



APPENDIX 4: Marine and Estuarine (Aquatic) Biodiversity Specialist Assessment

FINAL BASIC ASSESSMENT REPORT

**APPLICATION FOR ENVIRONMENTAL AUTHORISATION AND
PROSPECTING RIGHTS FOR PROSPECTING IN OFFSHORE SEA
CONCESSION AREA 6C, NORTHERN CAPE, BY TRANS
ATLANTIC DIAMONDS (PTY) LTD**

EA Application Ref. No.: NC30/5/1/1/2/14851 PR

September 2026



MARINE ECOLOGY AND FISHERIES ASSESSMENT FOR PROSPECTING ACTIVITIES IN OFFSHORE SEA CONCESSION AREA 6C, WEST COAST, NORTHERN CAPE



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MARINE ECOLOGY AND FISHERIES ASSESSMENT FOR PROSPECTING ACTIVITIES IN OFFSHORE SEA CONCESSION AREA 6C, WEST COAST, NORTHERN CAPE

2026

Report prepared for:

Trans Atlantic Diamonds (Pty) Ltd

109 Kloof Road, Bantry Bay,
Cape Town, South Africa, 8005



Anchor Environmental Consultants (Pty) Ltd

8 Steenberg House, Silverwood Close, Tokai, South Africa
www.anchorenvironmental.co.za



Authors: Adam Rees, Lily Bovim, Emily Gammon, Yi-Ting Ho, Amy Wright, Aiden Biccard and
Barry Clark

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PREAMBLE

Please note that all amendments to this final report have been highlighted in yellow.

EXECUTIVE SUMMARY

Project summary

Trans Atlantic Diamonds (Pty) Ltd proposes to undertake a phased offshore prospecting programme within Sea Concession Area 6C off the Northern Cape coast to assess the economic viability of future diamond mining. The prospecting programme comprises non-invasive geophysical surveys followed by grab, core and drill sampling, all undertaken from a dedicated survey vessel without the need for permanent infrastructure. Activities will occur intermittently over a five-year period and are intended solely to obtain geological, geotechnical and environmental information required to evaluate the resource and inform any future mining proposal. This assessment evaluates the potential impacts of these prospecting activities on the marine environment and fisheries and identifies measures to avoid or minimise adverse effects.

Affected environment

Concession Area 6C is located approximately 4–5 km from the coast and extends approximately 100 km offshore, in water depths of 90–200 m within the productive Southern Benguela ecosystem. The area comprises predominantly soft sediment habitats, including muddy sands and sandy outer shelf ecosystems that support diverse benthic macrofaunal communities and productive pelagic ecosystems. These habitats provide feeding and migration areas for commercially important fish species, seabirds, marine mammals and other marine megafauna. Although the concession area does not overlap Marine Protected Areas or Ecologically or Biologically Significant Areas, approximately 9% overlaps a Critical Biodiversity Area (CBA) Natural area, where prospecting activities should be carefully managed and, where possible, avoided. The broader marine ecosystem is classified as Least Concern under the 2025 National Biodiversity Assessment. Commercial fisheries operating within or adjacent to the area include tuna pole-and-line, commercial linefish, West Coast rock lobster and small-scale fisheries, although spatial overlap with the proposed prospecting activities is generally limited.

Impact Assessment

The assessment considered potential impacts associated with underwater noise from geophysical surveys and drilling, direct disturbance of benthic habitats, sediment plumes generated during drill sampling, vessel interactions with marine megafauna, operational waste discharges, impacts on commercial fisheries and cumulative impacts with other marine activities. Due to the relatively small footprint, temporary duration and dispersed nature of the proposed activities, ecological impacts are predicted to be localised and reversible. Direct disturbance of benthic habitats is confined to individual sampling locations, while underwater noise is expected to result primarily in temporary behavioural responses by sensitive marine fauna. Vessel collisions with marine mammals and seabirds are considered unlikely provided appropriate operational controls are implemented. Potential impacts on fisheries are expected to be minimal because of the limited overlap between prospecting activities and commercial fishing grounds, although continued engagement with local fishing communities is recommended.

Prior to mitigation, predicted impact significance ranges from Medium Negative to Insignificant. Implementation of the recommended mitigation measures reduces all impacts to Low, Very Low or Insignificant significance (Table 1).

Table 1 Summary of Impact Assessment for proposed prospecting activities within Concession Area 6C.

Impact	Significance (Before mitigation)	Significance (After mitigation)	+/-
Impact 1a: Geophysical survey noise disturbance to plankton	VERY LOW	VERY LOW (no mitigation available)	-
Impact 1b: Geophysical survey noise disturbance to benthic invertebrates	INSIGNIFICANT	INSIGNIFICANT (no mitigation available)	-
Impact 1c: Geophysical survey noise disturbance to marine fish	VERY LOW	VERY LOW (no mitigation available)	-
Impact 1d: Geophysical survey noise disturbance to marine mammals	MEDIUM	LOW	-
Impact 1e: Geophysical survey noise disturbance to seabirds	MEDIUM	LOW	-
Impact 2a: Phase 2 coring and drilling noise on marine receptors	VERY LOW	VERY LOW	-
Impact 2b: Phase 3 coring and drilling noise on marine receptors	LOW	VERY LOW	-
Impact 3: Benthic impacts associated with prospecting activities (all phases)	MEDIUM	LOW	-
Impact 4: Marine megafauna collisions with survey vessels	VERY LOW	VERY LOW	-
Impact 5: Indirect impacts associated with tailings discharge and fine sediment plumes	LOW	VERY LOW	-
Impact 6: Waste discharge during vessel operation	VERY LOW	INSIGNIFICANT	-
Impact 7: Impacts on fisheries	INSIGNIFICANT	INSIGNIFICANT (no mitigation required)	-
Cumulative Impacts	MEDIUM		-

Conclusions and recommendations

It is concluded that the proposed prospecting programme is environmentally acceptable from a marine ecology and fisheries perspective. The proposed activities are temporary, localised and of relatively small spatial extent, with no significant long-term impacts on marine habitats, biodiversity or fisheries resources anticipated. Residual impacts following mitigation are consistently assessed as Low, Very Low or Insignificant.

Key recommendations include implementation of soft-start procedures for acoustic equipment, deployment of Marine Mammal and Seabird Observers during acoustic surveys (in alignment with global standards for management of offshore survey activities with regards to sensitive mammal and bird receptors), adherence to vessel speed restrictions and collision avoidance protocols, avoidance of sensitive habitats and exclusion of CBA Natural areas from the prospecting footprint, compliance with all MARPOL waste management requirements, and appointment of a Fisheries Liaison Officer to facilitate communication with fishing sectors. Subject to implementation of these mitigation measures and the commitments contained within the Environmental Management Programme, the proposed prospecting activities are not expected to result in significant adverse environmental impacts and may proceed from a marine ecology and fisheries perspective. Annual benthic biodiversity monitoring must be undertaken to assess changes in ecological conditions and determine whether cumulative impacts are increasing over time, enabling the timely implementation of additional mitigation measures where required.

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GLOSSARY

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/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. Pertaining to the environment inhabited by organisms living on or in the ocean bottom

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

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 composition: The number of species in that community and their relative numbers.

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.

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: (Of 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.

Invertebrate: An animal without a backbone (e.g. a starfish, crab, or worm)

Macrofauna: Animals larger than 0.5 mm.

Macrophyte: An aquatic plant large enough to be seen by the naked eye.

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.

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 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.

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.

ABBREVIATIONS AND ACRONYMS

Anchor	Anchor Environmental Consultants (Pty) Ltd.
BCLME	Benguela Current Large Marine Ecosystem Programme
CBA	Critical Biodiversity Area
CPUE	Catch Per Unit Effort
DFFE	Department of Forestry, Fisheries and the Environment (formerly DEFF and DAFF)
DMPR	Department of Mineral and Petroleum Resources
DMRE	Department of Mineral Resources and Energy
EA	Environmental Authorisation
EBSA	Ecologically or Biologically Significant Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ESA	Ecological Support Area
ESIA	Environmental and Social Impact Assessment
ETP	Endangered Threatened and Protected
FLO	Fisheries Liaison Officer
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
MARPOL	The International Convention for the Prevention of Pollution from Ships
MBES	Multi Beam Echo Sounder
MLRA	Marine Living Resources Act
MMSO	Marine Mammal and Seabird Observer
MPA	Marine Protected Area
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act No. 107 of 1998, as amended
PAM	Passive Acoustic Monitoring
PR	Prospecting Right
PTS	Permanent threshold shift
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
TPL	Tuna Pole and Line
TSS	Total Suspended Solids
TTS	Temporary Threshold Shift
VHF	Very High Frequency

I INTRODUCTION

I.1 BACKGROUND

Trans Atlantic Diamonds (Pty) Ltd (the Applicant) intends to undertake prospecting activities within offshore Sea Concession Area 6C in the Northern Cape to assess the viability of future mining operations (Figure 1.1). To this end, the company is applying to the Department of Mineral and Petroleum Resources (DMPR) for a Prospecting Right (PR) in terms of the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) for the mineral listed above within Sea Concession Area 6C in the Northern Cape (EA Application Ref. No.: NC30/5/1/1/2/14851 PR). In addition to the PR, the Applicant is also required to obtain Environmental Authorisation from the DMPR in terms of the National Environmental Management Act (NEMA, Act No. 107 of 1998) and the 2014 Environmental Impact Assessment (EIA) Regulations.



Figure 1.1 Concession Area 6C (red polygon) is located within the Northern Cape Province., off the west coast of South Africa.

The 350 ha Sea Concession Area 6C is located in waters of 90–200 m depth (Figure 1.2), approximately 4–5 km offshore of the Northern Cape coast. Trans Atlantic Diamonds 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 and ferrous and base metals that may exist within Sea Area 6C, in terms of the Mineral and Petroleum Resources Development Act. Anchor Environmental Consultants (Pty) Ltd (Anchor) was appointed to undertake the Marine and Fisheries Specialist Study for the proposed Prospecting Right.

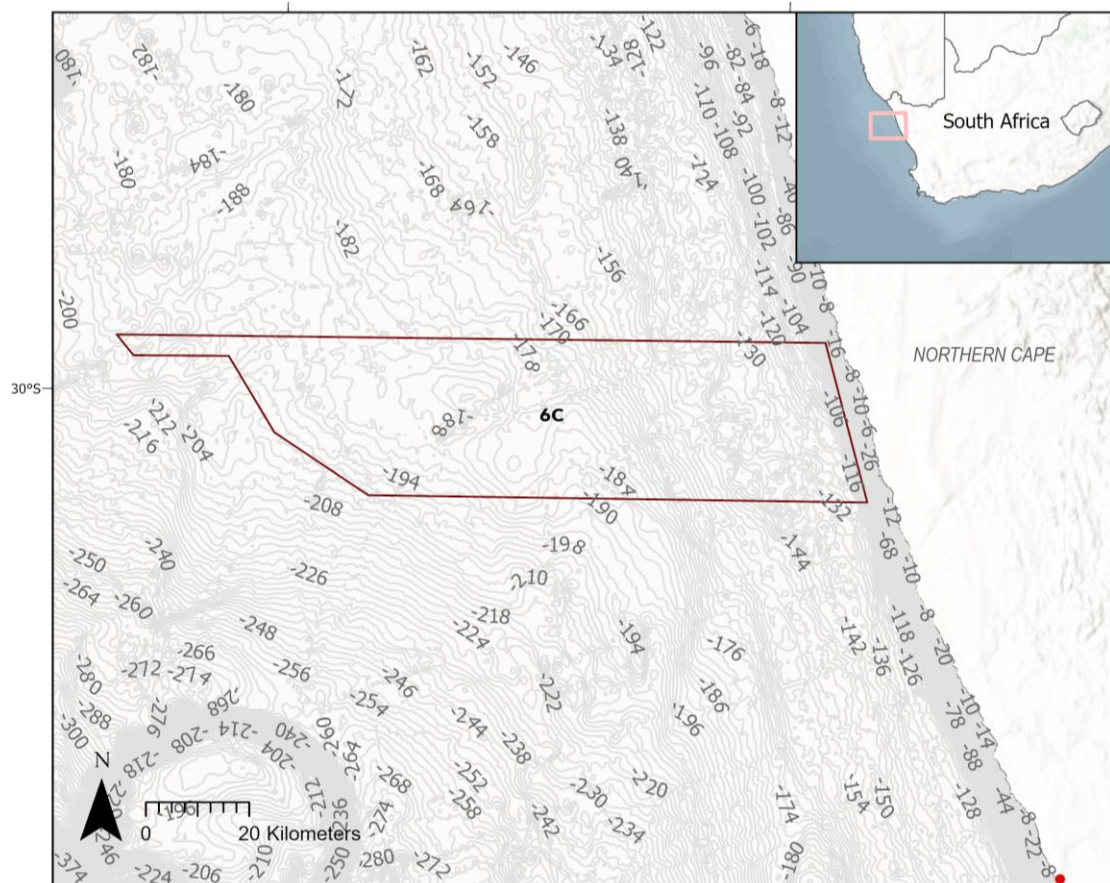


Figure 1.2 Sea Concession Area 6C off the Western Cape Coast with bathymetry (at 2 m intervals).

1.2 TERMS OF REFERENCE

This Marine and Fisheries Specialist Study undertook the identification and assessment of potential impacts of the proposed prospecting activities on the marine environment and user groups. The Terms of Reference include the following:

- 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 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.

1.3 DESCRIPTION OF THE PROPOSED ACTIVITY

1.3.1 OVERVIEW

Prospecting will be conducted using a dedicated survey vessel. The activity is located entirely offshore and comprises prospecting only, and as such no land-based infrastructure will be required. Sampling will be conducted in four phases, combining both non-invasive and invasive sampling activities, none of which require infrastructure. Activities will be followed by a feasibility study and resource estimation. The non-invasive activities are mostly related to geophysical exploration, data acquisition and analysis. The invasive activities are those related to sampling (collection of drill, core and grab samples).

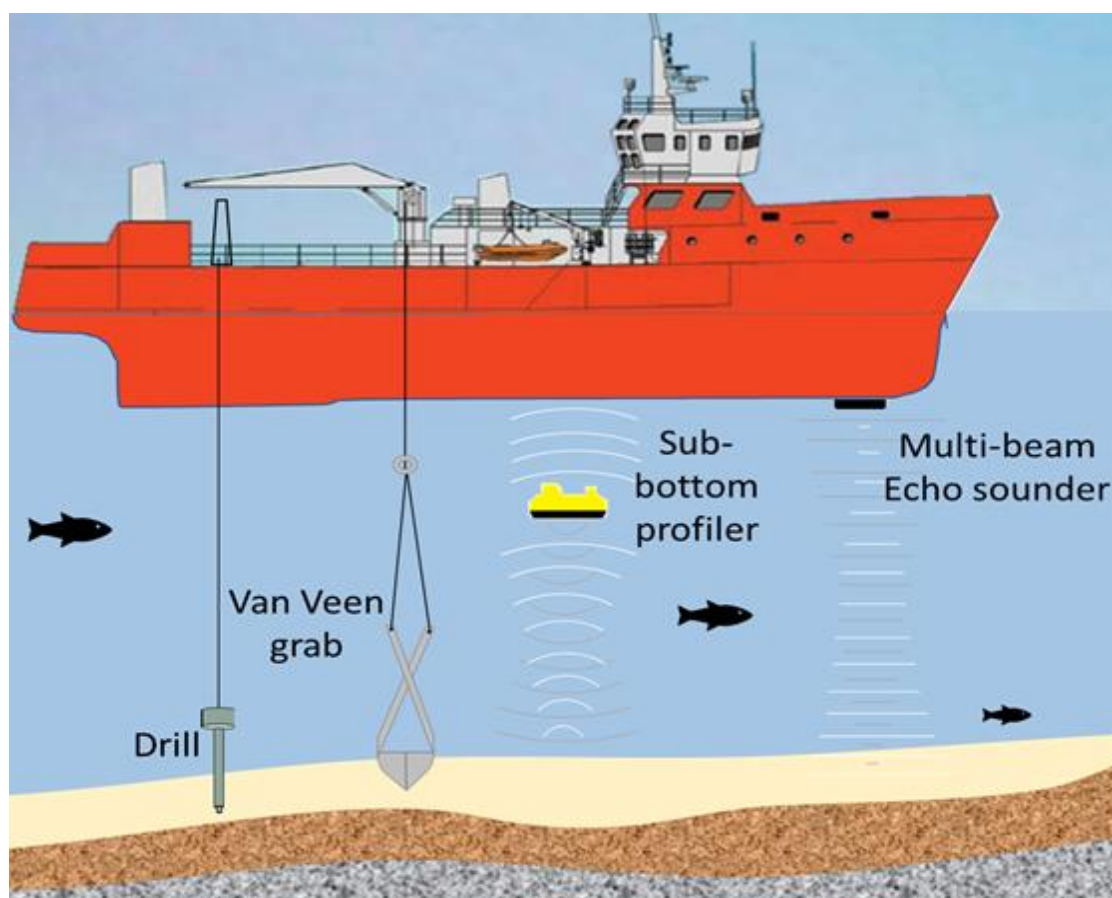


Figure 1.3 Illustration of some of the various sampling methods that will be used.

The proposed prospecting programme will take place during spring and/or summer and when weather conditions are suitable and seas are calm. While activities are anticipated to be completed within five years, prospecting operations are expected to occur sporadically over the entire extent of the concession area.

1.3.2 GEOPHYSICAL EXPLORATION – PHASE I

Geophysical surveying will be undertaken to collect high-resolution acoustic and multibeam echosounder data along survey lines spaced 100–1 000 m apart throughout

the concession area. The vessel can typically survey approximately 120 km/day in an offshore area. The geophysical survey is therefore anticipated to be undertaken within a broader operational window of up to two months to accommodate mobilisation, weather delays, sea-state constraints, and other logistical requirements, although the active survey period itself is expected to be shorter.

Surveys will be conducted using a dedicated survey vessel which will have a hull-mounted multibeam echo sounder (MBES) and a Topas sub-bottom profiler system that are designed to collect high-resolution acoustic data. As these devices are hull mounted, the vessel will not tow any cables, and no physical or environmentally destructive impacts are anticipated for this sampling method. The geophysical survey allows the operator to produce a digital terrain model of the seafloor. 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 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 221 dB re 1µPa @ 1m, with a frequency range of between 200 and 400 kHz. The sub-bottom profiler uses shallow (35 to 45 kHz) and medium penetration (1 to 10 kHz) "Chirp" acoustic pulses. Potential noise or sound impacts on biota will therefore be considered as part of this Impact Assessment. This equipment has a variable power output and can ramp up power in accordance with survey requirements. As such, it is also capable of "soft starts". The use of a magnetometer to detect magnetic signatures will also be required.

