are vulnerable to both boat strikes and entanglement with seismic towed equipment. Turtles are mostly restricted to offshore pelagic waters off the west coast of South Africa and are likely to be encountered in Concession 10B. However, most incidents involve foraging turtles or turtles diving in an escape response becoming trapped by towed survey equipment which is not in the scope of works for the proposed seismic survey in Concession 10B. The overall impact is therefore assessed to be INSIGNIFICANT. Despite the low probability of impacts on turtles during the short survey duration their inability to timeously avoid an approaching survey vessel warrants a precautionary approach and required mitigation includes delayed start-ups and a 500 m buffer (Table 3-5). For the cumulative impact assessment; the extent increases to regional and duration increases to long-term (>15 years) and this raises the overall consequence from very low to medium and the overall significance from INSIGNIFICANT to LOW. However, our confidence for this assessment decreases from high to low (for reasons stated above).

Table 3-5. Seismic disturbance to turtles.

<table>
<tr><th></th><th>Extent</th><th>Intensity</th><th>Duration</th><th>Consequence</th><th>Probability</th><th>Significance</th><th>Status</th><th>Confidence</th></tr>
<tr><td>With and Without mitigation</td><td>Local
1</td><td>Low
1</td><td>Short-term
1</td><td>Very Low
3</td><td>Improbable</td><td>INSIGNIFICANT</td><td>-ve</td><td>High</td></tr>
<tr><td colspan="9"><u>Essential mitigation measures:</u>
• A designated onboard Marine Mammal, Turtle and Seabird Observer (MMSO) to ensure compliance with mitigation measures during geophysical surveying
• MMSO to conduct pre-survey visual scans of at least 30 minutes for the presence of feeding seabirds in the survey area
• If spotted wait until all marine life (seabirds, seals, cetaceans and turtles) have cleared an area of 500 m radius of the centre of the seismic source before resuming with seismic survey (initiate soft start procedure when resuming seismic survey).
• Terminate the survey, if any turtles show affected behaviour within 500 m of the survey vessel or equipment, until they have vacated the area.
• Record incidences of encounters with marine life (seabirds, turtles, seals, fish) their behaviour and response to seismic survey activity.
• Suspend operations if any obvious mortalities or injuries to marine life are observed</td></tr>
<tr><td>Cumulative impacts</td><td>Regional
2</td><td>Low
1</td><td>Long-term
3</td><td>Medium
6</td><td>Improbable</td><td>LOW</td><td>-ve</td><td>Low</td></tr>
</table>

Mitigation Measures

Current mitigation measures for impacts to marine fauna include spatial and temporal restrictions (i.e., activity restricted to specific areas or a time of year), source-based mitigation (i.e., sound containment and improvement of current equipment used), and operational mitigation where a certain protocol is followed to avoid mortalities and/or injuries to marine animals when they are encountered during survey operations. Additional restrictions on the extent of destructive sampling using the larger drill tool have also been recommended. These existing mitigation measures are highly valuable for a country such as South Africa, which has a rich coastal biodiversity and is an important habitat for threatened marine species, while experiencing a rapid increase in coastal industrial developments (Koper and Plön 2012).

The following mitigation measures identified by Mason (2017) and Koper and Plon (2012) are recommended where applicable to reduce the severity of the aforementioned impacts:

- Implement “soft-starts” of at least 20 minutes duration when the SBP is deployed.
- Employ on board independent observer(s) / MMSO(s) with experience in seabird, turtle and marine mammal identification and observation techniques to carry out daylight observations.
- If surveys are to be undertaken at night, it is recommended that the vessel is fitted with Passive Acoustic Monitoring (PAM) technology. Utilise PAM technology when surveying at night or during adverse weather conditions and thick fog (commonly encountered on the west coast of South Africa).
- Record marine mammal incidences and responses to seismic survey activity, including data on position, distance from the vessel, swimming speed and direction and obvious changes in behaviour (e.g., startle responses or changes in surfacing/diving frequencies, breathing patterns) along with seismic noise levels.
- Terminate acoustic survey if mass mortalities of fish are observed.
- If spotted, wait until all marine life (seabirds, seals, cetaceans and turtles) have cleared an area of 500 m radius of the centre of the seismic source before resuming with seismic survey (initiate soft start procedure when resuming seismic survey).
- Record incidences of encounters with marine life (seabirds, turtles, seals, fish) their behaviour and response to seismic survey activity.
- Suspend operations if any obvious mortalities or injuries to marine life are observed.
- Wait until all small cetaceans (<3 m in overall length) have cleared an area of 500 m radius of the seismic survey vessel before resuming with seismic survey. If, after a period of 30 minutes, small cetaceans are still within 500 m of the airguns, the normal “soft start” procedure should be allowed to commence for at least 20-minutes duration. Small cetacean behaviour during “soft starts” shall be monitored.
- Record seabird incidences and behaviour, including any attraction of predatory seabirds and incidents of feeding behaviour around the survey vessel.
- Ensure that MMSOs compile a survey close–out report incorporating all recorded data to the relevant DFFE authorities.
- Make marine mammal incidence data and seismic source output data from surveys available on request to the Marine Mammal Institute (MMI), DFFE and DMR.

3.1.3 Marine megafauna collisions with survey vessels

There is a low risk of survey vessel collisions with marine megafauna such as whales and turtles that are susceptible to “ship strikes”. Any increase in vessel traffic through habitat used by these animals can increase the risk of collision whilst the deployment of towed survey gear carries a risk of entanglement. The main causes of cetacean (mainly southern right and humpback whales) entanglement in South Africa involve static fishing gears particularly west coast and south coast rock lobster traps and long lines (Meyer *et al*. 2011). The potential for collision between cetaceans and other megafauna and the survey vessel, or entanglement in the deployed sampling equipment is directly proportional to the vessel speed and the abundance and behaviour and cetaceans in the area during the surveys. The 10B concession area is part of the natural range of several species of marine mammals including large whales such as humpback and southern right whales, but it is not considered an important aggregation site or migration route (see 2.3.3). The number of marine fauna expected to be encountered during the limited time that the survey vessel is active is therefore expected to be very low and the intensity of the impact is considered high for the individual affected animal and medium for the population as a whole. The potential impact of marine megafauna collision with the survey vessel or entanglement in sampling equipment is therefore assessed to be of VERY LOW significance and with the implementation of mitigation measures is reduced to INSIGNIFICANT (Table 3-6). For the assessment of cumulative impacts; the duration increases to long-term (>15 years) and this raises the overall consequence from very low to medium and the overall significance from INSIGNIFICANT to LOW. However, our confidence for this assessment decreases from high to low.