The information collected during the acoustic survey will be reviewed by the geologist and used to model the bathymetry of 6C to identify target areas for sampling, any areas that need to be avoided and to inform the appropriate core sampling and drilling method that must be implemented. This process can take approximately one month. The preferred alternative within the site is therefore subject to change pending results from the geophysical survey.

I.3.3 VAN VEEN GRAB SAMPLING – PHASE 2A

This is a widely used method used to collect sediment samples for biological, environmental and seafloor characterisation studies (geotechnical studies). The device consists of a stainless-steel clamshell bucket that closes around and collects sediment from the seabed.

A Van Veen grab with a sampling capacity of approximately 50 kg will be used to collect baseline environmental data on sediments and benthic macrofauna at between 20 and 50 sampling sites. The grab penetrates approximately 20-50 cm into the seabed and collects surface sediment samples. A portion of each sample will be preserved (using formalin or ethanol) and sent to a laboratory for biological analysis, while another portion will be analysed to determine the physical characteristics of the sediments, including composition and grain size. Biological analyses will be used to identify and characterise benthic macrofaunal communities (small animals such as worms, mussels, and crustaceans), while sediment analyses will provide information on the nature and geological characteristics of the seabed. The sampling programme will disturb a total seabed area of approximately 5 m² and will result in the collection of approximately 1.5 m³ of sediment. The information obtained will provide baseline data against which

any future changes in benthic communities can be assessed following prospecting and, should the project proceed, mining activities.

I.3.4 CORE SAMPLING – PHASE 2B

Geotechnical samples will be collected at 100–200 sites using either vibracoring, gravity coring or sonic coring. Geotechnical samples are physical samples of soil, sediment, or rock collected to assess the physical properties of the material. A core is a cylindrical tool used to penetrate the seafloor to collect sediment samples. These samples are analysed to determine the seafloor geology (types of material present, such as sand, gravel and/ or rock as well as the hardness and strength of rock), topography (for example trenches, slopes or elevated features on the seabed) and sediment stratigraphy (the layering of sand, mud and rock over time). This information is then used to engineer the drilling tool (for Phase 3 of the prospecting activities – see below) and the future mining vessel. Geotechnical sampling is also used for resource evaluation, i.e. determining whether there are materials that can be mined in the area and whether it will be economically viable. The type of coring will depend on the geological formations of the seafloor.

The sonic corer is a type of drilling tool that uses high-frequency vibrations to push a core barrel (a hollow tube) into the seabed. This allows it to sample not only loose sediments but also harder materials such as some types of rock. In contrast, gravity coring and vibracoring can only collect unconsolidated material, meaning loose sediments such as sand and mud.

Each core sample is about 10 cm in diameter and is typically drilled to a depth of 3–8 m below the seabed. Each core contains approximately 0.024 m³ of material. Overall, the sampling will disturb a very small footprint on the seabed, affecting a total surface area of about 1.57 m² and yielding approximately 4.71 m³ of material in total. There is no release or spillage of material into the ocean during sampling, as the material remains intact within the core tube and is brought back to the vessel for secure storage. No sediment processing is undertaken on the vessel, as all samples are transported to shore for analysis. Collecting around 200 cores will take approximately 10 working days. Exact sampling locations will be determined using results from geophysical surveys and recommendations from the marine ecology specialist study as part of the EIA.

I.3.5 DRILL SAMPLING – PHASE 3

Prospective target areas will be investigated using a specially designed drilling tool that can collect gravel and other seabed materials. The material brought to the surface will be processed onboard a vessel using a processing plant, and the remaining fine material (tailings) will be discharged back into the sea.

Depending on the final tool design, the drill will impact an area of approximately 3–5 m² per sample. The average drilling depth is expected to be around 3 m, although the system is capable of drilling up to 12 m into the seabed if required. Each sample is expected to yield approximately 9 to 15 m³ of material. The DMRE has confirmed that this activity does not constitute bulk sampling in terms of the Mineral and Petroleum Resources Development Act, as it is undertaken for prospecting purposes only and not for commercial extraction, and does not involve large-scale removal or dredging of the seabed. At an initial sampling density of 0.06 samples per hectare, approximately 150

samples will be collected. A further 150 follow-up samples may be required, resulting in a total of 300 drilling samples. These will cover a total disturbed area of approximately 1 500 m² (based on a 5 m² drill footprint) and will be spaced roughly 300 m apart in a north–south direction. At a rate of about 30 samples per day, this phase would take approximately 10 days, excluding potential weather delays. If follow-up results indicate a potentially viable resource, a more detailed phase of resource evaluation would be undertaken. This would focus on smaller defined areas of up to 500 m by 300 m, with additional sampling on a 50 m grid. Around 20 such resource development areas are expected, requiring approximately 1 200 additional samples and covering a total disturbed area of about 6 000 m² (again based on a 5 m² drill footprint). At a rate of 30 samples per day, this phase would take approximately 40 days.

The information collected will be used to understand seabed conditions, evaluate mineral resources, and determine whether mining within Concession Area 6C is economically viable. It will also inform the design of the future mining vessel and help identify potential areas suitable for mining activities.

2 DESCRIPTION OF THE AFFECTED ENVIRONMENT

2.1 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 marine biodiversity in the system, strongly influencing both water temperature and nutrient levels, which, in turn, influence 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 (Branch & Griffiths 1988, Duncombe Rae 2005). 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 & Branch 2018).

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 highest and lowest astronomical tide being 2.25 m and 0.056 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 & Griffiths 1988). Southerly and south-westerly waves frequently exceed 2 m. The predominant SW swell direction in this area results in a northward-flowing littoral current that runs parallel to the coast (MacDonald & 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 & Clark 2018).

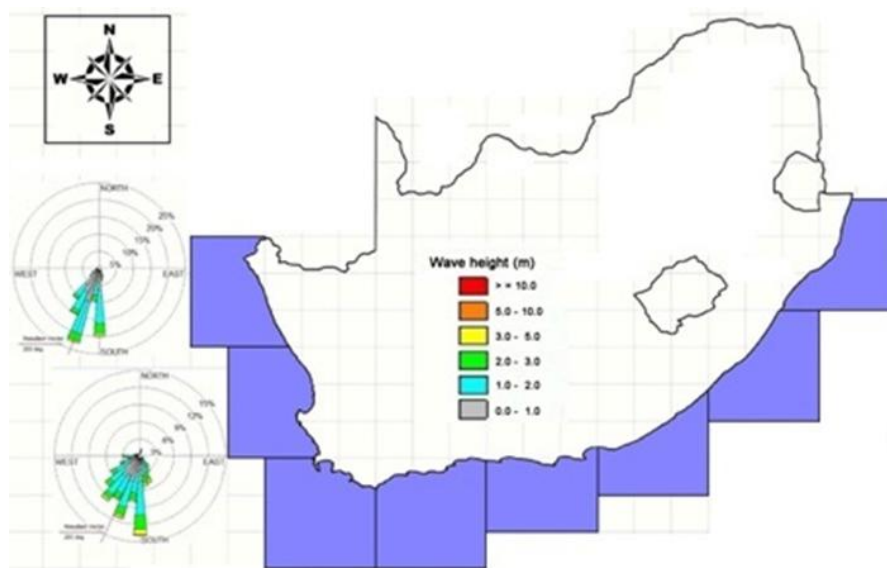


Figure 2.1. Wave roses showing the frequency of significant wave heights and direction on the West Coast (Source: SADC Voluntary Observing Ships data).

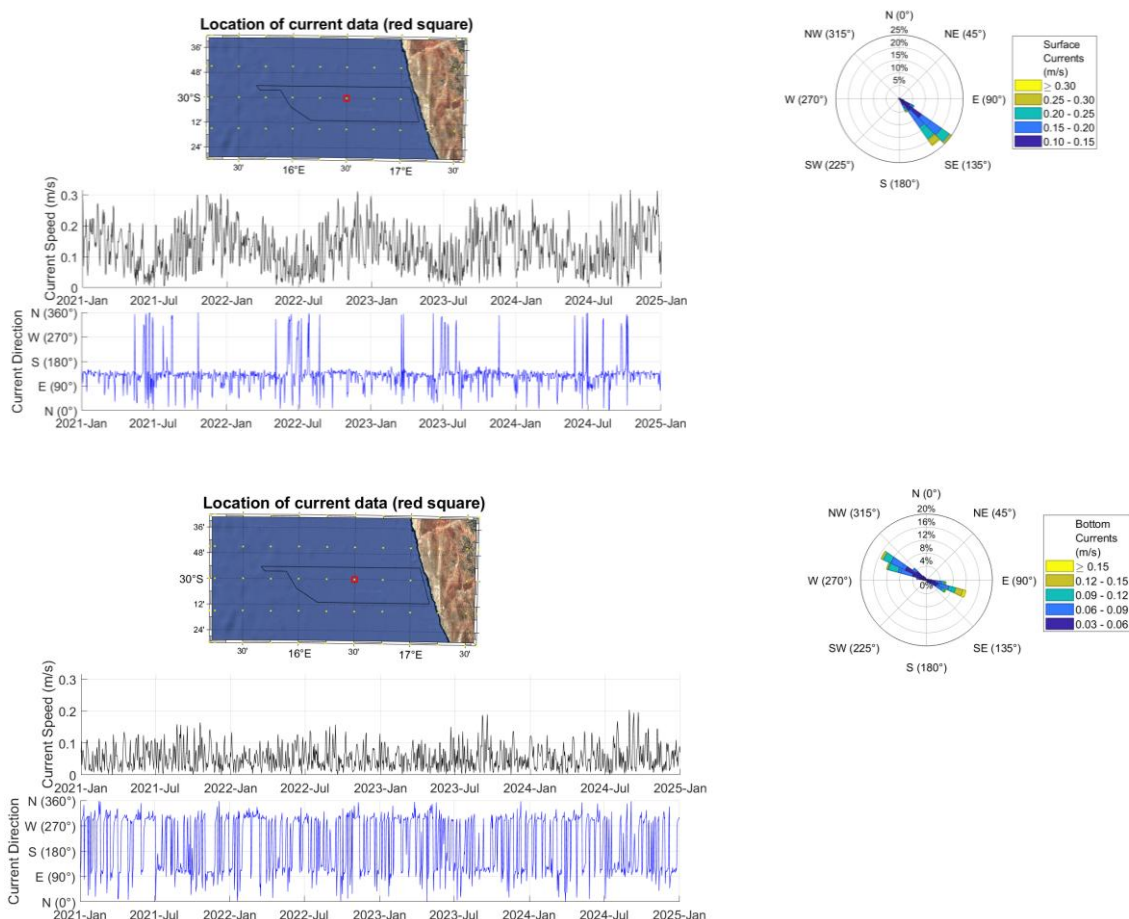


Figure 2.2. Left) location of data source and the temporal time series for current direction and speed, Right) Current rose showing current speed, direction and strength data at the surface (top) and at -163m (bottom) water depth from a central location of Concession 6C (Copernicus Marine Service Information (CMEMS) 2026).

2.2 BIOGEOGRAPHY

The classification and mapping of ecosystem types is the foundation to their assessment and management. The first iteration of the South African National Spatial Biodiversity Assessment by Lombard et al. (2004) used a hierarchical habitat classification to map and describe different marine bioregions. This has been further developed through several iterations and the latest National Biodiversity Assessment (NBA) recognises 150 different marine ecosystem types in the South African Exclusive Economic Zone embedded within a hierarchical classification system (Sink et al. 2019b).

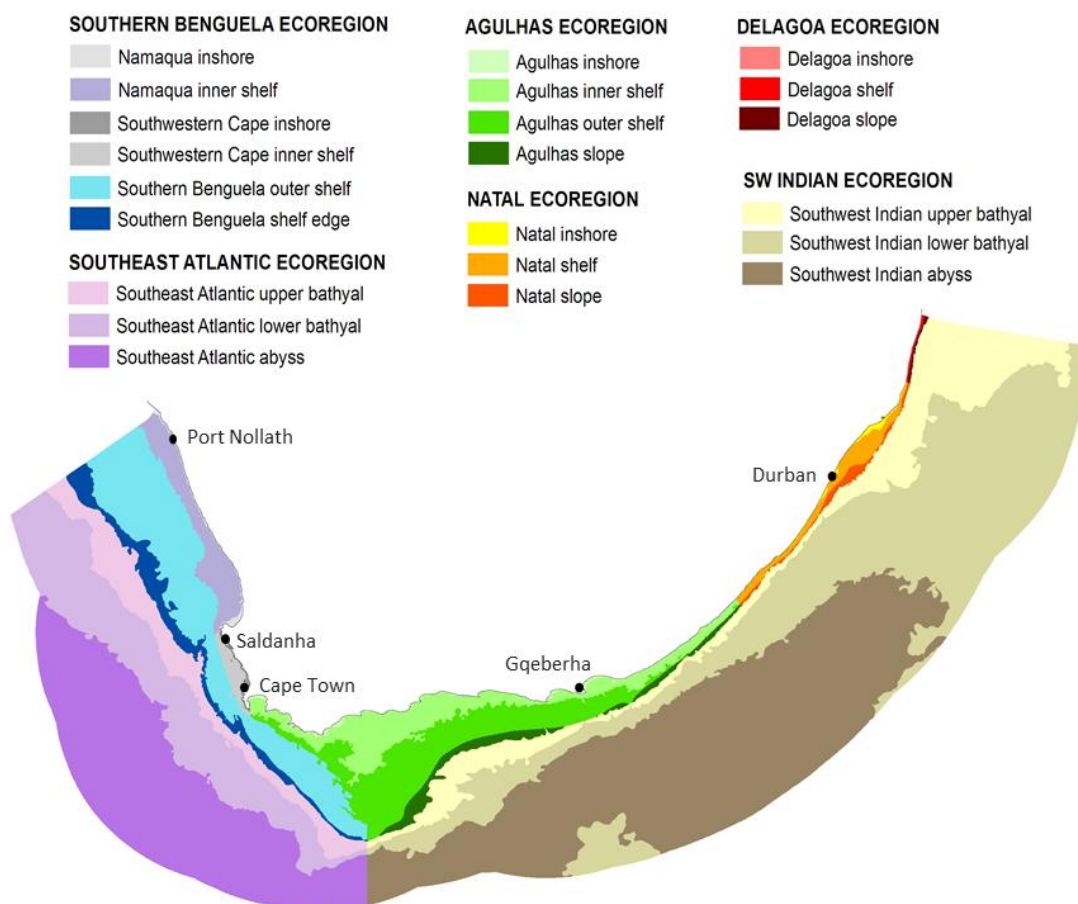


Figure 2.3. Inshore and offshore ecoregions in South Africa as defined by Sink et al. (2012).

The largest spatial scale are ecoregions comprised by four shelf ecoregions and two deep ocean ecoregions (Figure 2.3). Concession Area 6C falls within the Southern Benguela Ecoregion, within the Namaqua inner shelf of the ecoregion (Figure 2.3) (Emanuel et al. 1992, Turpie et al. 2000, Branch et al. 2022). The Namaqua inner shelf spans the inner most portion of the west coast of South Africa, extending from the northern border of South Africa to approximately St Helena Bay (Figure 2.3).

The South African National Biodiversity Institute (SANBI) has further delineated bathyregions for South Africa's biogeography, constituting the six main ecoregions divided by depth (Sink et al. 2019b). Concession Area 6C is positioned in the Southern Benguela Shelf bathyregion, which mainly follows the cool temperate West Coast (Figure 2.4).

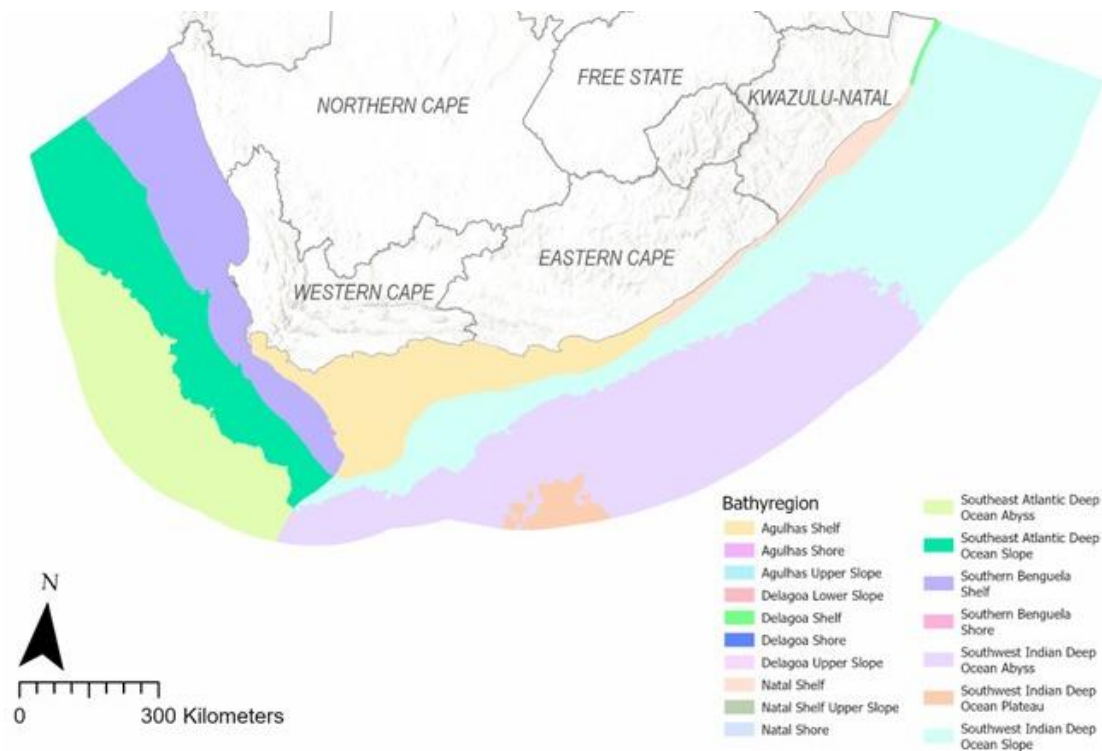


Figure 2.4. Marine bathyregions of South Africa's EEZ with incorporating biogeographic and depth divisions in the South African marine environment as defined by Sink et al. (2019b).

2.3 MARINE ECOLOGY

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 broad marine habitats within or adjacent to the 6C Concession Area, see below.

2.3.1 SUBTIDAL SOFT 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 & 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. Concession Area 6C is mostly classified as 'Muddy sand' with an intrusion of 'Sand' through the middle (Rogers 1977). This is further confirmed by the NBA ecosystem map which classified the benthic substrata as Southern Benguela Muddy Shelf, almost entirely within 6C (Figure 2.5).