Table 3-6. Marine megafauna collisions with survey vessels.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional 2	Medium 2	Short-term 1	Low 5	Possible	**VERY LOW**	-ve	High
Essential mitigation measures: • A designated onboard Marine Mammal Observer (MMO) and vessel operator to keep watch for marine megafauna in the path of the vessel during geophysical surveying. • Avoid planning geophysical surveys during the movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (beginning of June to end of November) and ensure that migration paths are not blocked by sonar operations. • Vessel transit speed to not exceed 12 knots (22 km/hr), except within 25 km of the coast where it should be kept to less than 10 knots (18 km/hr) as well as when sensitive marine fauna are not present in the vicinity.								
With mitigation	Regional 2	Low 1	Short term 1	Very Low 4	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative impacts	Regional 2	Low 1	Long term 3	Medium 6	Possible	**LOW**	-ve	Low

3.1.4 Seabed sampling and tailings disposal

Approximately 100-200 sites will be sampled in Concession 10B during the initial sampling phase, using either vibracoring, gravity coring or sonic coring techniques. The diameter of core samples will be approximately 10 cm, the corers will penetrate to depths of 3–8 m and the material brought to the surface for analysis. The volume per core is calculated at 0.24 m^3. The total volume for the 200 cores is calculated at 4.71 m^3. The 200 cores will cover a total surface area of 1.57 m^2, although the core might impact a surface area slightly larger than this. The core samples do not require onboard processing (i.e., no sediment spill in the ocean) as all material collected will remain intact within core tubes which are to be analysed on land.

In addition to this, a Van Veen grab with a sampling capacity of approximately 50 kg will be used to collect baseline environmental data on sediment and benthic macrofauna at 20-50 sites. Total volume of the grab is 0.03 m^3 and it will disturb an area covering approximately 0.1 m^2. The total area expected to be disturbed by the Van Veen grab will be approximately 5 m^2. Grab samples are typically washed and processed once on board. This will produce a very small sediment plume that is expected to dissipate almost immediately.

Additionally, and of more concern, is the footprint and the tailings discarded from the proposed use of the large 3-5 m^2 experimental drill, as this will result in a maximum of 15 m^3 of sediment being discarded per site, which amounts to 900 m^3 (at least 900 tonnes) per resource development area (500 x 300 m area), with 20 of these areas proposed in total (18 000 m^3 total). The initial phase of drilling, which entails taking a single sample every 300 metres will have a lesser impact on the local benthos. According to the prospecting work programme "The material will be processed onboard by a processing plant and tailings will be discarded overboard in a designated area to avoid sensitive habitats, reefs and important fishing areas". This is an absolute necessity, as this poses a risk to local pelagic and benthic communities should this occur above sensitive habitat. A minimum of a 100m buffer zone from reef habitat is required and effort should also be made to spread out the tailings so that the thickness of deposits on the seafloor are minimised.

Impacts from sampling are likely to result in localised removal of benthic organisms and their habitat within the footprint of the sampling tool, which is expected to be virtually negligible for the coring and grab samples, yet significant for the larger drill samples. These impacts include direct habitat loss and smothering of the benthos adjacent to sampling sites associated with localised tailings discard. The grab and core samples are discrete (not contiguous) with a small footprint, and as a result, recolonisation from adjacent undisturbed areas is possible. Considering the available area of similar habitat on the continental shelf of the West Coast, the reduction in benthic biodiversity through sediment removal using these sampling tools can be considered negligible. However, the proposed use of the larger drill tool and high sample density in the resource development phase is expected to have high intensity impacts on benthic biodiversity in sampled areas.

The impact on the offshore benthos as a result of the cumulative removal of sediments from sampling is considered to be of high intensity at a local scale (i.e. sampling locations). Full recovery is expected to take place within the short to medium term (i.e. 6 - 15 years), as the sampled areas are expected to have slow infill rates and may persist for extended periods (years). Furthermore, biomass often remains reduced for several years as long-lived species like molluscs and echinoderms need longer to re-establish the natural age and size structure of the population. It is generally accepted that offshore disturbed areas take longer to recover than those in shallow water further inshore (Figure 3.1). Important drivers of inshore habitat recovery are related to the exposure to dynamic physical processes such as wave action and sediment refill from river mouths (Biccard *et al*. 2020b). Hence, recovery times greatly increase with depth and distance from sources of sedimentation. Essential mitigation measures include the planning and management of potential discharges to ensure that tailings are not discarded onto potentially sensitive habitats (particularly reef habitat); and keeping the total number of resource development areas to a minimum and ensuring that these areas are not of ecological significance (Penney *et al*. 2007; Pulfrich 2017). The overall consequence of this impact is considered to be medium and is of MEDIUM significance and will become LOW with the implementation of mitigation measures.

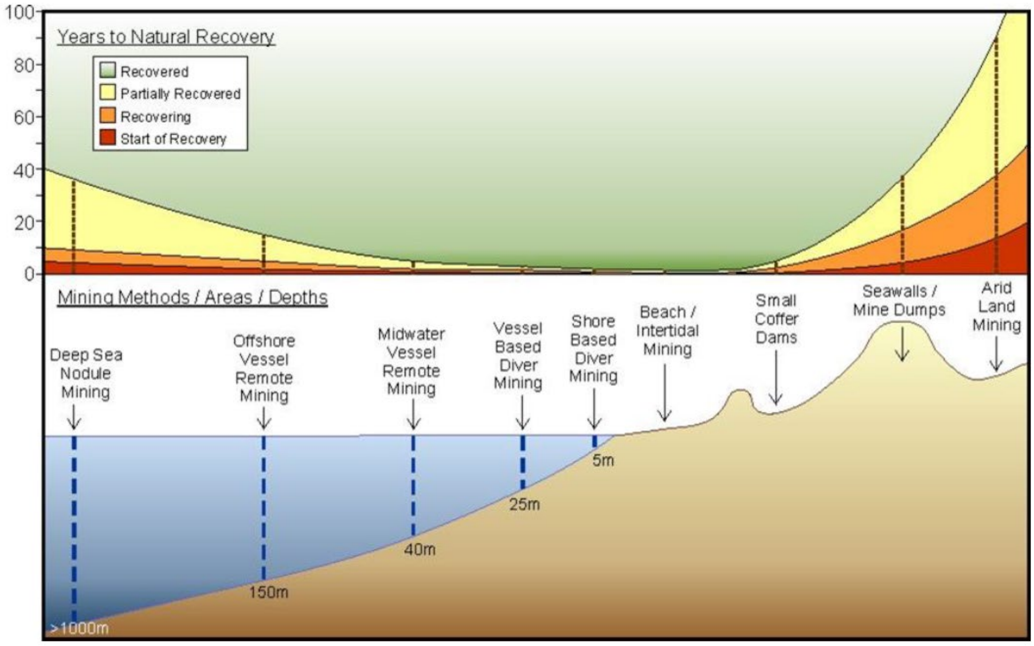


Figure 3.1. **Maximum times to various stages of natural recovery (still impacted, recovering, partially recovered and recovered) reported in the literature for various local studies of marine mining, and relevant international studies on other seabed disturbances (Penney et al. 2007).**