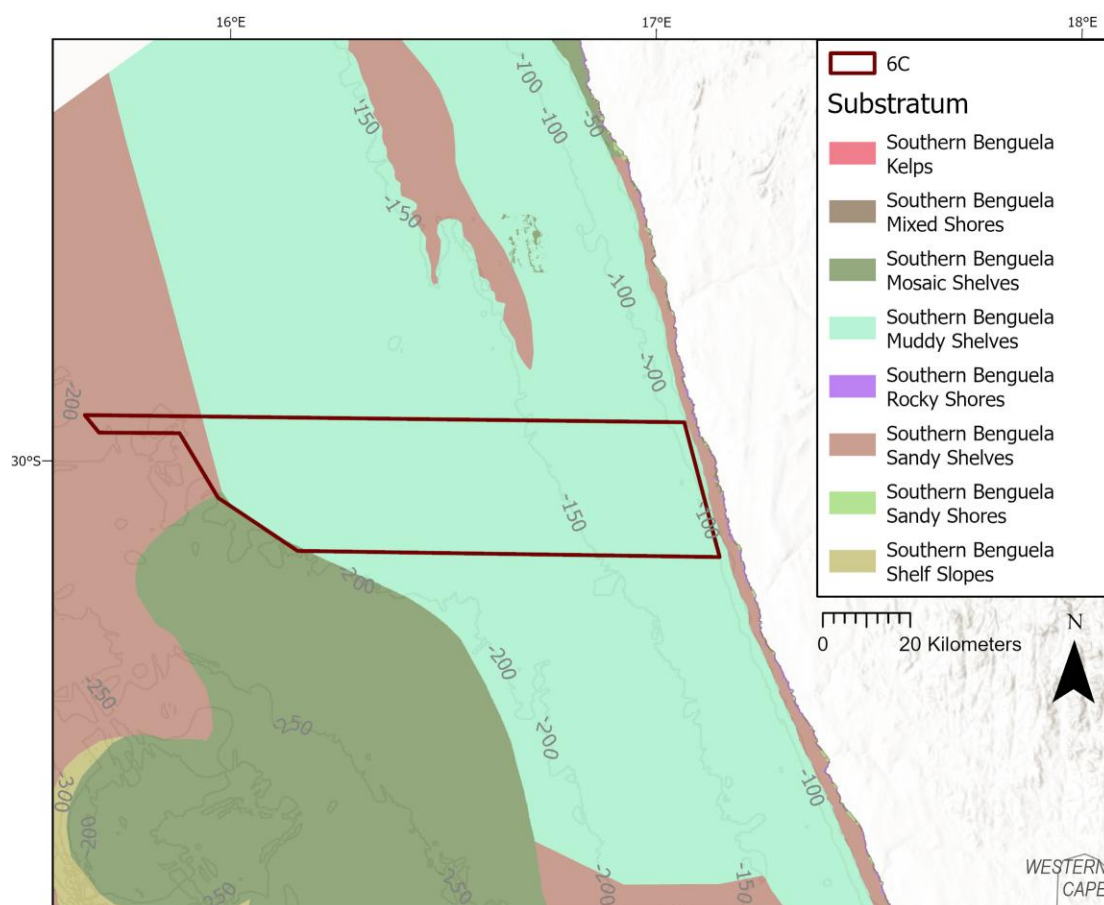


Figure 2.5. Marine substrate map of 6C, taken from the NBA Ecosystem Layer 2025 (Sink et al. 2026).

In terms of ecosystem types, 6C covers three ecosystem types from shallow to deep water: Namaqua Muddy Mid Shelf Mosaic, Namaqua Muddy Sands, and Southern Benguela Sandy Outer Shelf (Figure 2.6). These are described respectively as: (i) a mosaic of muddy and rocky seafloor within the highly productive mid-shelf zone (approximately 50–150 m depth) of the Namaqua Ecoregion; (ii) river-influenced muddy sand and associated turbid, productive pelagic habitat on the northern outer shelf (approximately 150–350 m depth); and (iii) sandy seafloor and associated highly productive benthic and pelagic habitat on the outer shelf of the Southern Benguela Ecoregion. In the nearshore portion of the alignment, the Namaqua Muddy Mid Shelf Mosaic ecosystem is expected to comprise predominantly muddy sediments interspersed with patches of consolidated substrate, resulting in a heterogeneous seabed that supports a diversity of benthic habitats.

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. Dean (2008) showed that polychaetes are generally most abundant,

in anthropogenically disturbed (e.g., poor environmental conditions) areas followed by amphipods and gastropods.

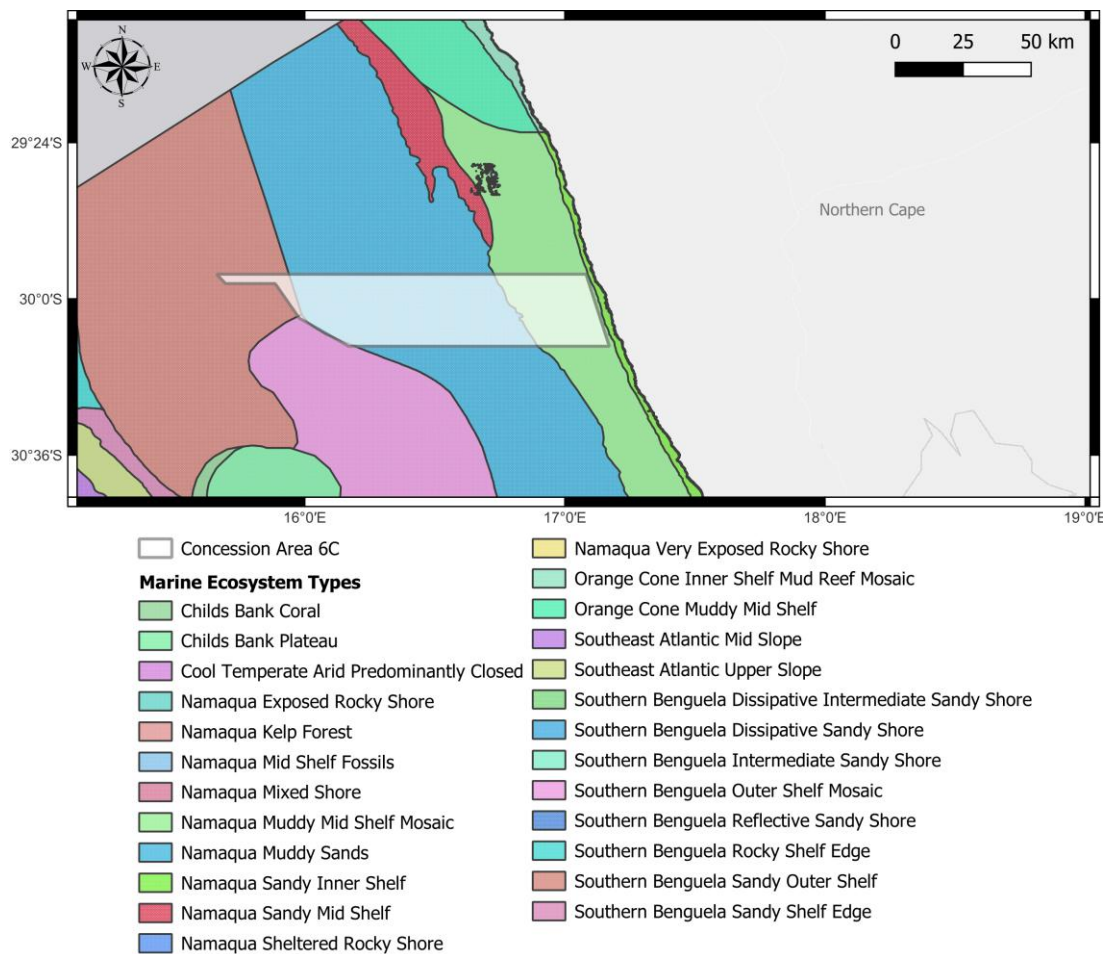


Figure 2.6. Marine ecosystem types found within and around Concession Area 6C as described by Sink et al. (2019b)

There is great diversity in benthic infauna, where much of the benthic infauna on the west coast of South Africa are deposit feeders (e.g., worms) (Castro & Huber 1997), which either ingest sediments and extract organic matter trapped between the grains, or actively collect organic matter and detritus (Castro & 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 & 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. monkfish 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 & Huber 1997). Similarly, reef-associated fish also rely on unconsolidated substrates for food, often feeding on the infaunal/epifaunal species that inhabit such habitats. 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.

The soft sediment infauna of the shelf ecosystem (Figure 2.5) of the west coast of South Africa is moderately well studied. Benthic sampling undertaken by Anchor in Concession Areas 1B, 1C and 2C (further north but of a similar depth range and biogeographical zone as 6C) had a benthic macrofaunal community comprised of 45 species with an average biomass of 85.9 g/m² (Concession Area 1B), 31.8 g/m² (1C) and 38.9 g/m² (2C) (Mostert et al. 2016, Biccard et al. 2020). 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 in St. Helena Bay of 846.53 g/m², and in Saldanha Bay of 970.78 g/m²) (Clark et al. 2020, Biccard et al. 2021). Available evidence suggests that the macrofaunal communities of Concession Area 6C 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 should be confirmed during proposed future baseline sampling.

2.3.2 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. 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.

PLANKTONIC COMMUNITIES

The ecology of the open water pelagic habitat within Concession Area 6C is typical of the Benguela upwelling region and the Namaqua inshore ecozone (See Section 2.2). 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 larvae from almost all marine phyla. For example, ichthyoplankton in the southern Benguela is composed mainly of small pelagic anchovy and sardine fish eggs and larvae, with some hakes and mackerel (Shannon & 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 *Thyrsites atun*, yellowtail *Seriola lalandi* and hake *Merluccius* spp. (Cury et al. 2000, Shannon et al. 2020).

SEABIRDS

Fourteen species of seabirds breed in southern Africa; Cape Gannet *Morus capensis*, African Penguin *Spheniscus demersus*, four species of Cormorant *Phalacrocorax* spp.,

White Pelican *Pelecanus onocrotalus*, three Gull *Larus* spp. and four Tern species *Hydroprogne caspia* and *Sterna* spp. (Table 2.1). Species listed as Endangered on the IUCN Red List include the Cape Gannet, Cape Cormorant and the Bank Cormorant, as well as the African Penguin which is listed as Critically Endangered. 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 the Cape Gannet regularly feeds from the inshore environment to as far as 100 km offshore while 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 Area 6C (the inner margin is located only 5 km offshore).

Table 2.1. Breeding seabirds present on the west coast of South Africa (adapted from Pulfrich (2021)), and their Global and local IUCN Red List status (IUCN 2025, Lee et al. 2025).

Common name	Species name	Global and local IUCN Red List Status
African Penguin	<i>Spheniscus demersus</i>	Critically Endangered
Great Cormorant	<i>Phalacrocorax carbo</i>	Least Concern
Cape Cormorant	<i>Phalacrocorax capensis</i>	Endangered
Bank Cormorant	<i>Phalacrocorax neglectus</i>	Endangered
Crowned Cormorant	<i>Phalacrocorax coronatus</i>	Least Concern
White Pelican	<i>Pelecanus onocrotalus</i>	Least Concern
Cape Gannet	<i>Morus capensis</i>	Endangered (locally Vulnerable)
Kelp Gull	<i>Larus dominicanus</i>	Least Concern
Grey-headed Gull	<i>Larus cirrocephalus</i>	Least Concern
Hartlaub's Gull	<i>Larus hartlaubii</i>	Least Concern
Caspian Tern	<i>Hydroprogne caspia</i>	Least Concern (locally Vulnerable)
Swift Tern	<i>Sterna bergii</i>	Least Concern
Roseate Tern	<i>Sterna dougallii</i>	Least Concern (locally Vulnerable)
Damara Tern	<i>Sterna balaenarum</i>	Least Concern (locally Vulnerable)

Pelagic seabirds such as albatross, petrels and shearwaters are also likely to be encountered in the offshore waters of 6C. 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 & Arnott 2021). Pelagic seabirds classified as being common in the southern Benguela are listed in Table 2.2.

Threatened species include the Yellow-nosed Albatross *Thalassarche chlororhynchos*, White-chinned Petrel *Procellaria aequinoctialis*, and Leach's Storm Petrel *Oceanodroma leucorhoa*. Most of the species in the region reach highest densities offshore of the shelf break (200 – 500 m depth) (Baker & Arnott 2021), mostly offshore of Concession Area 6C.

Table 2.2. Pelagic seabirds common to the southern Benguela region (Crawford et al. 1991) and IUCN Global and local Red List status (IUCN 2025, Lee et al. 2025).

Common Name	Species name	IUCN Red List status
Shy Albatross	<i>Thalassarche cauta</i>	Near Threatened
Black browed Albatross	<i>Thalassarche melanophris</i>	Least Concern
Yellow nosed Albatross	<i>Thalassarche chlororhynchos</i>	Endangered
Giant Petrel sp.	<i>Macronectes halli/giganteus</i>	Least Concern (locally Near Threatened)
Pintado Petrel	<i>Daption capense</i>	Least Concern
Great-winged Petrel	<i>Pterodroma macroptera</i>	Least Concern (locally Near Threatened)
Soft plumaged Petrel	<i>Pterodroma mollis</i>	Least Concern (locally Near Threatened)
Prion spp.	<i>Pachyptila</i> spp.	Least Concern
White-chinned Petrel	<i>Procellaria aequinoctialis</i>	Vulnerable
Cory's Shearwater	<i>Calonectris diomedea</i>	Least Concern
Great Shearwater	<i>Puffinus gravis</i>	Least Concern
Sooty Shearwater	<i>Ardenna grisea</i>	Near Threatened
European Storm Petrel	<i>Hydrobates pelagicus</i>	Least Concern
Leach's Storm Petrel	<i>Oceanodroma leucorhoa</i>	Vulnerable
Wilson's Storm Petrel	<i>Oceanites oceanicus</i>	Least Concern
Black-bellied Storm Petrel	<i>Fregetta tropica</i>	Least Concern (locally Near Threatened)
Skua spp.	<i>Catharacta/Stercorarius</i> spp.	Least Concern
Sabine's Gull	<i>Larus sabini</i>	Least Concern

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, as presented in Table 2.3 (Lane & Carter 1999, Penney et al. 2007, Child et al. 2016, Biccard et al. 2018, Baker & Arnott 2021, Pulfrich 2021). Conservation status from the IUCN (2025) Red List is also provided.

Of the species listed, the blue whale is considered Critically Endangered, fin and sei whales are Endangered, and humpback and sperm whales are considered Vulnerable (IUCN 2025). Altogether 10 species are listed as Data Deficient underlining how little is known about cetaceans, their distribution and population trends (IUCN 2025). 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 2.7). 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 (Barendse 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 (2025) Red List is indicated.

Marine Mammal hearing group	Species	Shelf/Offshore	Likely encounter frequency in 6C (seasonality)	IUCN Red List status
Low frequency cetaceans (Baleen whales) Generalised hearing range: 7 Hz to 35 kHz	<i>Balaenoptera bonaerensis</i> (Antarctic minke whale)	Shelf and offshore	Monthly (winter)	Least Concern
	<i>B. acutorostrata</i> (Dwarf minke whale)	Shelf and offshore	Occasional (year-round)	Least Concern
	<i>B. physalus</i> (Fin whale)	Shelf and offshore	Occasional (rarely in summer)	Vulnerable
	<i>B. musculus</i> (Blue whale)	offshore	Unlikely (seasonality unknown)	Critically Endangered
	<i>B. borealis</i> (Sei whale)	Shelf and offshore	Occasional (winter)	Endangered
	<i>B. brydei</i> (offshore Bryde's whale)	Shelf and offshore	Occasional (summer)	Not assessed
	<i>B. brydei</i> (subsp) (inshore Bryde's whale)	Shelf and offshore	Occasional (year-round)	Vulnerable
	<i>Eubalaena australis</i> (Southern right whale)	Shelf	Daily (year-round, higher in early spring and summer)	Least Concern
	<i>Megaptera novaeangliae</i> (Humpback whale)	Shelf and offshore	Daily (year-round, higher in summer)	Least concern
High frequency cetaceans (Dolphins, toothed whales, beaked whales) Generalised hearing range: 150 Hz to 160 kHz	<i>Lagenorhynchus obscurus</i> (Dusky dolphin)	Shelf (0-800 m)	Daily (year-round)	Data Deficient
	<i>Cephalorhynchus heavisidii</i> (Heaviside's dolphin)	Shelf (0-200 m)	Daily (year-round)	Near Threatened
	<i>Tursiops truncatus</i> (Common bottlenose dolphin)	Shelf and offshore	Monthly (year-round)	Least Concern
	<i>Delphinus delphis</i> (Common short beaked dolphin)	Shelf and offshore	Monthly (year-round)	Least Concern
	<i>Lissodelphis peronii</i> (Southern right whale dolphin)	Shelf and offshore	Occasional (year-round)	Least Concern
	<i>Stenella coeruleoalba</i> (striped dolphin)	Offshore	Unlikely (unknown)	Least Concern
	<i>S. attenuate</i> (Pantropical spotted dolphin)	Shelf edge and offshore	Unlikely (year-round)	Least Concern
	<i>Globicephala melas</i> (Long-finned pilot whale)	Shelf edge and offshore	Monthly (year-round)	Least Concern

Marine Mammal hearing group	Species	Shelf/Offshore	Likely encounter frequency in 6C (seasonality)	IUCN Red List status
	<i>G. macrorhynchus</i> (Short-finned pilot whale)	Unknown	Unlikely (unknown)	Least Concern
	<i>Steno bredanensis</i> (Rough-toothed dolphin)	Unknown	Unlikely (unknown)	Least Concern
	<i>Orcinus orca</i> (Killer whale)	Shelf and offshore	Occasional (year-round)	Data Deficient
	<i>Pseudorca crassidens</i> (False killer whale)	Shelf and offshore	Monthly (year-round)	Near Threatened
	<i>Feresa attenuate</i> (Pygmy killer whale)	Offshore	Occasional (unknown)	Least Concern
	<i>Grampus griseus</i> (Risso's dolphin)	Shelf edge and offshore	Occasional (unknown)	Least Concern
	<i>Kogia breviceps</i> (Pygmy sperm whale)	Shelf edge and offshore	Occasional (year-round)	Data Deficient
	<i>K. sima</i> (Dwarf sperm whale)	Shelf edge	Unlikely (unknown)	Data Deficient
	<i>Physeter macrocephalus</i> (Sperm whale)	Shelf edge and offshore	Occasional (year-round)	Vulnerable
	<i>Ziphius cavirostris</i> (Cuvier's beaked whale)	Offshore	Occasional (year-round)	Data Deficient
	<i>Berardius arnouxii</i> (Arnoux's beaked whale)	Offshore	Occasional (year-round)	Data Deficient
	<i>Hyperoodon planifrons</i> (Southern bottlenose beaked whale)	Offshore	Occasional (year-round)	Least Concern
	<i>Mesoplodon layardii</i> (Layard's beaked whale)	Offshore	Occasional (year-round)	Data Deficient
	<i>M. mirus</i> (True's beaked whale)	Offshore	Unlikely (year-round)	Data Deficient
	<i>M. grayi</i> (Gray's beaked whale)	Offshore	Occasional (year-round)	Data Deficient
	<i>M. densirostris</i> (Blainville's beaked whale)	Offshore	Unlikely (year-round)	Data Deficient
Phocid carnivores in water (PCW)	<i>Mirounga leonine</i> (Southern elephant seal)	Shelf and offshore	Unlikely (unknown)	Least Concern
	<i>Hydrurga leptonyx</i> (Leopard seal)	Shelf and offshore	Unlikely (unknown)	Least Concern
Other marine carnivores in water (OCW)	<i>Arctocephalus pusillus pusillus</i> (Cape fur seal)	Shelf	Daily (year-round)	Least Concern

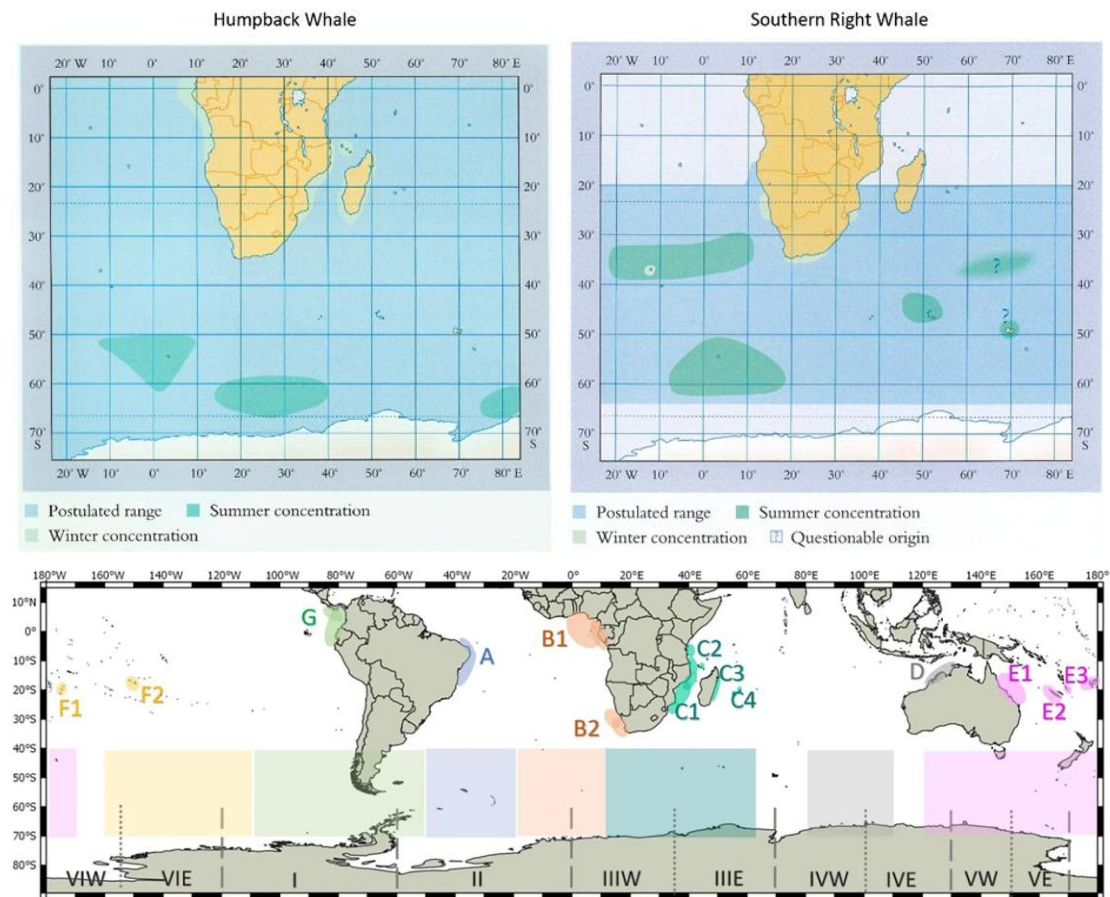


Figure 2.7. Migration routes are inferred from the seasonal distribution of humpback (top left) and southern right (top right) whales off the coast of southern Africa. Source: Best (2007). (Bottom) Distribution of the core breeding and primary feeding grounds of the Southern Hemisphere humpback whale (Breeding Stocks A – G, and Southern Ocean Management Areas I – VI and sub-areas) B2 = breeding grounds near Namibia and West Coast South Africa (Seyboth et al. 2023).

2.4 SENSITIVITY AND SIGNIFICANCE

2.4.1 ECOSYSTEM THREAT STATUS

The 2025 National Biodiversity Assessment (NBA) for marine benthic and coastal habitat threat status layer is shown in Figure 2.8 for Concession Area 6C. This Ecosystem Threat Status developed by SANBI 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 (Sink et al. 2025). 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 2025 NBA, the entire area covered by Concession Area 6C is classified as “Least Concern” (Figure 2.8).

2.4.2 CONSERVATION DESIGNATIONS

The 6C Concession Area does not overlap with any National Marine Protected Areas (MPAs), with the Namaqua Fossil Forest MPA found ~30 km north of the concession area

and the Namaqua MPA ~50 km southeast. The area also does not overlap with any designated Ecological and Biologically Significant Areas (EBSA) (Figure 2.9).

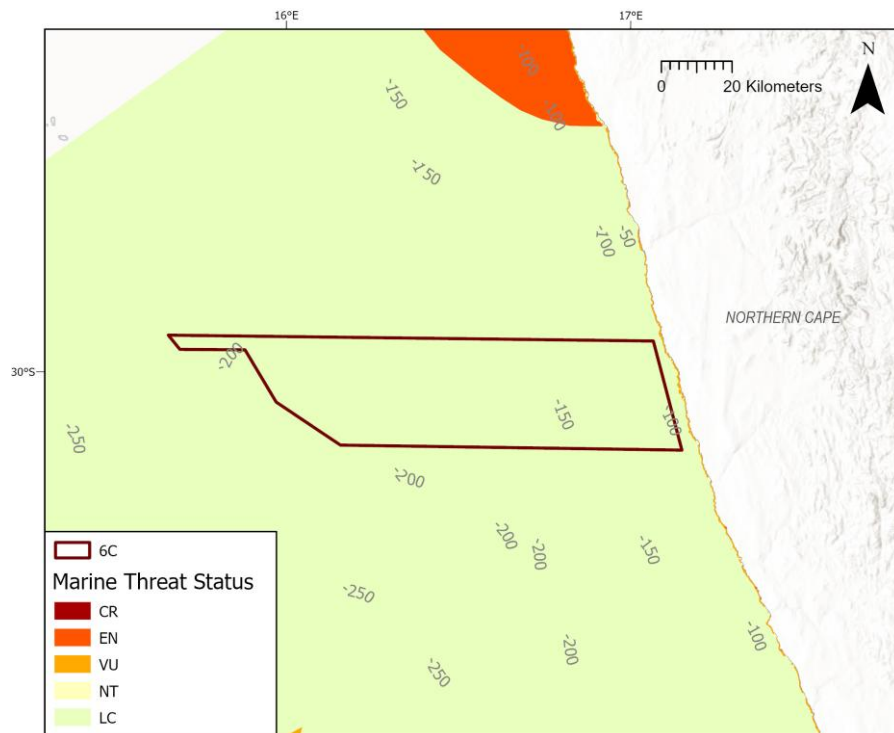


Figure 2.8 Marine Ecosystem Threat Status of the broader marine region surrounding and including Concession Area 6C.

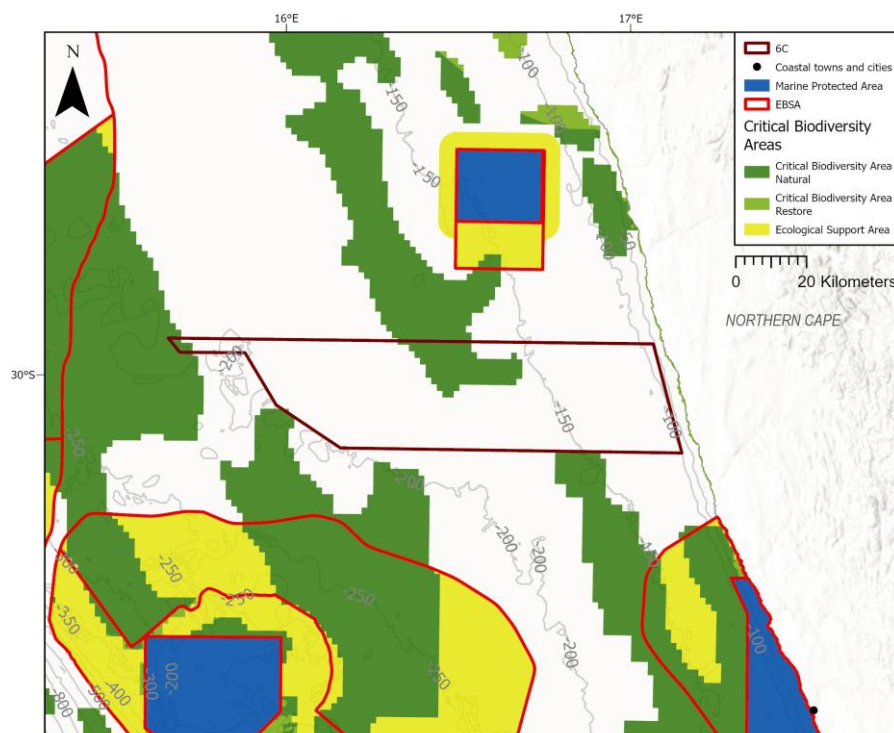


Figure 2.9 CBA, MPA and EBSA designations within the marine areas surrounding Concession Area 6C.

Critical Biodiversity Areas (CBAs) are spatially identified areas required to meet biodiversity targets and safeguard ecological processes, as determined through systematic biodiversity planning and spatial prioritisation. In the marine environment, these typically include areas important for key habitats, species distributions, ecological connectivity, and ecosystem functioning. CBAs are used in South Africa as decision-support tools to guide sustainable development and biodiversity conservation. They have been developed through national-scale biodiversity planning processes, however their incorporation into regulatory and decision-making frameworks alignment with marine spatial planning instruments, and consistent application within ESIA processes are still developing in practice. A range of sea-use activities and recommendations as to their permissibility, subject to compatibility with different Critical Biodiversity Areas, is presented in Harris et al. (2022), the Draft Marine Biodiversity Sector Plan (DFFE 2023) and the Proposed Approach to Spatial Development and Management for South Africa's Marine Planning Areas 2019.

There are two categories of CBA, namely 'CBA Natural' areas and 'CBA Restore' areas. CBA Natural sites have natural/near-natural ecological condition, with the management objective of maintaining the sites in that natural/near-natural state. CBA Restore sites have moderately modified or poorer ecological condition, with the management objective to improve ecological condition and, in the long term, restore these sites to a natural/near-natural state, or as close to that state as possible. As a minimum in CBA Restore sites, further deterioration in ecological condition must be avoided, and options for future restoration must be maintained. The Ecological Support Areas (ESAs) include all portions of EBSAs that are not already within MPAs or CBAs, and a 5 km buffer area around all MPAs (where these areas are not already CBAs or ESAs). Within ESAs, negative impacts of human activities on key biodiversity features are managed and minimised to maintain the features in at least a functional, semi-natural state and/or to allow the area to improve in ecological condition. Around 9% (320 km² approximately) of 6C is classified as a CBA Natural area (Figure 2.9).

The CBAs of highest priority are CBA Natural areas. Mining prospecting (non-destructive) activities (including acoustic surveys, geotechnical sampling), are restricted within all CBA delineations, and so, as far as possible, prospecting activities in these areas should be avoided. Activities with restricted compatibility require a detailed assessment to determine whether the recommendation is that they should be permitted (general), permitted subject to additional regulations (consent), or prohibited, depending on a variety of factors. This assessment is undertaken in Section 3. Management recommendations and regulations for these activities need to consider the context in which the activities take place or are proposed to take place. It is also critical to take cumulative impacts into account, which may have implications for the intensity, extent or even the presence of activities, especially new or expanding activities in a biodiversity priority area (Harris et al. 2022).

There is a degree of misalignment between permitting prospecting activities and prohibiting mining within CBA Natural areas. As such, the suitability of allowing prospecting in these areas should be re-evaluated in the context of its potential to enable or support future mining activities and the associated cumulative impacts on biodiversity priorities.

2.5 USER GROUPS

2.5.1 INTRODUCTION

The main users of the sea space in Concession Area 6C are the commercial shipping 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 crossing the Concession Area would be fishing vessels and other prospecting or mining vessels. The potential spatial overlap of commercial fisheries with the Concession Area 6C was investigated based on analysis of spatially referenced commercial catch return data obtained from the Department of Forestry, Fisheries and the Environment (DFFE). The large commercial fishing sectors that are active along the west coast (the demersal trawl, demersal hake longline and large pelagic longline fishing sectors) all typically operate well offshore of the 6C Concession Area, while the West Coast rock lobster fishery operates inshore, in water shallower than the concession area (Norman et al. 2018, DFFE 2025). Possible spatial overlap with the commercial linefish and tuna pole fisheries was identified. These fisheries are considered in more detail below.

2.5.2 TUNA POLE AND LINE

The South African tuna pole and line (TPL) sector targets longfin tuna *Thunnus alalunga*, yellowfin tuna *T. albacares*, bigeye tuna *T. obesus* and skipjack tuna *Katsuwonus pelamis* seasonally between November and May. Due to the seasonality of the TPL fishery, fishers also have access to snoek *Thyrsites atun* and yellowtail *Seriola lalandi* that are also important targets of the traditional linefishery. The tuna pole fleet consists of approximately 100 vessels ranging from small outboard powered skiboats (7–9 m length) to inboard diesel-powered deck boats (6–25 m length). The reported longfin tuna catch in 2018 was 2 471 tonnes, with a wholesale value of R124 Million, or 1.2% of the total South African commercial fisheries value (Japp & Wilkinson 2021).

The commercial tuna pole fishing grounds lie between Cape Agulhas and the Orange River, but the fleet operates predominantly out of Cape Town and Hout Bay harbours and most fishing effort takes place within 100 nautical miles of these ports (particularly in the Cape Canyon area). Some effort does take place further up the West Coast, although this is mostly far to the south of Concession Area 6C. On average, a small amount of effort (estimated to be 10–50 days) occurs to the south-west of the 6C Concession Area and there is limited overlap with the fishing grounds (Figure 2.10). The TPL fleet also targets snoek inshore of the 100 m depth contour (SLR 2021), which may be more likely to occur within 6C than tuna. Snoek fishing activity within the region is seasonal with all fishing reported within the period April to May inclusive (SLR 2021). Snoek utilizes extensive offshore (150–400 m depth) breeding grounds between the Agulhas Bank and central Namibia with generally random longshore movement (Griffiths 2002). This species is targeted by the commercial linefish and TPL sectors throughout this extensive range usually during inshore movements between offshore spawning and inshore feeding grounds (Hutchings et al. 2002). Due to the minimal overlap between Concession Area 6C and the TPL fishing effort, coupled with the short-term nature of the prospecting activities and small spatial and temporal overlap with snoek fishing activity, impacts on the TPL fleet due are expected to be insignificant.

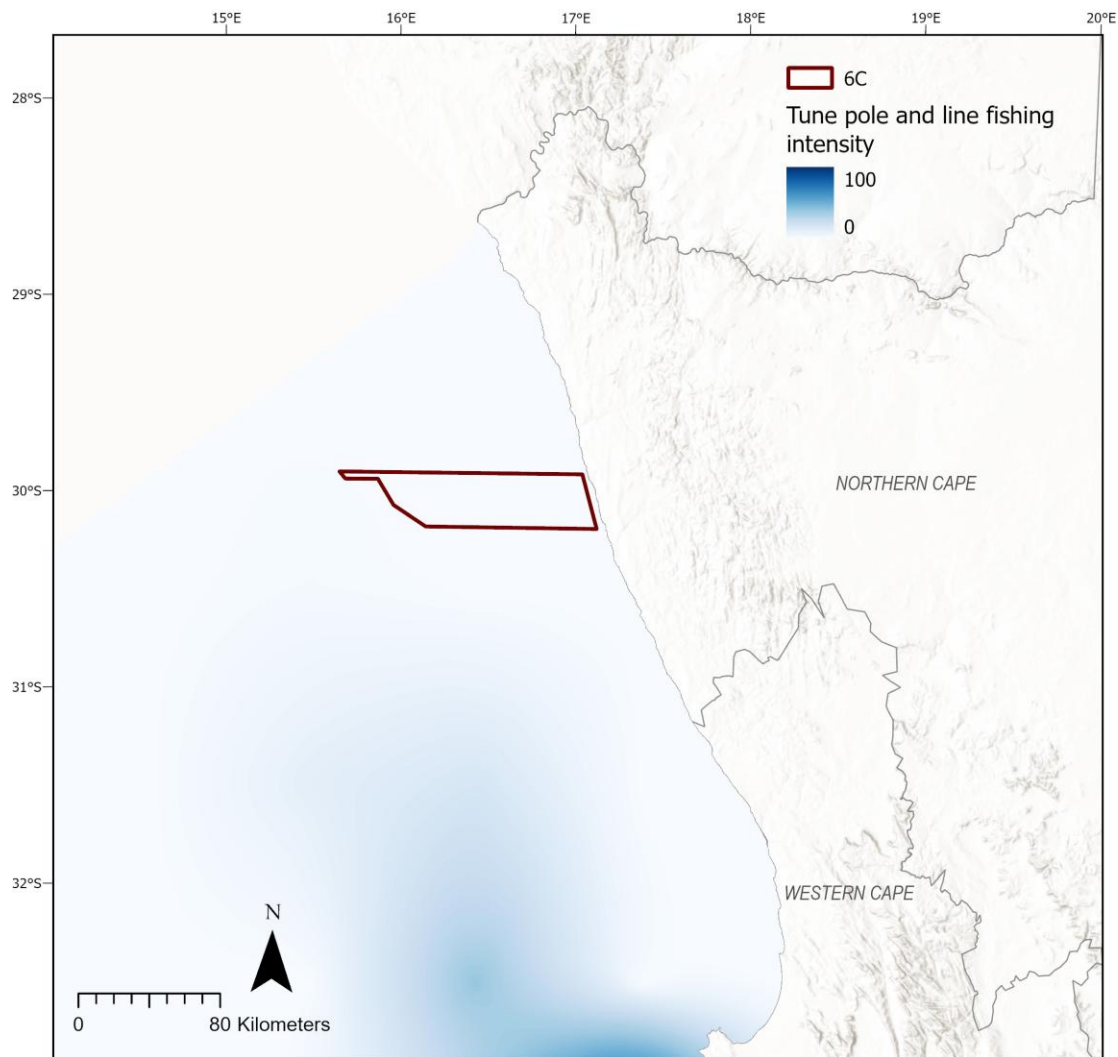


Figure 2.10 Tuna Pole and Line west coast fishing intensity (average annual effort 2010-2019, taken from NBA 2018 (Sink et al. 2019a).