Table 3-7 **Benthic Impacts of seabed sampling and tailings disposal.**

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	High 3	Medium-term 2	Medium 6	Definite	**MEDIUM**	-ve	High
Essential Mitigation: • No destructive sampling or tailings discharge to take place withing a buffer of at least 100m from identified reefs and sensitive areas of potential ecological significance. • Planning and management of potential discharges to ensure that tailings are not discarded onto potentially sensitive habitats, particularly for drilling activities. • Total number of resource development areas must be kept to a minimum or as this is the activity with the highest impact and areas of potential ecological significance must be avoided.								
With Mitigation	Local 1	Medium 2	Medium-term 2	Low 5	Probable	**LOW**	-ve	Medium
Cumulative impacts	Local 1	Medium 2	Long-term 3	Medium 6	Probable	**MEDIUM**	-ve	Low

3.1.5 Fine sediment plumes

During the sampling process, sedimentary material that has been brought to the surface will be processed onboard and unwanted material (tailings) will be discarded overboard, thereby causing sediment plumes. These plumes can affect light penetration through the water column and can adversely affect phytoplankton productivity in the water column (Johnson 1981; Poopetch 1982; Kirk 1985; Parsons *et al*. 1986a; 1986b; Monteiro 1988; O'Toole 1997; Pulfrich 2017). Suspended sediment plumes can also develop either near the seabed, or in mid-water due to the dynamic collapse and diffusion of the sediment jet following the discharge. Suspended sediment concentrations generated at the point of discharge, the extent and area over which plumes disperse, and their duration, depend largely on the proportions of silts, muds and clays in the mined sediments, as well as the sea-surface conditions during disposal. The finer sediments discharged at the surface generate a plume in the upper water column, which is dispersed away from the vessel by prevailing currents, diluting to background levels at increasing distances from the vessel.

In addition to reduced phytoplankton productivity, suspended sediments may also affect the biological responses of consumers (hatching success, larval survival, and foraging behaviour) provided they contain inorganic particles (Clarke and Wilber 2000). Although, these plumes differ in intensity and timing from natural background conditions, marine communities in the Benguela region are well adapted to such events as they are frequently exposed to naturally elevated suspended-sediment levels (Penney *et al* 2007). Where deep-water sampling/prospecting is practiced, increased turbidity in the pelagic offshore environment as result of tailings plumes is not expected to have any significant effects on the marine biota (Penney *et al*. 2007; Pulfrich 2017). The latter statement is well supported as numerous modelling studies and aerial observations of plumes generated from mining vessels have shown that concentration of suspended sediments reduce rapidly with distance from the vessel, allowing a fairly fast settlement and dilution of fine sediment fractions (Figure 3.2)– Poopetch 1982; Hitchcock and Drucker 1996; Shillington and Probyn 1996; CSIR 1998; Carter and Midgley 2000). In addition, studies conducted on dredge-mining operations have recorded that water-column turbidity returns to natural background levels within a few hours after dredging has ceased (Evans 1994; Whiteside *et al*. 1995).

The 10B concession area does overlap with the west coast nursery area utilised by several commercially important fish species (particularly anchovy). However, due the short-term nature and very localised scale of the impact relative to the large spatial scale of the fish nursery area (most of the west coast inner shelf), the significance of any sediment plumes generated by prospecting activities on fish stock recruitment is assessed as very low.

The coring and grabbing phase of sampling in 10B will not be contiguous. This will result in a delay in time while the seabed tool is transferred to the new sampling site before additional sediment is released overboard with the next sample. Furthermore, the volumes of sediment that are expected to be collected and processed during this phase of prospecting are relatively small. No direct mitigation is feasible for tailings in this phase as tailings disposal is an integral part of this sampling method and the impacts on the environment associated with these forms of sampling are expected to be insignificant and without any measurable cumulative impact. However, for the drilling phase, the volumes of sediment generated will be much greater, therefore, it will be necessary for sediment tailings to be discarded in areas of low ecological significance, as these areas are not typically exposed to such large volumes of suspended sediment. Should tailings be disposed of on-site during the resource development phase, this will result in the disposal being somewhat contiguous, as the samples are located in proximity (50 metres) from each other, leading to very short transit times between sites, and increased turbidity.

Overall, the impacts are rated as VERY LOW without mitigation, and remains VERY LOW with the mitigation measure of discarding the drilling tailings away from the sampling area and outside of CBA or EBSA area. This mitigation measure also reduces the intensity of the activities from Medium to Low. For the cumulative impact assessment, the duration increases from short term to medium term, however, the overall significance remains VERY LOW with mitigation.

Table 3-8. Potential Impact of tailings discharge and fine sediment plumes on the pelagic habitat.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Medium 2	Short-term 1	Very low 3	Definite	**VERY LOW**	-ve	High
Essential Mitigation: • Sediment tailings from the drilling and resource development phases must be discarded in areas of low ecological significance away from the sampling area and outside of the CBA or EBSA area.								
With Mitigation	Local 1	Low 1	Short-term 1	Very Low 3	Definite	**VERY LOW**	-ve	Medium
Cumulative impacts	Local 1	Low 1	Medium-term 2	Very low 4	Definite	**VERY LOW**	-ve	Low

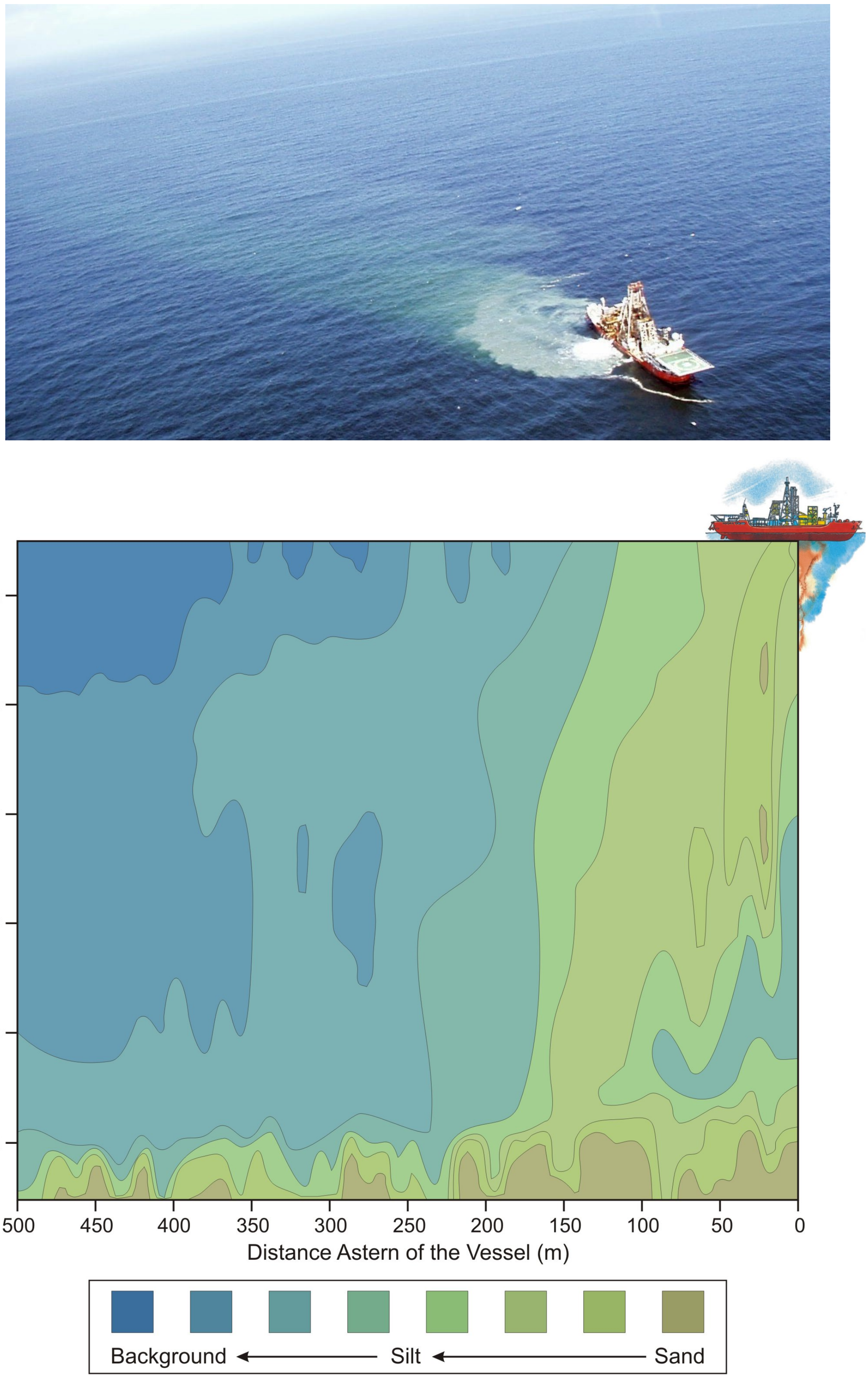


Figure 3.2. **An example of suspended sediment plume from the MV Grand Banks operational in the Atlantic 1 MLA (Top). Acoustic Doppler Current Profiler (ADCP) longitudinal section along a tailings plume astern of a marine diamond mining vessel off southern Namibia, showing the depth and distance distribution of sediment particles of various size fractions behind the vessel (adapted from CSIR 1998; Penney *et al*. 2007).**

3.1.6 Waste discharges during vessel operations

Water quality in the vicinity of exploration, sampling and associated support vessels may be impaired by various forms of waste discharged into the marine environment. During operation, normal discharges to the sea can come from a variety of sources but these are all regulated generally by onboard waste management plans which must be MARPOL compliant. The impacts on marine life depend on the properties of the waste discharged. The various kinds of waste produced at sea, their associated impacts and management protocols are outlined below.

Discharge of wastes and hydrocarbons

Vessel operators may experience accidental spills from operational machinery, which could include hydrocarbons such as hydraulic fluids, diesel, oils and/or hazardous substances. Spills of this nature are highly toxic and unless carefully managed, may pollute nearshore and coastal environments as well as damage and potentially destroy, marine organisms (wreckage of a vessel). The duration of the impact would depend on the bio-degradation of the type of waste. Solid wastes (e.g., plastics, scrap metals) may take decades or centuries to degrade. Cumulative impacts are unlikely due to the low likelihood of major accidents such as collision or wreckage. Strict waste management plans should be enforced for all operators; all deck drainage from workspaces and ballast water to be discharged must meet the MARPOL compliance level of 15 ppm oil in water. This is achieved through use of an oily-water separation system. The oily substances must be skimmed off the top of the discharge water and added to the waste (oil) lubricants and disposed of on land.

Sewage

In accordance with MARPOL, sewage effluent must not produce visible floating solids in, nor cause discolouration of the surrounding water. The treatment system must provide primary settling, chlorination and dechlorination before the treated effluent can be discharged into the sea. The discharge depth is variable, depending upon the draught of survey vessel at the time, but should not be less than 5 m below the surface.

Litter

Large numbers of marine organisms, including fish and marine mammals, are killed or injured by becoming entangled in debris (Wallace 1985), while others, including seabirds, are at risk through the ingestion of small plastic particles (Shomura and Yoshida 1985). The problem of litter entering the marine environment has escalated dramatically in recent decades, with an ever-increasing proportion of litter consisting of non-biodegradable plastic materials. Objects that are particularly harmful to marine fauna include plastic bags and bottles, pieces of rope and small plastic particles (Wehle and Coleman 1983). All reasonable measures must be implemented to ensure that no littering takes place during exploration and prospecting activities.

Food (galley) waste

Food waste may be discharged after it has been passed through a grinder in cases where the drilling unit or production facility is located more than 3 nautical miles offshore. Discharge of whole food waste is permitted beyond 12 nautical miles offshore. The ground wastes must be capable of passing through a screen with openings <25 mm. The daily volume of discharge from a standard drilling unit is expected to be <0.5 m^3 (Pulfrich 2015). This volume is not expected to be exceeded for exploration and prospecting activities in Concession 10B.

Detergents

Detergents used for washing exposed marine deck spaces are discharged overboard. The toxicity of detergents varies greatly depending on their composition, but low-toxicity, biodegradable detergents should preferably be used. Those used on work deck spaces should be collected with the deck drainage and treated as described above.

Cooling Water

Electricity on exploration, sampling and associated support vessels is typically provided by diesel-powered engines and generators, which are cooled by pumping water through a set of heat exchangers. The cooling water is then discharged overboard. Other equipment is cooled through a closed loop system, which may use chlorine as a disinfectant. Such water should be tested prior to discharge and should comply with relevant Water Quality Guidelines.

Based on the relatively small volumes of waste that can be expected, the potential impact of operational discharges from exploration and sampling/prospecting on the marine environment are of very low consequence, and the extent is likely to be limited to the immediate area around the vessel(s).