2.5.3 COMMERCIAL LINEFISH

Catching fish with hook and line is amongst the oldest form of fishing in South Africa and can be traced back to the fishing activities of indigenous Khoi and European seafarers in the 1500s. Commercial, recreational and subsistence line fishers target up to 200 different fish species, both from boats and the shore. Commercial line fishing effort peaked in the 1990s with about 3 000 registered boats (only about 700 were active commercially), whilst recreational boat fishing (currently estimated at about 4 000 vessels), shore angling (~1 million participants) and subsistence fishing (largely shore-based with an estimated 25–30 000 participants), continues to grow.

A management framework that included a comprehensive suite of line fish regulations was introduced in 1985, including revised minimum size limits equal to sizes at maturity (when known), daily bag limits, closed seasons, commercial fishing bans for certain species and the capping of the commercial effort at the 1984 level. CPUE data and stock assessments conducted since the mid-1980s have revealed that, with the exception of fast-growing species such as snoek and yellowtail, most commercially exploited traditional line fishes have been depleted to dangerously low levels. This suggested that

the line fish management framework in place at the time was failing to provide adequate protection for line fish stocks. In an effort to rebuild depleted line fish stocks, an environmental emergency in the traditional line fishery was declared in December 2000. In terms of the emergency, the Minister determined that a Total Allowable Effort (TAE) of no more than 450 vessels and 3 450 persons may fish commercially for line fish. Revised bag and size limits for commercial and recreational line fishers were implemented in 2005. The commercial line fishery was split into three regional management zones, restricting the movement of vessels from one region to the next with the long-term rights allocation. Marine protected areas are a key component of line fish management, providing research opportunities in the absence of fishing effects, whilst numerous studies have demonstrated protection of spawner biomass in these areas and potential enhancement of adjacent fisheries through export of adults and juveniles. These measures have been met with some success and improved standardized CPUE trends are apparent for some species. However, the reduction in effort and resource recovery has been somewhat undermined by effort creep (via crew exemptions and interim relief measures), illegal fishing activity and unregulated subsistence fishing in important nursery habitats such as estuaries.

Line fishers operate in shallow water (generally <100 m depth) and would potentially be negatively impacted by coastal and nearshore exploration, prospecting and mining operations (particularly recreational, small scale and subsistence shore fishing). Concession Area 6C is, however, relatively far offshore in water that is mostly deeper than 100m. The area is located offshore of Hondeklipbaai, which has a small traditional linefishing community. Based on spatial analysis, there is no overlap between commercial linefish operations and Concession Area 6C (Figure 2.11). This fact, combined with the low intensity potential impacts, small spatial scale and short duration of the proposed prospecting activities means that negligible impacts on the traditional linefish sector as a whole are anticipated. Small-scale linefishing activity by local Hondeklipbaai fishers that takes place on the inshore edge of the 6C concession is, however, likely very important at the individual vessel, right holder or fisher level and mitigation measures to minimise potential negative impacts on local fishers are provided in the Impact Assessment (Section 3).

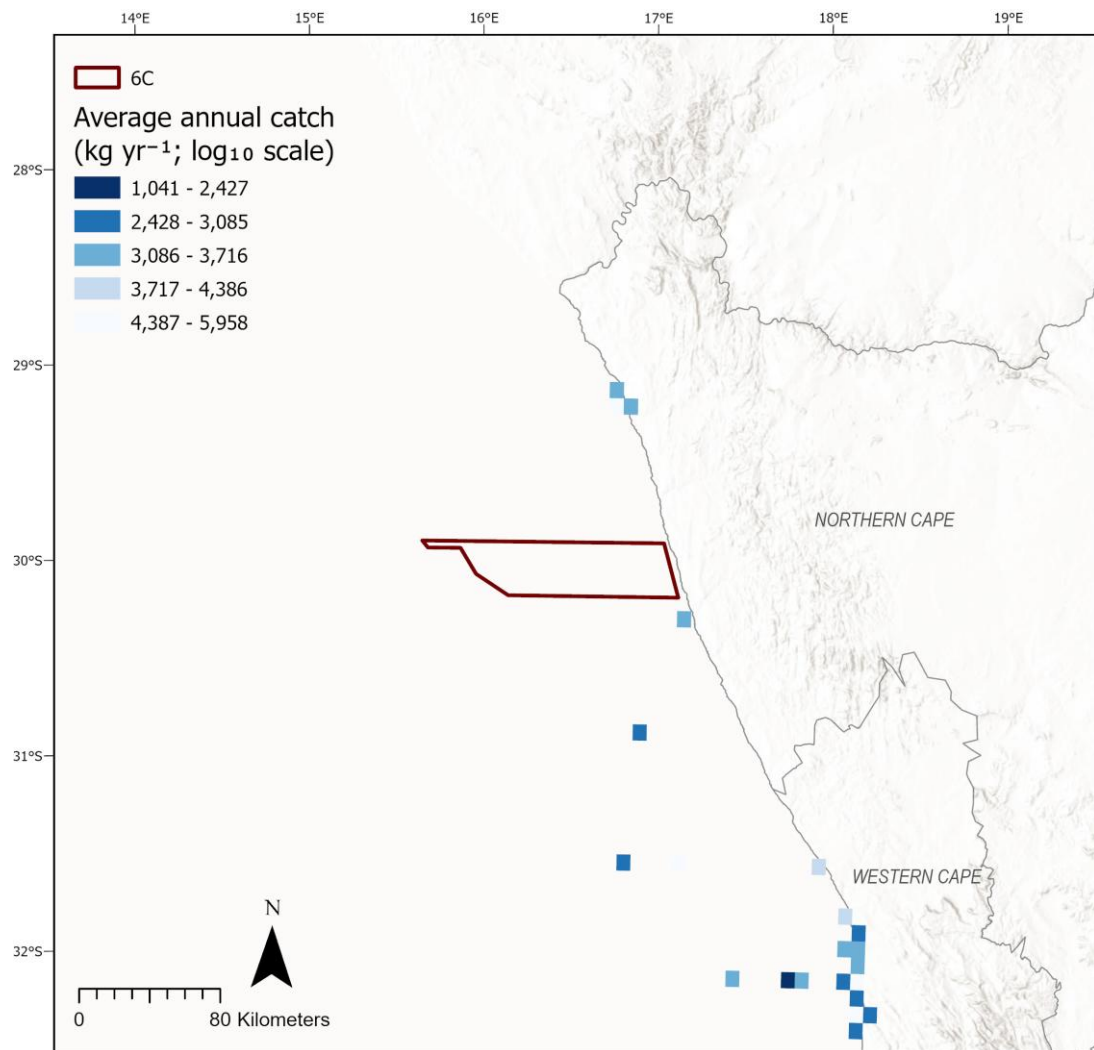


Figure 2.11 Commercial linefishing average annual catch (kg) (2010-2020) along the west coast, reported on the 5' National Marine Linefish reporting grid (Data sourced from DFFE).

2.5.4 WEST COAST ROCK LOBSTER

The West Coast rock lobster *Jasus lalandii* is a marine crustacean with a range extending from Walvis Bay, Namibia, to Gqeberha on the South Coast of South Africa (Jones 2008). West Coast rock lobsters are under heavy harvesting pressure in South Africa, and their population is considered severely depleted. Harvesting began in the late 1800s and peaked at 18 000 tonnes/annum in the 1950s. Despite the introduction of more efficient traps and motorboats, this yield decreased to 10 000 tonnes/annum in the 1960s and has continued to decrease since, with catches declining to 1 500 tonnes/annum in 1996 and not recovering since (DFFE 2025). A minimum size limit was implemented in 1979, and in the 1980s, a total allowable catch (TAC) system was implemented (DEFF 2020). The TAC is divided across different geographically defined fishing zones and different fishing sectors. There are two regions for his activity the offshore commercial and the nearshore commercial, plus some allocation for Small-Scale. The TAC has continued to decrease since 2005, with a TAC of 400 tonnes (offshore commercial component), 135 tonnes (inshore commercial component) instituted for the 2025/2026 season, although the allocated TAC has not been reached for the past eight years (DFFE 2025).

The most recent West Coast rock lobster stock assessment in 2022 found that the resource is substantially more depleted than estimated in previous assessments, which did not have complete datasets. The harvestable portion (males) of the West Coast rock lobster population is estimated to be only 1.2% of “pristine” levels (Johnston & Butterworth 2024). Despite this, the species continues to support a fishing industry worth R500 million per annum (DFFE 2025). For recreational fishing, there is a bag limit of four West Coast rock lobsters per person per day, which may only be harvested during the summer months on specific days (currently only 12 days per summer season) between 8am and 4 pm, and without the use of traps (baited hoop nets, diving and shore-based pole fishing is permitted) or SCUBA (DAFF 2017).

Apart from the strictly controlled commercial, recreational and subsistence harvest, it is the illegal harvest of West Coast rock lobster that has a major impact on the population (Brill & Raemaekers 2013, DFFE 2025). In 2015, the illegal harvest of West Coast rock lobster was estimated at 1 500 tonnes per year, worth R345 million/year in 2017 (Johnston & Butterworth 2016, Blamey & Bolton 2018). Poaching continues to drive local population declines, undermines management efforts, and creates significant economic losses, both for regulated fisheries and coastal communities dependent on sustainable harvests.

Similar to line fishing, West Coast rock lobster fishing constitutes an important economic activity for residents of Hondeklipbaai, Kleinsee etc., where few other livelihood options exist. Information as to the exact distribution of these Small-Scale rights is presently unavailable, hence it is not possible to quantify the full extent of lobster fishing in the area of interest for this project.

West Coast rock lobster is a nearshore, west coast species and any mining or prospecting activities that negatively impact the kelp bed and reef habitat required by this crustacean will further impact this depleted stock. However, the proposed prospecting activity will take place relatively far offshore (5 km) in sandy inner shelf habitat, as opposed to the inshore rocky-reef habitat that the lobster prefer. It is therefore highly unlikely that the proposed prospecting will have any significant impact on this fishery and it is screened out of the assessment at commercial, small-scale, and interim relief levels.

2.5.5 SMALL-SCALE/SUBSISTENCE/RECREATIONAL FISHERS

Small-scale fisheries, both in South Africa and abroad, are an important source of income and food security for many thousands of people, and has been so for generations (Clark et al. 2002, Sowman et al. 2014, Auld & Feris 2022). Small-scale fishing in South Africa has been considered to include various fishing methods targeting more than 30 species (Griffiths & Branch 1997) from a range of habitats (Branch et al. 2002, Clark et al. 2002). Although small-scale fisheries contribute less than 1% to South Africa’s GDP, they play an important role in the provision of protein and employment for an estimated 136 coastal communities distributed along South Africa’s 3 000 km coastline (Figure 2.12). The extent and spread of small-scale fishers covers the four provinces with coastlines, especially the Western Cape, where fishing has been an important source of protein among the coastal communities since the 1700s (Isaacs 2013). Small-scale fishers are found both in urban and rural coastal areas.

Small-scale fishery operations have historically not been included in the fisheries policy development in South Africa — the definition of “commercial fishing” as per the 1998

Marine Living Resources Act (MLRA) excluded small-scale and artisanal fishers who catch and sell fish to sustain livelihoods, despite commercial fisheries around South Africa spanning a wide spectrum, and in 2005, the government adopted long-term fishing policies that made no provision for small-scale fishers.

In response to an Equality Court order in 2007, South Africa's cabinet adopted the Small-Scale Fisheries Policy (SSFP) in June 2012, which sought to address imbalances of the past and ensure that small-scale fishers were accommodated and properly managed. The policy proposed that fishing rights be allocated on a group, rather than an individual, basis. The policy further aimed to support investment in community entities who could take joint responsibility for sustainably managing the fisheries resources and assist in addressing the depletion of critical fisheries stocks. Accordingly, the MLRA was amended in 2014 (commencement date 8 March 2016) to allow the DFFE to proceed with the SSFP implementation process. As part of the amendments, a definition of 'small-scale fishers' and the communities involved was provided (Section 1) as follows:

'small-scale fisher' means a member of a small-scale fishing community engaged in fishing to meet food and basic livelihood needs, or directly involved in processing or marketing of fish, who—

- traditionally operate in near-shore fishing grounds;
- predominantly employ traditional low technology or passive fishing gear;
- undertake single day fishing trips; and
- is engaged in consumption, barter or sale of fish or otherwise involved in commercial activity, all within the small-scale fisheries sector.
- 'small-scale fishing community' means a group of persons who—
- are, or historically have been, small-scale fishers;
- have shared aspirations and historical interests or rights in small-scale fishing;
- have a history of shared small-scale fishing and who are, but for the impact of forced removals, tied to particular waters or geographic area, and were or still are operating where they previously enjoyed access to fish, or continue to exercise their rights in a communal manner in terms of an agreement, custom or law; and
- regard themselves as a small-scale fishing community;''

The amended MLRA also replaces any reference to 'subsistence fisheries' with 'small-scale fisheries', essentially encasing the 'subsistence' definition within the larger understanding of 'small-scale fisheries'. In terms of resource management, the amended MLRA includes 'small-scale fishing' alongside 'commercial fishing' in terms of fisheries management and explicitly includes small-scale fishing within the definition of total allowable catch alongside commercial, recreational and foreign fishing. In this way, small-scale operations range from fulfilling food security to full-blown commercial operations.

In 2016, a Schedule pertaining to the Small-Scale Fishing Regulations in terms of Section 19 of the MLRA (as amended) was published. As per these regulations, communities wishing to be recognised as small-scale fishing communities needed to register their expression of interest with the Department, organise themselves into cooperatives. Later that same year, the former Department of Agriculture, Forestry, and Fisheries (DAFF) verified 8 488 individuals in fishing communities that had expressed interest in the small-scale fisheries sector. This was followed by the declaration of 2 802 registered small-scale fishers, but this process was considered inadequate which prompted re-

evaluation. In the Western Cape, 62 cooperatives were granted 15-year fishing rights, with 3 850 fishers declared in 2023¹.



Figure 2.12 Small-scale fishing communities in South Africa (Isaacs et al. 2022). Yellow dots = small-scale fishing community within each recognised 'basket' area.

Of the estimated 30 000 small-scale fishers active along the South African coastline in 2002, 85% of them harvested linefish (Clark et al. 2002). The basket of species granted to these fishers included squid (see below), hake hand line, traditional linefish, seaweed, South Coast rock lobster and abalone ranching. The majority of species applied for were linefish species, some of which required use of a vessel. The small-scale fishing sector has been allocated a portion of the TAE in the finalised 2023 rights-allocation process for the Sector. Allocations as part of other Sectors are still being finalised pending the 2021 Fishing Rights Allocation appeals process.

The west coast area of South Africa in closest proximity to the 6C has a number of recognised small-scale fishing communities (Figure 2.12). These communities comprise of estuarine fishers (30%) and marine fishers (70%) which target a range of intertidal invertebrates (marine and estuarine) and fish (Figure 2.13).

¹

https://www.dffe.gov.za/sites/default/files/legislations/appeals/13nov23gpr_smallscalefisheries_reallocation.pdf (accessed 2023/12/19)

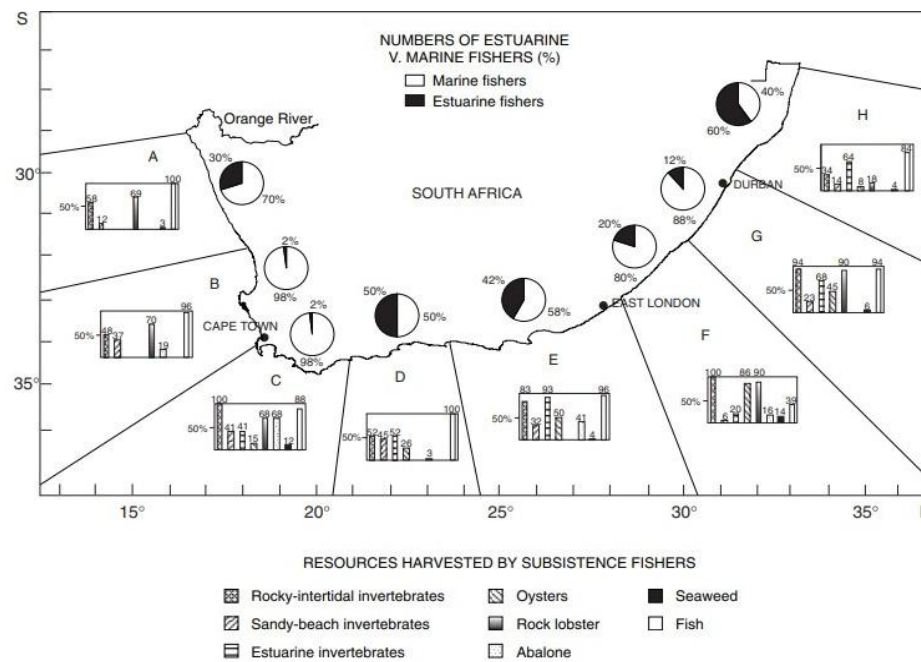


Figure 2.13 Proportions of marine and estuarine fishers, and relative importance of various different resources to ‘subsistence’ fishers in each of the eight regions taken from (Clark et al. 2002).

At time of writing, spatial activity and catch data for these fishers is lacking but is presumed to be similar to that of the existing fishery. The outcomes of the rights allocation appeals process are also currently not known. However, it is considered likely that any offshore operations will overlap with existing spatial footprints for these resources, given that fisheries, both “traditionally commercial” and small-scale, are likely to operate where the resource is present. Given that the TAC for these small-scale offshore fisheries operations will come from the existing commercial sector, the overlap with the 6C is considered to be suitably captured in the commercial linefishing assessment.