Overall, the potential impact of operational discharges on the marine environment is considered to be of VERY LOW significance. With the implementation of the stipulated mitigation measures this is reduced to INSIGNIFICANT (Table 3-9). For the cumulative impact assessment; the duration increases to long-term (>15 years) and this raises the overall consequence from very low to low and the overall significance from insignificant to very low. However, our confidence for this assessment decreases from high to low.

Table 3-9. Waste discharge during vessel operation.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Medium-term 2	Very low 4	Probable	**VERY LOW**	-ve	High
Best Practice: • Inform & empower all staff about sensitive marine species & suitable disposal of waste; • Ensure compliance with relevant MARPOL standards; • Develop a waste management plan using waste hierarchy; • A Shipboard Oil Pollution Emergency Plan (SOPEP) must be prepared for all vessels and should be in place at all times during operations; • Deck drainage should be routed to a separate drainage system (oily water catchment system) for treatment to ensure compliance with MARPOL (15 ppm);								

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
• All process areas should be bunded to ensure drainage water flows into the closed drainage system; • Drip trays should be used to collect run-off from equipment that is not contained within bunded areas and the contents routed to the closed drainage system; • Low-toxicity biodegradable detergents should be used in the cleaning of all deck spillages; • All hydraulic systems should be adequately maintained and hydraulic hoses should be frequently inspected; and • Spill management training should be provided, and crew members made aware of the need for thorough cleaning-up of any spillages immediately after they occur in order to minimise the volume of contaminants washing off decks.								
With mitigation	Local 1	Low 1	Short term 1	Very low 3	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative impacts	Local 1	Low 1	Long term 3	Low 5	Improbable	**VERY LOW**	-ve	Low

3.1.7 Impacts on the Namaqua Coastal Area EBSA

As the entirety of Concession 10B is located within the Namaqua Coastal Area EBSA, which is further located within a CBA considered to be in natural condition, the impacts of the proposed prospecting activities must be considered in detail to determine their viability with respect to the key functions and value of the EBSA, discussed below (Figure 2.7, and Figure 2.8).

As mentioned in 2.4, the proposed Namaqua Coastal Area EBSA has been shown to be highly relevant in terms of the following EBSA criteria: “productivity”, “importance for threatened, endangered or declining species and/or habitats”, and “naturalness” (van Niekerk and Turpie 2012). The associated pelagic environment within the EBSA is characterized by upwelling, giving rise to very cold waters with very high productivity/chlorophyll levels (Lagabrielle 2009, Roberson et al., 2017). The EBSA was chosen largely due to the lack of anthropogenic pressure within the relatively isolated stretch of coastline, with Sink *et al.* (2012) stating that the area between the Brak and SoutRiviers’is the only stretch of coastline in the Northern Cape that remains in somewhat pristine condition. Furthermore, the EBSA has two endangered ecosystem types (Cool Temperate Arid Predominantly Closed Estuary and Southern Benguela Reflective Sandy Shore), and five vulnerable ecosystem types: Namaqua Exposed Rocky Shore, Namaqua Kelp Forest, Namaqua Mixed Shore, Namaqua Very Exposed Rocky Shore and Southern Benguela Intermediate Sandy Shore (Nelson Mandela University N.D, Majiedt *et al*. 2013).

In addition to taking place within the proposed EBSA, the northern-most limit of the proposed prospecting within Concession 10B will take place 6.5 km south-east of the Namaqua National Park MPA, which was formalised in 2019, where the Groen and Spoeg Estuaries are found (Figure 2.16). These estuaries represent areas of particular conservation importance within the EBSA, as they are considered to be important fish nursery habitat for numerous fish species(Figure 2.16), including some species endemic to South Africa, in addition to being hotspots of local biodiversity due to the protected nature of estuarine environments. (Turpie *et al*. 2000, Hutchings *et al*. 2002). Since the EBSA’s original description, an offshore extension of 7-20 km has been proposed so that the EBSA now extends 36 km offshore at its widest point. The alongshore extent remains the same as before between the Spoeg and Sout estuaries. The extension was based on better alignment with the features comprising the EBSA, and their condition and threat status, based on the best available information (e.g., Holness *et al.* 2014; Majiedt *et al.* 2013; Sink *et al.* 2012, 2019). Despite being a proposed EBSA at the time of the writing of this report, impacts should be considered as if this EBSA has been formally ratified, as the final Conference of the Parties (COP) decision will be made in December of 2022, which will probably result in the EBSA being formalised by the time the prospecting takes place. This is in addition to the conservation and environmental concerns associated with conducting activities in an area which has been identified as having the qualities mentioned above (Nelson Mandela University N.D.).

According to the 2022 Marine Spatial Planning Report, non-destructive prospecting (which doesn't include bulk sampling or other related destructive activities) within CBA's or ESA's (in this case the area of an EBSA which is not also considered to be a CBA or MPA) are considered to be of restricted compatibility with the objectives of the EBSA and permissible should the impacts on the objectives of the EBSA or CBA be appropriately low (Harris *et al*. 2022). Destructive prospecting is, however, not compatible with management objectives in CBA areas, and since the entirety of Concession 10B is found in CBA area (Figure 2.7 and Figure 2.8), destructive prospecting activities should not occur. Mining within areas considered to be ESA's is also of restricted compatibility, however, for areas classed as CBA's, the following regulations on mining activities apply: "The activity should not be permitted to occur in CBAs because it is not compatible with the respective management objective. However, if significant mineral or petroleum resources are identified during prospecting/exploration, then the selection of the site as a CBA could be re-evaluated as part of compromise negotiations in current or future Marine Spatial Planning (MSP) processes. This would require alternative CBAs and/or biodiversity offsets to be identified. However, if it is not possible to identify alternative CBAs to meet targets for the same biodiversity features that are found at the site, it is recommended that the activity remains prohibited" (Harris *et al*. 2022). Since the entirety of 10B is found within a CBA, the regulations on CBA's will apply. It is our specialist opinion that the proposed prospecting using the 3-5 m^2 drilling tool constitutes destructive sampling due to the volume of sediment removed from the sea floor, likely noise and vibration created, high sample intensity during the Resource Development Phase, and turbidity associated with the sediment plumes likely to be generated during onboard sample processing. The use of this drilling tool is not compatible with the CBA guidelines, and it is considered an essential mitigation to not undertake destructive sampling in this concession. Mining is, therefore, likely not compatible with the CBA or EBSA objectives unless sufficient resources are found, and suitable mitigations and like-for-like offsets are in place (Harris *et al*. 2022).

However, the low impact nature of acoustic sampling, coring, and grab sampling, makes these activities permissible within the EBSA. Should these non-destructive forms of prospecting indicate the presence of sufficient mineral resources, then future mining might be possible should sufficient offsets be found (Harris *et al*. 2022).

Since maintaining pristineness and lack of anthropogenic alteration are key focus areas of the EBSA, any invasive activities are a concern. However, when considering the location of 10B, the low impact nature of the acoustic, coring, and grab prospecting, and very brief duration of the activities, impacts on the EBSA from these activities are likely to be minimal.

The significance of the impacts on the Namaqua Coastal EBSA are considered to be MEDIUM, with high intensity and the duration being Medium term due to the slow recovery of the benthic environment (Table 3-10). With Mitigation, however, the potential impact assessed as VERY LOW, since the prospecting areas have been reduced and the most destructive element of the prospecting (drilling) has been removed. For Cumulative impacts with mitigation, the extent remains local, the intensity changes remains medium, and the duration shifts to long term, thus resulting in a significance rating of MEDIUM, however, the confidence in this assessment shifts to low. This assessment would suggest that, if long-term prospecting and mining activities occur within the region, the negative impacts on the key EBSA criteria, which characterise the Namaqua Coastal EBSA and CBA, could be more significant.

Table 3-10. Impacts on the Namaqua Coastal Area EBSA and adjacent CBA

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	High 3	Medium-Term 2	Medium 6	Definite	**MEDIUM**	-ve	High
Essential Mitigation Measures: • Minimise prospecting activities within the northern-most section of Concession 10B closest to the MPA, to further reduce the chance of negative impacts occurring due to prospecting activity. • Minimise prospecting activities along the southern boundary of Concession 10B, to reduce the possible impacts to the Sout Rivier estuarine habitat • If possible, prospecting should primarily take place on the seaward side of the concession area, to minimise the risk to endangered and vulnerable coastal ecosystems. • The destructive 3-5 m^2 drilling methodology should not take place within this concession as the entire area is considered to be a CBA.								
With mitigation	Local 1	Medium 2	Short term 1	Very low 4	Probable	**VERY LOW**	-ve	High
Cumulative impacts	Local 1	Medium 2	Long term 3	Medium 6	Probable	**MEDIUM**	-ve	Low

3.1.8 Impacts on fisheries

According to the International Regulations for Preventing Collisions at Sea (Colregs 1972), vessels engaged in seismic surveys are recognised as vessels limited in their ability to manoeuvre and as such, vessel engaged in other activities (such as fishing) are obliged to give way. Furthermore, the implementation of a safety (exclusion) zone around the seismic vessel will exclude any other users of the sea from these areas. In practice, this exclusion zone takes form of a moving footprint extending around the survey vessel (Mason 2017). In this case, the size of the footprint can be expected to be around 500 m in extent.

Exclusion of fishing vessels from fishing areas, possible altered behaviour of fish due to seismic activities and interference with shipping could have (indirect) socio-economic implications for the affected industries. Fisheries might be affected by target species avoiding seismic survey areas for several days after the survey has terminated or the vessel has moved on (Mason 2017). Fisheries can also be indirectly impacted should prospecting activities negatively impact fish reproduction and recruitment, e.g., impairment of egg or larval survival due to increased turbidity in the water column resulting from sediment plumes generated by sampling activities.

The only fishery which was found to overlap with Concession 10B is the small pelagic purse seine fishery. Overlap with this sector is shown in Figure 2.14, Figure 2.15, and Figure 2.16– the catches from this sectors made within the concession area 10B is of limited significance as a proportion of the national total catch of each of these fisheries but they may be important at the individual vessel, right holder or fisher level. Due to the short-term nature and small degree of overlap of proposed prospecting in 10B with fishing grounds and fish nursery areas, the impact is assessed to be INSIGNIFICANT and INSIGNIFICANT with implementation of mitigation to avoid fishing seasons and inform key stakeholders from the potentially affected Small pelagic sector (The cumulative potential impact on fisheries due to the proposed prospecting activities within 10B in combination with other anthropogenic activities along the west coast is assessed as LOW overall negative significance with the implementation of the same mitigation, however, the confidence in this assessment is reduced to low.

Table 3-11). The cumulative potential impact on fisheries due to the proposed prospecting activities within 10B in combination with other anthropogenic activities along the west coast is assessed as LOW overall negative significance with the implementation of the same mitigation, however, the confidence in this assessment is reduced to low.

Table 3-11. Impact on fisheries.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Short-term 1	Very Low 4	Possible	**INSIGNIFICANT**	-ve	High
Essential mitigation measures: • Prior to survey commencement, key stakeholders (see below) should be consulted and informed of the proposed survey activity and the likely implications thereof. • Conduct the survey outside of the main fishing season and time of peak recruitment of juvenile pelagic fish in this area (i.e. Conduct prospecting during August – December)								
With mitigation	Local 1	Low 1	Short-term 1	Very Low 4	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative Impact with mitigation	Regional 2	Low 1	Long-term 3	Medium 6	Possible	**LOW**	-ve	Low

Recommended stakeholder consultation during prospecting planning and operations.

Prior to survey commencement, the following key stakeholders should be consulted and informed of the proposed survey activity (including navigational co-ordinates of the survey area, timing and duration of proposed activities) and the likely implications thereof:

- Fishing industry / associations (contactable via liason@fishsa.org):
  - South African Pelagic Fishing Industry Association (SAPFIA);
  - Local fishing communities;
- Other associations and organs of state
  - DFFE;
  - SAMSA;
  - South African Navy Hydrographic office; and
  - Overlapping and neighbouring right holders.

These stakeholders should again be notified at the completion of surveying when the survey vessel(s) is/are off location. The operator must request, in writing, that the South African Navy Hydrographic office release Radio Navigation Warnings and Notices to Mariners throughout the survey periods. The Notice to Mariners should give notice of (1) the co-ordinates of the proposed survey area, (2) an indication of the proposed timeframes of surveys and day-to-day location of the survey vessel(s), and (3) an indication of the required safety zone(s) and the proposed safe operational limits of the survey vessel. These Notices to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.

4 CONCLUSIONS AND RECOMMENDATIONS

Anchor Environmental Consultants were requested to undertake a marine specialist study for Trans Atlantic Diamonds (Pty) Ltd who are applying for a diamond prospecting right for Concession Area 10B, offshore of the Western Cape and Northern Cape Coastlines. Proposed activities include geophysical exploration and sampling/prospecting to detect the presence of palaeo-beach deposits at different submerged sea levels that occur in Concession 10B, which are known from other concessions to contain diamondiferous gravels. Seismic surveying will be conducted using a dedicated survey vessel with a hull-mounted MBES (high frequency range) and Topas sub-bottom profiler (SBP) system (mid-frequency range) collecting high-resolution acoustic data along lines 50 m to 200 m apart throughout the concession area. A description of the affected environment is provided. Habitat and biota of conservation importance were identified and mapped in relation to the proposed survey area. The likelihood of occurrence of affected marine fauna within the proposed survey area was ascertained from available literature. Important user groups such as fisheries are described and mapped in relation to the proposed survey area. Potential impacts from the proposed exploration and prospecting activities were identified. Impacts were assessed and, where possible, mitigation measures have been identified to avoid/minimise/reduce any impacts.