As such there is no perceived overlap between the 6C and commercial line fishing effort. Therefore, it is unlikely that there will be any overlap with the offshore small-scale line fishery.

RECREATIONAL FISHERS

Recreational fisheries in South Africa include line fisheries, rock lobster fisheries and harvesting of intertidal resources such as mussels, redbait and oysters (Griffiths et al. 2004, Cooke & Cowx 2006, Lewin et al. 2006, Winker et al. 2014, Maggs et al. 2016, Parker et al. 2016, Kerwath et al. 2019, Steyn et al. 2019). In the MLRA, “recreational fishing” means any fishing done for leisure or sport and not for sale, barter, earnings or gain. Recreational linefishing is a popular activity in South Africa and takes place along the entire coast. Between 1994 and 1997, the first nation-wide survey was conducted to evaluate participation in South Africa’s recreational shore angling fishery, and its management (Brouwer et al. 1997, Mann et al. 2003). Recreational fishing in South Africa includes participation from approximately 1.32 million fishers, of which approximately half are marine, targeting mainly linefish and rock lobster (Saayman et al. 2017). The

MLRA legally recognises ‘recreational fishers’, and along South Africa’s south coast there are a number of areas where recreational fishers operate very close to shore. It is therefore assumed this sector is largely shore based and so impacts from the proposed prospecting activities on the marine ecology, as they will occur > 5 km from the coast, are not considered relevant.

2.5.6 MARICULTURE

Diamond Coast Abalone was granted a right to undertake an abalone (*Haliotis midae*) ranching operation in ranching Concession Area NC4 on the Namaqualand coast, in the vicinity of Hondeklipbaai and near to 6C (Figure 2.14). Ranching takes place in kelp beds in water predominantly shallower than 20 m, and mostly in water shallower than 5 m. Concession Area NC4 extends 40 km from Skulpfontein (30°6’8.16”S; 17°11’8.03”E) in the north to about 10 km south of Hondeklipbaai in the south (30°25’56.26”S; 17°20’5.43”E). Juvenile abalone for the ranching operation are sourced from Diamond Coast Abalone’s land-based abalone farm in Kleinzee, situated near the southern border of the NC2 ranching Concession Area. Juvenile abalone are spawned, settled, and grown-out in the land-based facility until they were of a suitable size for seeding in the wild (approximately 25–65 g = 50–70 mm shell length). The juvenile abalone are then seeded by divers into identified suitable habitat (kelp beds) in ranching Concession Area NC2. Harvesting of adult abalone is undertaken by divers in accordance with the Permit conditions.

Port Nolloth Sea Farms (Ranching) (Pty) Ltd was granted a right to undertake an abalone ranching operation in ranching Concession Area NC3 on the Namaqualand coast, south of Kleinzee (Figure 2.14). Concession Area NC3 extends from Kleinzee (29°40’43.9”S; 17°03’03.05”E) to Swartduine (30°02’52.04”S; 17°10’39.69”E) and falls within the Namaqua Inshore Ecoregion (see Section 2.2) (Sink et al. 2026).

Kleinzee Mariculture CC (previously operated by De Beers Ltd) is located at Kleinzee (29°39’46”S, 17°02’47”E) and operates a small land-based Pacific oyster (*Crassostrea gigas*) hatchery and production facility within a flooded, disused diamond mining pit. The facility historically received seawater via overflow from the adjacent Diamond Coast Abalone Farm, with intake infrastructure serving the abalone facility and outfalls located north of the oyster ponds. Current production volumes are understood to be small, although the ownership structure and operational status are uncertain. Available information indicates that the facility primarily produces oyster seed rather than market-size oysters.

Concession 6C lies approximately 5 km from these mariculture facilities (Figure 2.14). Given this distance, together with the fact that seawater abstraction and discharge occur close to shore, any temporary increases in suspended sediment concentrations associated with offshore drilling activities are not expected to affect the hatchery or production ponds.

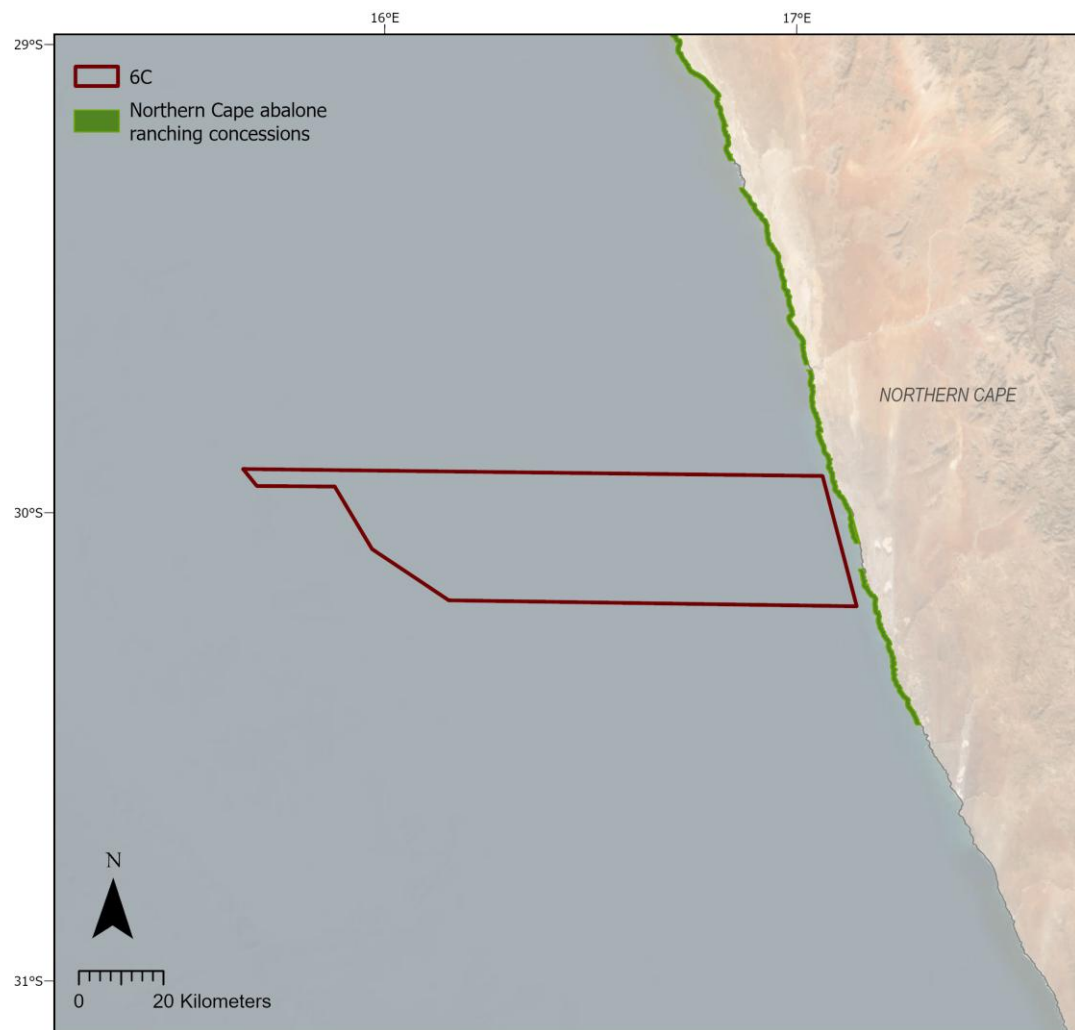


Figure 2.14 Abalone Ranching Concession Areas near to Sea Concession 6C.

3 IMPACT ASSESSMENT

3.1 INTRODUCTION

Potential impacts were identified for prospecting in Concession Area 6C and assessed in terms of their nature, extent, duration, intensity, probability of occurrence, potential for mitigation, cumulative effects and overall significance.

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 & Carter 1999, Penney et al. 2007, Pulfrich 2016, 2017, 2021, Biccard et al. 2018, Baker & 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 Environmental Management Programme (EMPr). Identified potential impacts include:

- Noise disturbance to marine fauna due to geophysical surveys and drilling/coring;
- 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 associated infaunal and epifaunal communities;
- Impact on surrounding benthos and water column via fine sediment plumes;
- Waste discharges during vessel operations;
- 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; and,
- Cumulative impacts due to combination of impacts with other overlapping activities such as shipping traffic.

To reduce negative impacts, precautions referred to as 'mitigation measures' are set and attainable mitigation actions are recommended. The proposed mitigation measures are based on international best practice mitigation hierarchy: avoid, minimise, rehabilitate/restore, offset and no-go, in that order. When project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible. If such avoidance is not attainable, the impacts must be minimised as far as possible by reducing the spatial extent (i.e., the development footprint). The next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

Measures for reducing negative impacts are classified as either:

- **Essential:** Mandatory measures that must be implemented and are non-negotiable. These measures are assumed to be implemented in the "with

mitigation” impact scenario and are therefore incorporated into the post mitigation impact assessment significance rating; or

- **Best practice/recommended:** Non-mandatory measures that should be implemented where feasible and appropriate. Alternative measures or approaches may be adopted, provided that the required environmental outcome is still achieved and a clear and defensible motivation is provided for not implementing the recommended measure. These do not affect the overall impact rating if not implemented.

3.2 ASSESSMENT OF IMPACTS

3.2.1 GEOPHYSICAL SURVEY NOISE DISTURBANCE TO MARINE RECEPTORS

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 & 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. 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.

Sounds generated by vessels in addition to the noise from geophysical surveys have been related to negative impacts on marine animals (Koper & 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 & Plön 2012). The impacts associated with acoustic surveys are not yet fully understood and further research is ongoing. 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, Finley et al. 1990, Gordon et al. 1992, Richardson & Malme 1993, Bauer et al. 1993, Maybaum 1993, McCauley 1994, Bain & Dahlheim 1994, Janik & Thompson 1996, Richardson & Würsig 1997, Gisiner 1998, Würsig et al. 1998, Lesage et al. 1999, Terhune & Verboom 1999, McCauley et al. 2000, Miller et al. 2000, Au & Green 2000, Nowacek et al. 2001b a, 2004, Erbe 2002, Leung Ng & Leung 2003). However, the potential effects of diamond prospecting on marine mammals have been reported to be minimal (Findlay 1996).

During prospecting, sounds and vibrations emanating from geophysical sampling tools only last a few days but can be intense. The source sound level of the MBES (echosounder) is variable but will be a maximum of 221 dB re 1µPa at 1 m, with a

frequency range of between 200 and 400 kHz. The sub-bottom profiler uses shallow (35 to 45 kHz) and medium penetration (1 to 10 kHz) “Chirp” acoustic pulses (this differs to airguns used in seismic surveys). 221 dB re 1 μ Pa at 1m is a high noise source in absolute terms when measured at the source. However, source level alone is not a reliable indicator of potential environmental impact, as the propagation characteristics, frequency, beam pattern, and duration of the sound must also be considered. The MBES operates at very high frequencies (200–400 kHz), substantially higher than those used in conventional seismic surveys, and emits sound in very short pulses directed towards the seabed.

Due to the high operating frequency of the MBES, sound energy is rapidly attenuated through absorption in seawater, limiting the distance over which the signal propagates. Furthermore, the acoustic energy is concentrated within narrow beams rather than being radiated broadly in all directions. As a result, the area exposed to elevated sound levels is relatively small compared to that associated with lower-frequency acoustic sources.

Although the source level of the MBES is only slightly lower than that of some seismic survey systems, the environmental implications are markedly different. Conventional airgun seismic surveys typically operate at low frequencies (generally below 100 Hz) in combination with high source levels (230–260 dB re 1 μ Pa at 1 m), and therefore produce sound that can propagate over tens to hundreds of kilometres (McCauley et al. 2000, Han et al. 2023). In contrast, the high-frequency signals generated by the MBES are more readily absorbed in the marine and therefore have a much smaller zone of influence. In general, the potential for physiological injury, including permanent hearing damage, is considered low under normal operating conditions.

The shallow Chirp component (35–45 kHz) operates at relatively high acoustic frequencies compared to most sub-bottom profiling systems. At these frequencies, sound attenuates more rapidly in seawater and sediments, resulting in a limited propagation distance. This means that the potential zone of influence is typically small and highly localised around the vessel. Any biological effects are therefore expected to be confined to short-range, temporary behavioural responses, particularly in fish or marine mammals located directly beneath or very near the survey vessel.

The medium penetration low-frequency Chirp sub-bottom profiler (typically ~1–10 kHz) is more relevant ecologically than the MBES, and it can potentially cause broader and more noticeable behavioural responses, although it still sits well below the impact levels of airgun seismic surveys. Chirp signals do overlap more with the hearing range of many marine organisms, including some fish and marine mammals (especially odontocetes, and to a lesser extent mysticetes at the very low end). Unlike the MBES, these frequencies also propagate more effectively through seawater, meaning the zone of audibility and potential disturbance is larger. In terms of effects, the most likely outcomes are still non-injurious and sublethal.

Considering the proposed geophysical surveys and the range of impacts that could occur depending on the source and the receptor, the impacts of various marine receptor groups have been assessed separately. Note, turtles are included as marine megafauna but they are not anticipated to be present in abundance within 6C and at risk from the prospecting activities, so are not formally assessed. If turtles are identified by the Marine Megafauna and Seabird observers then mitigations still apply (see below).

PLANKTON

Zooplankton and fish larvae and eggs (ichthyoplankton) cannot actively avoid the pressure from survey equipment and can be killed within a distance of less than 2 m where non-lethal injuries are possible within 5 m (Vereide et al. 2025). Given the rapid attenuation of acoustic energy with distance, the proportion of the water column (plankton habitat) affected at biologically meaningful thresholds is very small. Consequently, population-level effects are generally considered negligible (Prosnier 2024). Regional assessments of potentially more lethal seismic surveys, such as that conducted for the Disko West Area, Greenland, concluded that 3D seismic surveys were unlikely to have measurable impacts on fish recruitment at a stock level (Mosbech et al. 2007). Studies investigating the impacts of airguns (more powerful than the acoustic equipment suggested in this study) on zooplankton, found that there were no discernible negative effects on the zooplankton communities as a whole (Richardson et al. 2017, Fields et al. 2019).

The abundance and distribution of zooplankton are highly variable, reflecting seasonal production cycles and hydrodynamic processes such as upwelling. Consequently, ichthyoplankton densities in offshore environments (i.e. the project area) are typically low and spatially dispersed. Most regional fish species spawn in a temporally staggered manner, with spawning peaks occurring in winter or spring (e.g. horse mackerel in winter; sardine in early spring and autumn; hake in late winter to early spring; kingklip in August to September) (Punt & Japp 1994, Barange et al. 1998, Grote et al. 2012). In addition, ichthyoplankton in the Benguela system are not restricted to near-surface waters. Eggs and larvae are frequently distributed throughout the upper water column and are often advected offshore below the surface mixed layer. Studies suggest that eggs and larvae drift slowly though the assessment area at depths of 13–40 m, further reducing potential exposure to peak sound levels near the surface (Gibbons & Hutchings 1996). This combination of vertical and horizontal dispersion further reduces the likelihood of sustained exposure to concentrated acoustic energy or peak pressure levels.

While there is limited site-specific information on zooplankton and ichthyoplankton densities in the assessment area, available evidence suggests that densities are unlikely to be substantially higher than those reported in comparable offshore systems (Prosnier 2024). Importantly, recruitment in Benguela fish populations is driven primarily by large-scale environmental variability (e.g. upwelling intensity, transport processes, and food availability), rather than localised mortality events (Ekau et al. 2001). Due to the potential impacts being over the short term, relatively localised and the temporal overlap between spawning of key fish species and therefore reduced interaction with potential elevated densities of ichthyoplankton, it is therefore most likely that impacts of the proposed geophysical survey on planktonic communities are Very Low (Table 3.1).

Table 3.1. Geophysical survey related disturbance on plankton

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional 2	Low 1	Short term 1	Very Low 4	Probable	VERY LOW	-‘ve	Med
• No mitigation available								

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 acoustic survey noise on marine invertebrates, it has been postulated that benthic invertebrates can only hear such sounds at very close range. This implies that only surveys conducted in very shallow water will have any detrimental effects on benthic invertebrates. The impacts of the acoustic survey (as proposed for this study) on benthic communities is therefore anticipated to be negligible. The overall impact of noise disturbance to marine invertebrates is assessed to be Insignificant (Table 3.2). No mitigation is considered necessary.

Table 3.2. Geophysical survey related disturbance on benthic invertebrates

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Short term 1	Very Low 4	Possible	INSIGNIFICANT	-‘ve	Med
• No mitigation required								

FISH

The impacts of survey noise on spawning behaviour of fish have not been suitably 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 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 & Mason 2021). The lowest frequency of the chirp SBP is in the ‘mid-frequency’ (from Popper et al. (2014)) (1 kHz to 10 kHz) which is also mostly inaudible to fish (Mason 2017). Some fish species, particularly those that possess swim bladders, can suffer serious injury, but the majority of fish are highly mobile and are able to avoid acoustic noise at levels that can cause injury (seismic airguns as an example) (Mason 2017). Popper & Schilt (2008) conclude that, because the vast majority of fish exposed to acoustic survey sounds are not expected to be in close proximity to the acoustic source, they will be exposed to substantially lower sound levels owing to sound attenuation in seawater. Consequently, only a very small proportion of individuals within a population are likely to experience injury or mortality as a result of survey-generated sound. 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 noise generating survey methods. The overall noise related impact of the geophysical surveys on fish is assessed to be of Very Low risk (Table 3.3).

Table 3.3. Geophysical survey related disturbance on fish

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional 2	Low 1	Short term 1	Very Low 4	Probable	VERY LOW	-‘ve	Med
• No mitigation available								

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 may include both TTS and PTS. Such 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 acoustic surveys (including geophysical and seismic) have been conducted on the continental shelf on the west and south coasts of South Africa (Branch & Branch 2018). The scientific community have voiced their concern over the potential impacts associated with 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 dolphins and pilot whales are possible throughout the year. The timing of acoustic survey activity in Concession Area 6C 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 PTSs have been recorded (Mason 2017). Available information suggests that the animal would need to be in close proximity to operating acoustic survey equipment to suffer severe physiological injury (Koper & 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 anthropogenic elevated low frequency acoustic activities varies between species with smaller odontocetes displaying the strongest avoidance response, while the responses of medium and large odontocetes (killer whales and pilot whales) being less marked (Mason 2017). Baleen whales showed fewer responses to such survey activities than small odontocetes, but all baleen whales showed changes in behavioural responses. McCauley et al. (2000) found no obvious evidence that humpback whales were displaced by acoustic surveys and no apparent gross changes in the whale's migratory path could be linked to survey activities, although localised avoidance of survey vessel 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 survey activities, the sub-bottom profiler system which uses shallow (35-45 kHz) and medium penetration (1-10 kHz) Chirp pulses to map the sediment horizon could present a comparatively higher risk to marine mammals including 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 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 acoustic survey. Dusky dolphins (Least Concern) 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 & Mason 2021). That said, it is recommended that two Marine Mammal and Seabird Observers (MMSOs) be on duty during the proposed acoustic survey activities and as a precaution, the listed mitigation measures are followed. A passive acoustic monitoring (PAM) system must 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 acoustic survey activities in Concession Area 6C would be unlikely.