Assessment of potential impacts associated with the proposed activities range from medium to insignificant but with effective mitigation these are all reduced to very low, low or insignificant (Table 4-1). The potential impacts of most concern that were assessed as MEDIUM negative significance prior to mitigation were seismic disturbance to marine mammals, seabed sampling, and impacts on the Namaqua Coastal Area EBSA and CBA. It is known that migrating humpback and southern right whales are frequently encountered on the west coast of southern Africa and encounters with odontocetes such as dusky dolphins and Heaviside's dolphin (listed as near threatened on the IUCN red data list – Elwen *et al*. 2010) are likely throughout the year. Furthermore, humpback calves are vulnerable during the southern migration which takes place during the months of September and October.

Of the proposed seismic survey activities, the Topas sub-bottom profiler system which uses shallow (35-45 kHz) and medium penetration (1-10 kHz) "Chirp" seismic pulses to map the sediment horizon could present a risk to dusky and Heaviside's dolphins. These species are regarded as mid-frequency cetaceans (Simon Elwen *pers. comm.*) that could be at risk during the proposed seismic survey. A noise modelling study (using marine mammal noise exposure criteria from Southall *et al*. (2019) that was undertaken in Greenland in 50-250 m water depth for a similar MBES and Chirp sub-bottom profiler geophysical survey system predicted worst case scenario impact ranges for HF and LF cetacean hearing groups of less than 100 m for both PTS and TTS (Barham and Mason 2021). It is recommended that MMSOs be on duty during the proposed seismic survey activities and as a precaution, the listed mitigation measures are followed. Should seismic surveys continue into the night or during periods of low visibility (mist is frequently encountered at sea along the west coast), it is also recommended that a passive acoustic monitoring (PAM) system be used. Seismic surveying must be confined to seasons when cetaceans are scarce to ensure minimal disturbance (Gründlingh *et al*. 2006). Implementation of these mitigation measures should ensure that potential impacts on marine mammals arising from the proposed seismic survey activities in Concession 10B would be unlikely.

The potential impact of prospecting on the Namaqua Coastal Area EBSA and Adjacent Critical Biodiversity Area is of concern and may have significant negative impacts should the 3-5 m^2 drill be used, with an impact rating of MEDIUM. This methodology is not compatible with the EBSA objectives as it is considered to be destructive sampling due to the volume of sediment removed from the sea floor, noise and vibration created, high sample intensity during the Resource Development Phase, and turbidity associated with the plumes generated. This could have negative impacts on the surrounding benthic and pelagic communities. The majority of the EBSA area is classed as a critical biodiversity area which is in a natural state (Harris *et al*. 2022). Destructive prospecting within CBA's is not permitted according to the 2022 National Coastal and Marine Spatial Biodiversity Plan (Harris *et al*. 2022). Since the entirety of Concession 10B is considered to be a CBA, destructive prospecting should not be permitted. Recommended essential mitigation is, therefore, that the larger drilling tool is not used within the concession. However, acoustic surveying, coring and Van Veen Grab sampling are considered non- destructive and potential impacts of these activities are assessed as very low and acceptable in Concession 10B. Finally, should prospecting reveal an economically significant resource and mining then be considered in this concession, the impacts will require "alternative CBAs and/or biodiversity offsets to be identified, and if this is not possible, the activity should be prohibited. However, if it is not possible to identify alternative CBAs to meet targets for the same biodiversity features that are found at the site, it is recommended that the activity remains prohibited." (Harris *et al*. 2022). With mitigation, the impacts on the EBSA and CBA are reduced to VERY LOW. Cumulative impacts on the Namaqua Coastal Area EBSA and Adjacent Critical Biodiversity Area with this essential mitigation have been rated as VERY LOW.

Temporary exclusion of fishing vessels from the concession area during seismic survey and sampling/prospecting activities is also of potential concern. The historical fishing catch and effort reported by the potentially affected small pelagic sector in the 10B concession area is of limited national importance but may well be significant at an individual vessel and right holder level. The absence of coastal settlements on the coastline adjacent or near to Concession 10B, coupled with the lack of license holders living in the surrounding area means that the prospecting activities are unlikely to have any impact on small scale and interim-relief fishers. Overall, the potential impacts on fisheries are assessed to be of NEGLIGIBLE negative significance with effective implementation of mitigation measures. The cumulative, potential impacts of prospecting, mining, and associated activities in the region on fisheries assessed as a potential LOW significance on fisheries at a regional scale. Offshore reef habitat may be encountered in concession 10B (Figure 1.4). These reefs are considered sensitive habitat and it is recommended that they be visually assessed (by means of drop camera deployments or remotely operated underwater vehicle) during the baseline environmental survey with regular repeat surveys in the event of future mining operations in the area – offshore reefs may not be directly impacted (mined) but are at risk of being indirectly impacted by smothering from tailings disposal. These offshore rocky reefs are colonised by a range of epifauna including bryozoans, encrusting and upright sponges, solitary and colonial ascidians, sea anemones and cold-water coral colonies – the latter being slow-growing and taking many years to become established (Biccard *et al*., 2020b). Studies undertaking assessments of prospecting and mining-related impacts on these habitats in this region are relatively new and the time taken for disturbed epifaunal communities inhabiting offshore rocky reefs to recover has not yet been determined (Biccard *et al*., 2020b). Identified reefs should be protected by implementing a buffer zone of at least 100m within which no destructive sampling or tailings disposal should occur.

Table 4-1. Summary table of potential marine ecological and fisheries impacts associated with offshore diamond exploration activities (seismic survey and sampling/prospecting) in South African Sea Area concession 10B.

Impact	Consequence	Probability	Significance	Status	Confidence
Seismic disturbance to invertebrates	Very Low	Probable	**VERY LOW**	-ve	Medium
With Mitigation	Very Low	Probable	**VERY LOW**	-ve	Medium
Cumulative Impact	Medium	Probable	**MEDIUM**	-ve	LOW
Seismic disturbance to fish No mitigation	Very low	Possible	**INSIGNIFICANT**	-ve	Medium
Cumulative Impact	Medium	Possible	**LOW**	-ve	Low
Seismic disturbance to marine mammals	Medium	Probable	**MEDIUM**	-ve	Medium
With Mitigation	Low	Improbable	**VERY LOW**	-ve	Medium
Cumulative Impact	High	Improbable	**MEDIUM**	-ve	Low
Seismic disturbance to seabirds	Low	Probable	**LOW**	-ve	High
With Mitigation	Very low	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative Impact	High	Improbable	**MEDIUM**	-ve	Low
Seismic disturbance to turtles With/ Without Mitigation	Very Low	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative Impact	Medium	Improbable	**LOW**	-ve	Low
Marine megafauna collisions with survey vessels	Low	Possible	**VERY LOW**	-ve	High
With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative Impact	Medium	Possible	**LOW**	-ve	Low
Benthic impacts of seabed sampling and tailings disposal	Medium	Definite	**MEDIUM**	-ve	High
With Mitigation	Low	Probable	**LOW**	-ve	Medium
Cumulative Impact	Medium	Probable	**MEDIUM**	-ve	Low

Impact	Consequence	Probability	Significance	Status	Confidence
Fine sediment plumes	Very low	Definite	**VERY LOW**	-ve	High
With Mitigation	Very Low	Definite	**VERY LOW**	-ve	Medium
Cumulative Impact	Very low	Definite	**VERY LOW**	-ve	Low
Waste discharges during vessel operations	Very low	Probable	**VERY LOW**	-ve	High
With Mitigation	Very low	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative Impact	Low	Improbable	**VERY LOW**	-ve	Low
Impacts on the Namaqua Coastal Area EBSA and adjacent CBA	Medium	Definite	**MEDIUM**	-ve	High
With Mitigation	Very low	Probable	**VERY LOW**	-ve	High
Cumulative Impact	Medium	Probable	**MEDIUM**	-ve	Low
Impact on fisheries	Very Low	Possible	**INSIGNIFICANT**	-ve	High
With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	-ve	High
Cumulative Impact	Medium	Possible	**LOW**	-ve	Low

5 REFERENCES

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6 APPENDIX :1 IMPACT RATING METHODOLOGY

The significance of all potential impacts that would result from the proposed project is determined in order to assist decision-makers. The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring and the **probability** that the impact will occur. The significance of each identified impact was thus rated according to the methodology set out below:

Step 1 – Determine the **consequence** rating for the impact by determining the score for each of the three criteria (A-C) listed below and then **adding** them. The rationale for assigning a specific rating, and comments on the degree to which the impact may cause irreplaceable loss of resources and be irreversible, must be included in the narrative accompanying the impact rating:

Rating	Definition of Rating	Score
A. ***Extent – the area over which the impact will be experienced***		
Local	Confined to project or study area or part thereof (e.g. limits of the concession area)	1
Regional	The region (e.g. the whole of Namaqualand coast)	2
(Inter) national	Significantly beyond the Namaqualand coast and adjacent land areas	3
B. ***Intensity – the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources***		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered	3
C. ***Duration – the time frame for which the impact will be experienced and its reversibility***		
Short-term	Up to 2 years	1
Medium-term	2 to 15 years	2
Long-term	More than 15 years (state whether impact is irreversible)	3

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

Combined Score (A+B+C)	**3 – 4**	**5**	**6**	**7**	**8 – 9**
Consequence Rating	Very low	Low	Medium	High	Very high

Example 1:

Extent	Intensity	Duration	Consequence
Regional 2	Medium 2	Long-term 3	High 7

Step 2 – Assess the **probability** of the impact occurring according to the following definitions:

Probability– the likelihood of the impact occurring	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

Example 2:

Extent	**Intensity**	**Duration**	**Consequence**	**Probability**
Regional 2	Medium 2	Long-term 3	High 7	Probable

Step 3 – Determine the overall **significance** of the impact as a combination of the **consequence** and **probability** ratings, as set out below:

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	**INSIGNIFICANT**	**INSIGNIFICANT**	**VERY LOW**	**VERY LOW**
	Low	**VERY LOW**	**VERY LOW**	**LOW**	**LOW**
	Medium	**LOW**	**LOW**	**MEDIUM**	**MEDIUM**
	High	**MEDIUM**	**MEDIUM**	**HIGH**	**HIGH**
	Very High	**HIGH**	**HIGH**	**VERY HIGH**	**VERY HIGH**

Example 3:

Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**
Regional 2	Medium 2	Long-term 3	High 7	Probable	HIGH

Step 4 – Note the **status** of the impact (i.e. will the effect of the impact be negative or positive?)

Example 4:

Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**Status**
Regional 2	Medium 2	Long-term 3	High 7	Probable	HIGH	– ve

Step 5 – State the level of **confidence** in the assessment of the impact (high, medium or low).

Impacts are also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in the table below. Depending on the data available, a higher level of confidence may be attached to the assessment of some impacts than others. For example, if the assessment is based on extrapolated data, this may reduce the confidence level to low, noting that further ground-truthing is required to improve this.

Confidence rating	
Status of impact	+ ve (beneficial) or – ve (cost)
Confidence of assessment	Low, Medium or High

Example 5:

Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Regional 2	Medium 2	Long-term 3	High 7	Probable	HIGH	– ve	High

The significance rating of impacts is considered by decision-makers, as shown below. Note, this method does not apply to minor impacts which can be logically grouped into a single assessment.

- **INSIGNIFICANT**: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity.
- **VERY LOW**: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity.
- **LOW**: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity.
- **MEDIUM**: the potential impact **should** influence the decision regarding the proposed activity.
- **HIGH**: the potential impact **will** affect a decision regarding the proposed activity.
- **VERY HIGH**: The proposed activity should only be approved under special circumstances.

Step 6 – Identify and describe practical **mitigation** and **optimisation** measures that can be implemented effectively to reduce or enhance the significance of the impact. Mitigation and optimisation measures must be described as either:

- **Essential**: must be implemented and are non-negotiable; and
- **Best Practice**: must be shown to have been considered and sound reasons provided by the proponent if not implemented.

Essential mitigation and optimisation measures must be inserted into the completed impact assessment table. The impact should be re-assessed with mitigation, by following Steps 1-5 again to demonstrate how the extent, intensity, duration and/or probability change after implementation of the proposed mitigation measures.

Example 6: A completed impact assessment table

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional **2**	Medium **2**	Long-term **3**	**High 7**	Probable	**HIGH**	**– ve**	High
Essential mitigation measures: xxxxx xxxxx								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Improbable	**VERY LOW**	**– ve**	High

Step 7 – Prepare a summary table of all impact significance ratings as follows:

Impact	***Consequence***	***Probability***	**Significance**	***Status***	***Confidence***
Impact 1: XXXX	Medium	Improbable	LOW	–ve	High
With Mitigation	Low	Improbable	VERY LOW		High
Impact 2: XXXX	Very Low	Definite	VERY LOW	–ve	Medium
With Mitigation:	*Not applicable*				

Indicate whether the proposed development alternatives are environmentally suitable or unsuitable in terms of the respective impacts assessed by the relevant specialist and the environmentally preferred alternative.

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