Cape fur seals *Arctocephalus pusillus pusillus* are highly mobile animals with a general foraging area covering the continental shelf (which extends approximately 220 km offshore). It is likely that seals will be encountered during prospecting activities in Concession Area 6C. 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 *Phoca hispida* showed only limited avoidance of measured seismic operations (Lee et al. 2005). In another study, ringed seals were shown to habituate to industrial noise (Blackwell et al. 2004). It is noted that these studies are on phocid seals (true seals without ears). The anticipated Cape fur seal is an otariid (eared seal). There is currently no evidence that otariids are inherently more susceptible to seismic noise than phocids, although otariids generally exhibit lower underwater hearing sensitivity to low-frequency sounds than phocid seals. Species-specific data for Cape fur seals remain limited. Southall et al. (2019)'s Marine Mammal Noise Exposure Criteria places phocids and otariids into separate hearing groups because of measured differences in underwater hearing. Compared with phocid (true) seals, otariids (fur seals and sea lions) generally exhibit lower underwater hearing sensitivity to low-frequency sounds, with hearing that is relatively more sensitive at higher frequencies.

In summary, it is likely that seals would only suffer significant injury if they were diving directly below the vessel in close proximity to such a noise source. The likelihood of this occurring is considered very low. Based on the above, impacts to marine mammals was assessed to be of Medium significance and with the implementation of mitigation (see below) this is reduced to Low significance (Table 3.4).

Table 3.4 Geophysical survey related disturbance on 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:								
- Employ a minimum of two independent, designated, appropriately qualified Marine Mammal and Seabird Observers (MMSOs) experienced in marine mammal, seabird and turtle identification to ensure compliance with mitigation measures during geophysical surveying – as per the JNCC 2017 guidelines. MMSOs shall be on duty throughout all daylight survey operations. - Where surveys are undertaken during darkness, fog or other periods of poor visibility, the survey vessel shall be equipped with Passive Acoustic Monitoring (PAM) and operated by at least two suitably trained PAM operators. - Note, the PAM operators and MMSOs can be the same individual but a minimum of two (for both PAM and MMSO) are required. - MMSOs/ PAM operators to implement the JNCC (2017) mitigation protocols before and during all geophysical survey operations. As prescribed below:								

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
	○ Monitor a 500 m mitigation zone around the acoustic source before and during surveys. ○ Undertake pre-survey visual and/or Passive Acoustic Monitoring (PAM) observations for 30 minutes in water depths <200 m and 60 minutes in water depths >200 m. PAM must supplement visual observations in deeper water to improve detection of deep-diving species. ○ Commence all applicable acoustic sources using an approved soft-start (ramp-up) procedure. Where equipment design limits conventional soft starts (e.g. certain sub-bottom profilers), the closest practicable equivalent procedure shall be adopted. ○ Delay commencement or recommencement of acoustic operations until marine mammals (and turtles) have moved beyond the 500 m mitigation zone, with a minimum 20-minute delay from the last detection before initiating the soft start, in accordance with the JNCC guidelines. ○ In accordance with the JNCC guidelines, there is no requirement to halt an ongoing survey should marine mammals or turtles enter the mitigation zone once full-power operations have commenced. ○ Record all observations of marine mammals, seabirds, turtles, seals and other notable marine fauna, including species, location, distance from the vessel, swimming direction, behaviour and any observable responses to survey activity. Seabird attraction and feeding behaviour around the survey vessel must also be recorded. ○ Suspend survey operations immediately must any injury or mortality of marine fauna be observed. ○ Prepare an MMSO survey close-out report for submission to DFFE and make marine fauna observation data and acoustic source information available, upon request, to the Marine Mammal Institute (MMI), DFFE and DMPR. ○ Maintain dedicated visual watches for marine fauna during all vessel operations. ● “Soft starts” must 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 must 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 geophysical surveys during the movement of migratory cetaceans (i.e., humpback and southern right whales) from their feeding grounds into low latitude waters (i.e., winter - beginning of June to end of November) and ensure that migration paths are not blocked by acoustic survey operations.							
With mitigation	Regional 2	High 3	Short term 1	Medium 6	Possible	LOW	-ve	Medium

Desired impact management outcome to be achieved: To avoid injury to marine mammals and ensure that any disturbance arising from geophysical survey activities is limited to short-term, localised and reversible behavioural effects, with limited significant interference with migration, feeding, or breeding behaviours, and no measurable population-level impacts.

SEABIRDS

As with other vertebrates, the assessment of indirect effects of acoustic surveys on diving seabirds is limited by the complexity of trophic pathways in the marine environment (Mason 2017). Impacts of Chirp pulses to marine birds (diving or resting on water surface) include physiological injury, behavioural avoidance of acoustic survey areas and indirect impacts due to effects on prey. The Critically Endangered African Penguin *Spheniscus demersus* is particularly susceptible to impacts from underwater noise. Due to the continuous nature of the intermittent 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. (2017) who have shown that feeding

areas within 50 km of acoustic (seismic in the case of the research discussed) 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 acoustic 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 Area 6C include the Cape Cormorant, and various terns and gull species. Pelagic seabirds such as albatross, petrels and shearwaters are likely to be encountered in the offshore waters of 6C and may also be impacted.

The overall impact is assessed to be of Low risk and with the implementation of mitigation (see below) is reduced to Very Low (Table 3.5).

Table 3.5 Geophysical survey related disturbance on seabirds

	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: - Designated onboard Marine Mammal and Seabird Observers (MMSOs) to ensure compliance with mitigation measures during geophysical surveying – as per the JNCC 2017 guidelines. More detail presented in report conclusions. - If spotted wait until all seabirds have cleared an area of 500 m radius (mitigation zone) of the centre of the emanating noise source before resuming with acoustic survey (initiate soft start procedure when resuming geophysical surveys). - 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 seabirds, their behaviour and response to survey activity. - Suspend operations if any obvious mortalities or injuries to seabirds are observed.								
With mitigation	Regional 2	High 3	Short term 1	Medium 6	Possible	LOW	-ve	Medium

Desired impact management outcome to be achieved: To avoid injury and mortality of seabirds, and to ensure that any disturbance associated with geophysical survey operations is limited to short-term, localised and reversible behavioural effects only, with no significant ecological or population-level consequences.

3.2.2 IMPACTS OF CORE AND DRILL SAMPLING NOISE ON MARINE FAUNA

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 during **Phase 1 and 2**. 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. Overall, the sampling will affect a total surface area of about 1.57 m² and yielding approximately 4.71 m³ of material in total (details are provided in Section 1.3). There is no planned

release or spillage of material into the ocean during sampling, as the material remains intact within the core tube and is brought back to the vessel for secure storage. Collecting around 200 cores will take approximately 10 working days. Exact sampling locations will be determined using results from geophysical surveys and recommendations from this marine ecology specialist study. This information is then used to engineer a drilling like tool (used for Phase 3 of the prospecting activities – see below - and by the future mining vessel). Prospective target areas will be investigated using a specially designed drilling tool that can collect gravel and other seabed materials.

All three coring methods generate non-impulsive sound. While this sound may still contribute to underwater noise and result in behavioural disturbance or acoustic masking for marine fauna, it is generally considered to have lower ecological impacts than impulsive sound because it lacks the high peak pressures and rapid rise times associated with impulsive noise sources (Lenchine 2023). In general, studies have found that coring is less likely to induce hearing damage in marine mammals than hammering noises (Huang et al. 2023). Furthermore, due to the small (10 cm) core diameter of these sampling methods, relatively low levels of energy would be required to undertake this drilling, and noise levels are not expected to be intense (see details in Section 1.3). Sonic coring/drilling is anticipated to produce non-impulsive noise of a source level of 189 dB SPL, across 50–16 000 Hz (MMRPS 2015), with another study reporting 50-200 Hz (Sun et al. 2017). Noise modelling of a survey conducted in the Irish Sea found that exceedance of TTS for VHF cetaceans was up to 600 m, and less than 240 m distance for other hearing groups (MMRPS 2015).

For the **Phase 3 drilling** prospective target areas will be investigated using a specially designed drilling tool to collect gravel and other seabed materials. Depending on the final tool design, the drill will impact an area of approximately 3 to 5 m² per sample. A total of 300 drilling samples may be collected over approximately 10 days, excluding potential weather delays (see details in Section 1.3).

Considering the relatively low source levels associated with coring and drilling activities, the non-impulsive nature of the sound produced, and the limited duration and spatial extent of Phase 2 operations, the overall significance of acoustic disturbance to marine fauna is rated as Very Low. While some temporary behavioural responses may occur in acoustically sensitive species within the immediate vicinity of the operations, significant impacts are not anticipated. The zone of potential disturbance is expected to remain relatively localised around active sampling sites, with effects limited to the duration of the activity and rapidly reversible following its cessation.

Overall, the noise-related impacts associated with geotechnical sampling and resource evaluation drilling are anticipated to be of local extent, medium magnitude and short duration, resulting in a Very Low overall significance (Table 3.6). However, to apply precaution, mitigation measures are recommended.

Table 3.6. Impacts of Phase 2 coring and drilling noise on marine receptors.

	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

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Essential mitigation measures:								
- MMSOs /PAM operators to undertake JNCC mitigation measures as stated above for acoustic surveys. Once drilling can go ahead, soft starts must be employed. - The quietest drilling method possible must be employed.								
With mitigation	Local 1	Low 1	Short-term 1	Very Low 3	Probable	VERY LOW	-ve	Medium

If follow-up results indicate a potentially viable resource, a more detailed phase of resource evaluation would be undertaken (Phase 3, see Section 1.3). It will result in a total disturbed area of about 6 000 m² (based on a 5 m² drill footprint) over approximately 40 days. These impacts have been assessed separately, with a higher intensity and greater extent of impacts anticipated (Table 3.7).

Table 3.7 Impacts of Phase 3 coring and drilling noise on marine receptors.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional 2	Medium 2	Short term 1	Low 5	Probable	LOW	-ve	Medium
Essential mitigation measures:								
Same Table 3.6 as above.								
Recommended mitigation:								
Limit drilling footprint where at all possible.								
With mitigation	Local 1	Low 1	Short-term 1	Very Low 3	Probable	VERY LOW	-ve	Medium

Desired impact management outcome to be achieved: To ensure that noise generated by coring and drilling activities does not result in injury or significant disturbance to marine fauna, and that any behavioural responses are temporary, localised and fully reversible, with no measurable population-level effects.

3.2.3 DIRECT BENTHIC IMPACTS ASSOCIATED WITH PROSPECTING ACTIVITIES (ALL PHASES)

As part of **Phase 2**, approximately 100–200 sites will be core sampled in Concession Area 6C using either vibracoring, gravity coring or sonic coring techniques. The 200 cores will cover a total surface area of 1.57 m², although the core might impact a surface area slightly larger than this. In addition to this, prospective targets will be analysed by a uniquely designed drill tool that can dredge gravel from the seabed. A Van Veen grab will be used to collect baseline environmental data on sediments and benthic macrofauna at between 20 and 50 sampling sites. The sampling programme will disturb a total seabed area of approximately 5 m² and will result in the collection of approximately 1.5 m³ of sediment. In **Phase 3**, approximately 1 200 additional samples will be collected covering a total disturbed area of about 6 000 m².

The material brought to the surface will be processed onboard a vessel using a processing plant, and the remaining fine material (tailings) will be discharged back into the sea. This can result in temporary sediment plumes in the water column and sediment being deposited on the seabed surface. The formation and persistence of these sediment

plumes depend mainly on the size of the particles and the prevailing ocean conditions. Coarser material such as sand settles quickly and produces short-lived plumes, while finer muddy sediments can remain suspended for longer periods.

Overall, the total seabed area disturbed across Phases 1, 2, and 3 is estimated at approximately 7 507 m² (0.75 ha / 0.007507 km²). This represents a small proportion (0.0002 %) of the total Concession Area 6C (~346 000 ha/ 3 500 km²).

Impacts from sampling are likely to result in localised removal of benthic organisms and their habitat within the footprint of the sampling tool, which due to the relatively small size of the various coring tools, is expected to be virtually negligible. However, the impacts from Phase 2 drill sampling are expected to be more extensive (total area affected is approximately 1500 m² initially and potentially rising to an additional 6 000 m². Impacts associated include direct habitat loss and smothering of the benthos adjacent to sampling sites associated with localised tailings discard. The samples are discrete (not contiguous), and as a result, recolonisation from adjacent undisturbed areas is possible (based on understanding of habitats along the continental shelf in similar, adjacent areas). Considering the available area of similar habitat on the continental shelf of the West Coast, the reduction in benthic biodiversity through sediment removal can be considered relatively low.

The impact on the offshore benthos as a result of the cumulative removal of sediments from sampling is considered to be of medium intensity at a local scale (i.e. the sampling location only, plus slight surrounds for tailings disposal). 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. 2020). Hence, recovery times greatly increase with depth and distance from sources of sedimentation (limited terrigenous input due to lack of nearby estuarine/riverine systems).

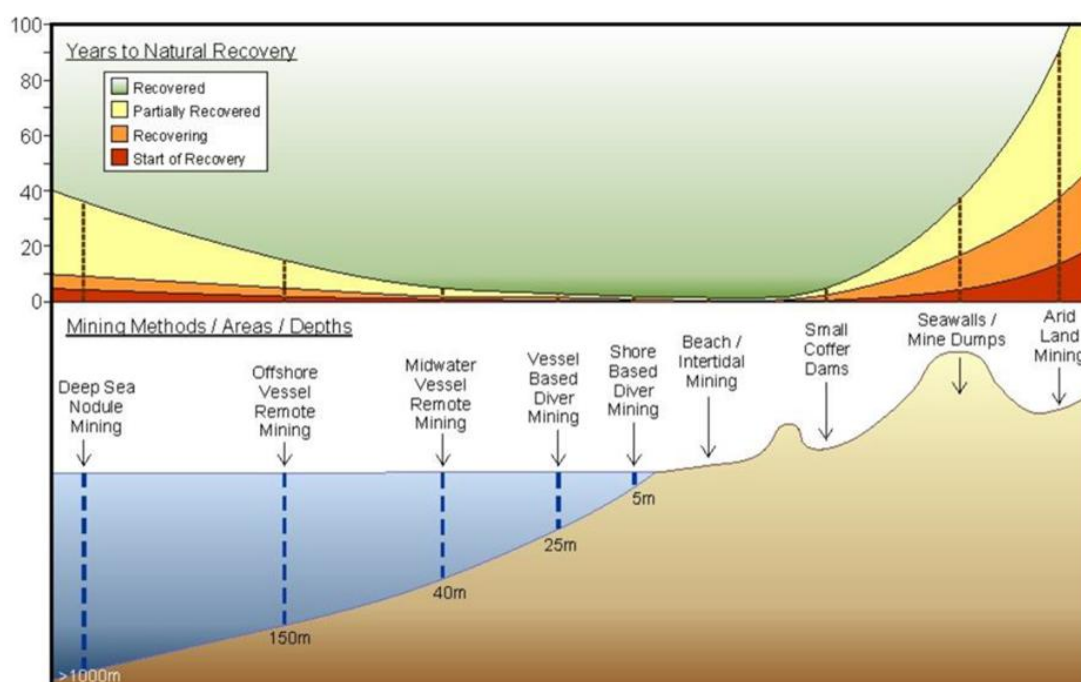


Figure 3.1 Maximum times to various stages of natural recovery (still impacted, recovering, partially recovered and recovered) reported in the literature for various local studies of marine mining, and relevant international studies on other seabed disturbances (Penney et al. 2007).

It is possible to implement careful planning and management of potential discharges to ensure that tailings are not discarded onto sensitive habitat (Penney et al. 2007, Pulfrich 2017). To this end, CBA Natural Areas should be avoided to avoid impacts of prospecting activities (direct and indirect) on the 'Natural' habitat. This is part of the mitigation hierarchy adopted by industry leaders. The assessment of benthic habitat impacts is based on the best available regional datasets, including detailed continental shelf habitat mapping and the current understanding of soft-sediment benthic ecosystems along the West Coast. However, as no site-specific benthic survey data are currently available for Concession 6C, some uncertainty remains regarding the fine-scale distribution of benthic communities within the licence area. Consequently, the confidence in the impact assessment has been rated as medium (Table 3.8). Nevertheless, given the generally good understanding of continental shelf soft-sediment habitats in the region, the broad habitat mapping available, and the commitment to avoid mapped CBA Natural areas, the assumptions underpinning this assessment are considered reasonable and sufficiently precautionary.

Considering the forecasted area of impact, across all phases with mitigation, this impact is rated to be of Low significance (Table 3.8).

Table 3.8 Direct benthic impacts associated with prospecting activities (all phases)

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	High 3	Medium term 2	Medium 6	Definite	MEDIUM	-ve	Med
Essential mitigation:								

Extent Intensity Duration Consequence Probability Significance Status Confidence								
• A pre-survey verification of sensitive marine habitats before intrusive sampling is mandatory. • Exclusion buffer zones must be implemented around sensitive habitats identified during geophysical surveys. The recommended exclusion buffer zone is 500 m. • All sensitive benthic habitats identified during geophysical surveys should be avoided, including exclusion zone buffers (500 m recommended) around such habitats. • The CBA Natural area must be clearly demarcated as a no-go area and be excluded from the prospecting footprint entirely, prior to prospecting. No prospecting may occur in the CBA. • Planning and management of potential discharges to ensure that tailings are not discarded onto potentially sensitive habitats. • Information gathered during all seabed sampling, reef identification and seabed video/camera assessments must be made available in a usable, geo-referenced format to the South African government (DFFE) and SANBI to inform future Marine Spatial Planning and confirmation of CBA status.								
With mitigation	Local 1	Medium 2	Short term 2	Low 5	Definite	LOW	-ve	Med

Desired impact management outcome to be achieved: To ensure that seabed sampling, drilling and tailings disposal result only in localised and temporary disturbance to benthic habitats, with sensitive habitats avoided wherever possible, no significant impacts on biodiversity features of concern, and no long-term loss of benthic ecosystem structure or function.

3.2.4 MARINE MEGAFaUNA COLLISIONS WITH SURVEY VESSELS

Additional vessel time at sea increases risk of survey vessel interactions with marine megafauna such as whales and turtles— an 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 rock lobster traps and long lines (Meÿer 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 6C 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 (see Section 2.3.2). Dusky dolphins, Heaviside's dolphins and pilot whales are also possible throughout the year.

While the intensity of the impact is considered high for the individual affected animal and medium for the population as a whole, the number of marine fauna expected to be encountered during the limited time that the survey vessel is active is expected to be low. As such, 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 (Table 3.9).

Table 3.9. Marine megafauna collisions with survey vessels.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	High 3	Short-term 1	Low 5	Possible	VERY LOW	-ve	High

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Essential mitigation measures:								
	- Designated onboard Marine Mammal and Seabird Observers (MMSOs) and vessel operator to keep watch for marine megafauna in the path of the vessel during all daylight vessel operations, including geophysical surveying. - If surveys are to be undertaken at night, the vessel must be fitted with Passive Acoustic Monitoring (PAM) technology and employs at least two PAM operators. Utilise PAM technology when surveying at night or during adverse weather conditions and thick fog (commonly encountered on the west coast of South Africa), throughout the year. Note, the PAM operators and MMSOs can be the same individual but a minimum of two (for both PAM and MMSO) are required. - Vessel transit speed to not exceed 12 knots (22 km/hr), except within 25 km of the coast where it must be kept to less than 10 knots (18 km/hr) as well as when sensitive marine fauna are present in the vicinity.							
With mitigation	Local 1	High 3	Short term 1	Low 4	Improbable	VERY LOW	-ve	High

Desired impact management outcome to be achieved: To avoid injury/mortality of marine megafauna from vessel strikes.

3.2.5 INDIRECT IMPACTS ASSOCIATED WITH TAILINGS DISCHARGE AND 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 (See Section 3.2.3). These plumes can affect light penetration through the water column and can adversely affect phytoplankton productivity in the water column (Johnston 1981, Poopech 1982, Kirk 1985, Parsons et al. 1986a b, O'Toole 1997, Monteiro 1998, 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 (Wilber & Clarke 2001). Although these plumes differ in intensity and timing from natural background conditions, marine communities in the muddy shelf areas of the Benguela 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) (Poopech 1982, Hitchcock & Drucker 1996, Shillington & Probyn 1996, CSIR 1998, Carter & 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 (Whiteside et al. 1995).

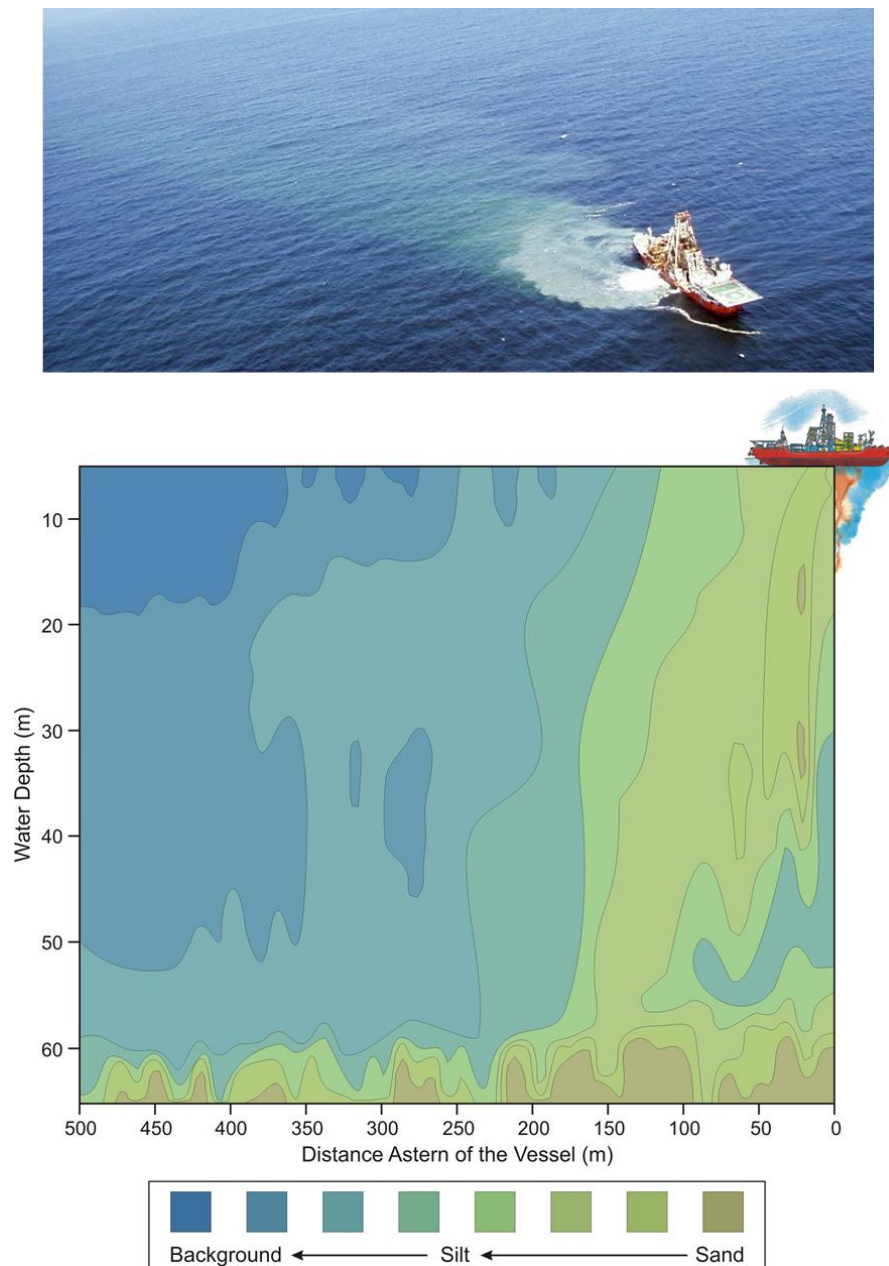


Figure 3.2. An example of suspended sediment plume from the MV Grand Banks operational in the Atlantic 1 MLA (Top). Acoustic Doppler Current Profiler (ADCP) longitudinal section along a tailings plume astern of a marine diamond mining vessel off southern Namibia, showing the depth and distance distribution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

Sampling activities in 6C 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 in this project are relatively small and hence impacts on the environment are expected to be of Very Low significance (Table 3.10). No

direct mitigation is feasible as tailings disposal is an integral part of this sampling method.

Table 3.10. Indirect impacts associated with tailings discharge and fine sediment plumes

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Medium 2	Short-term 1	Low 4	Definite	LOW	-ve	High
Essential mitigation: When planning where to undertake seabed sampling, sites outside of CBA: Natural areas, EBSAs and otherwise previously identified sensitive habitats must be prioritised.								
Without mitigation	Local 1	Low 1	Short-term 1	Very low 3	Probable	VERY LOW	-ve	High

3.2.6 WASTE DISCHARGES DURING VESSEL OPERATIONS

Water quality in the vicinity of survey 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.

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 biodegradation of the type of waste. Solid wastes (e.g. plastics, scrap metals) may take decades or centuries to degrade. Strict waste management plans must 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.

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 must not be less than 5 m below the surface.

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 & Coleman 1983). Large numbers of marine organisms, including fish, birds 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 & Yoshida 1985). All reasonable measures must be implemented to ensure

that no littering takes place during installation, operation and closure of oil and gas production facilities.

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 m³ (Pulfrich 2015). This volume is not expected to be exceeded for exploration and prospecting activities in Concession Area 6C.

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 would be collected with the deck drainage and treated as described above.

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 would be tested prior to discharge and would 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 3.11).

Table 3.11. 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
Essential Mitigation measures:								
• Inform & empower all staff about sensitive marine species & suitable disposal of waste; • Ensure compliance with relevant MARPOL standards; • A Shipboard Oil Pollution Emergency Plan (SOPEP) must be prepared for all vessels and must be in place at all times during operations; • Deck drainage must be routed to a separate drainage system (oily water catchment system) for treatment to ensure compliance with MARPOL (15 ppm); • All hydraulic systems must be adequately maintained and hydraulic hoses must be frequently inspected; • Spill management training and awareness must be provided to crew members 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 • The prospecting vessel must maintain a certified oil spill contingency plan with rapid-response containment equipment optimized for high-energy nearshore environments to ensure zero hydrocarbon or hazardous waste entry into the surf zones where these facilities source their production water.								
Recommended mitigation:								

Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
- Develop a waste management plan using waste hierarchy; - 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.							
With mitigation	Local 1	Low 1	Short term 1	Very low 3	Improbable	INSIGNIFICANT	-ve High

Desired impact management outcome to be achieved: To ensure that prospecting activities do not result in pollution of the marine environment, such that impacts on water quality, marine habitats and marine fauna remain negligible and no long-term environmental contamination occurs.

3.2.7 IMPACTS ON FISHERIES

According to the International Regulations for Preventing Collisions at Sea (COLREGS 1972), vessels engaged in geophysical surveys are recognised as vessels limited in their ability to manoeuvre and as such, vessels engaged in other activities (such as fishing) are obliged to give way. Furthermore, the implementation of a safety (exclusion) zone around the survey 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 acoustic survey activities and interference with shipping could have (indirect) socio-economic implications for the affected industries. Fisheries might be affected by target species avoiding survey areas for several days after the survey has terminated or the vessel has moved on (Mason 2017).

Fisheries sectors operating within Concession Area 6C that could be impacted include those listed in Section 2.5. Given the limited spatial overlaps, the catches from these sectors made within the Concession Area 6C are all of limited significance as a proportion of the national total catch of each of these fisheries. Furthermore, the remote, offshore location of the 6C Concession Area (north and offshore of the nearest coastal fishing community at Hondeklipbaai and with a landward boundary 5 km offshore) means that impacts on local small-scale fishers due to prospecting in this concession area will not occur. Overall, the impact is assessed to be Insignificant and recommended Best Practice would be to inform key stakeholders from the potentially affected sectors (Table 3.12).

Table 3.12. Impacts on fisheries.

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:							

Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Prior to survey commencement, key stakeholders (see below) should be consulted and informed of the proposed survey activity and the likely implications thereof.							

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), the 'operational alert protocol', and the likely implications thereof:

- Fishing industry / associations (contactable via liaison@fishsa.org):
 - SA Marine Linefish Management Association (SAMLMA);
 - South African Tuna Association (SATA);
 - South African Tuna Longline Association (SATLA);
 - Mariculture farm operators.
 - Large Pelagic Small Medium & Micro Enterprises Association (LPSMME); and
 - 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.

3.3 CUMULATIVE IMPACTS

Anthropogenic activities can result in numerous and complex effects on the natural environment. While many of these are direct and immediate, the environmental effects of individual activities or projects can interact with each other in time and space to cause incremental or aggregate effects. Impacts from unrelated activities may accumulate or interact to cause additional effects that may not be apparent when assessing the activities individually. Cumulative effects are defined as the total impact that a series of developments, either present, past or future, will have on the environment within a specific region over a particular period of time (DEAT 2004).

Marine mining is a well-established industry along the west coast of South Africa between St Helena Bay and the Orange River mouth (Figure 3.3). 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 3.3). These concessions (and the activities therein) are largely extracting diamondiferous gravels.

There are also offshore oil and gas production and prospecting licenses with additional exploration applications currently underway (Figure 3.3). The prospecting and exploration methods for oil and gas exploration (acoustic surveys (sometimes seismic) 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.

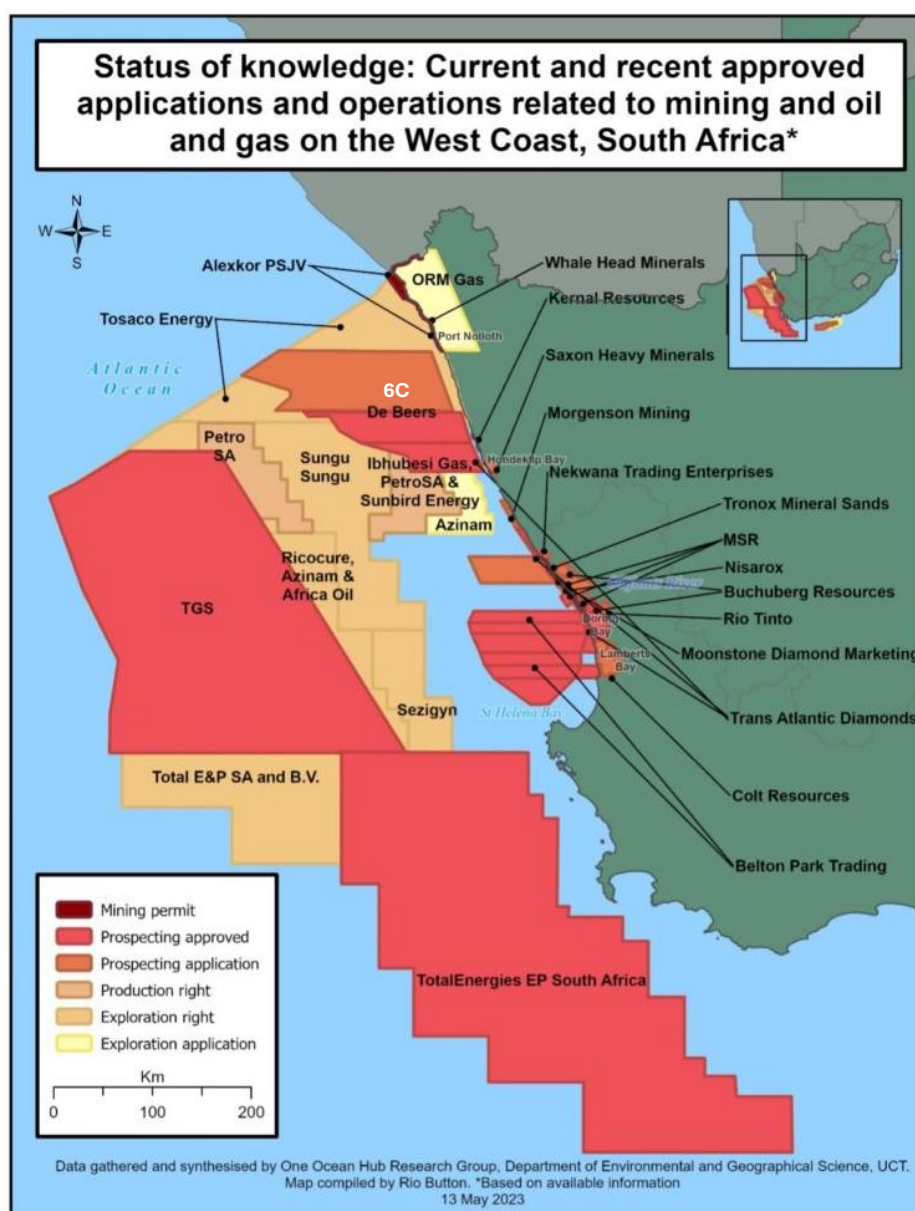


Figure 3.3. Extent of prospecting and mining applications and operations along South Africa's West Coast (Source: Sowman et al. (2023)). 6C labelled in white.

There has been a recent increase in applications for offshore diamond prospecting rights along South Africa's west coast, indicating that marine prospecting activity is likely to increase over the short to medium term. In addition to the proposed activities within Concession Area 6C, prospecting rights have already been approved for the adjacent Concession Area 7C to the north (Trans Atlantic Diamonds) and Concession Areas 4C

and 5C to the south (De Beers Consolidated Mines). These projects include similar prospecting methodologies, comprising geophysical (acoustic) surveys, grab sampling, coring and drilling. Should these programmes be undertaken over similar timeframes, there is potential for cumulative environmental effects across a broader regional area. Nevertheless, it is reasonable to conclude that if prospecting activities within Concession Areas 5C, 6C and 7C were undertaken concurrently, cumulative impacts would primarily result from an increase in the spatial extent and duration of otherwise localised impacts, rather than an increase in impact intensity. Consequently, impacts assessed as local and short-term for an individual prospecting programme could become regional in extent and medium-term in duration where multiple surveys occur simultaneously.

The principal cumulative ecological consideration is underwater noise associated with geophysical surveys. Concurrent acoustic surveys in adjacent concession areas could increase the spatial footprint and duration of acoustic exposure experienced by marine mammals, turtles and certain fish species. However, prospecting surveys are temporary, mobile and intermittent, and most sensitive marine fauna exhibit behavioural avoidance of approaching survey vessels. Provided that internationally recognised mitigation measures, including the JNCC (2017) guidelines, are implemented consistently across all prospecting operations, cumulative acoustic impacts are expected to remain of low significance, although marine mammals remain the most sensitive receptor group. Similarly, cumulative physical disturbance of the seabed from grab sampling, coring and limited drilling would remain highly localised. The total seabed footprint associated with prospecting is negligible when compared with historical and active diamond mining operations on the west coast. Localised sediment plumes generated during sampling are expected to disperse rapidly under the high-energy oceanographic conditions characteristic of the region and would only potentially become ecologically significant if multiple prospecting campaigns repeatedly sampled the same sensitive habitats over a short period (even then, the ecological risk remains low considering both the spatial scale of the Concession Area and then proposed activities to occur within them). At present, there is no evidence that such spatial or temporal overlap is planned.

Potential cumulative impacts on commercial fisheries are also expected to remain low. Prospecting vessels occupy relatively small operational areas for short periods and are readily avoided by fishing vessels through normal communication and operational planning. Engagement with fisheries stakeholders and coordination of survey timing would further minimise the likelihood of cumulative disruption to fishing activities.

While the proposed prospecting programme will contribute incrementally to cumulative environmental pressures within the west coast offshore diamond province, the contribution of Concession Area 6C is expected to be small relative to existing and historic marine mining activities. The project does not introduce a new impact pathway but rather contributes marginally to existing regional pressures. Consequently, cumulative impacts associated with the proposed prospecting programme are considered to be of Medium negative significance, although confidence in this assessment remains low owing to uncertainty regarding the timing, extent and intensity of future prospecting and mining activities within adjacent concession areas (Table 4.2). A revised strategic level Environmental Impact Assessment to assess cumulative impacts would increase this 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).

Suggested monitoring: Annual benthic biodiversity monitoring must be undertaken to assess changes in ecological conditions and determine whether cumulative impacts are increasing over time, enabling the timely implementation of additional mitigation measures where required.

4 CONCLUSIONS AND RECOMMENDATIONS

The proposed diamond prospecting programme within Concession Area 6C has the potential to result in a number of temporary and localised impacts associated with geophysical surveying, seabed sampling and vessel operations. Assessment of these impacts indicates that, prior to mitigation, significance ranges from Medium Negative to Insignificant. With implementation of the recommended mitigation measures, all impacts are reduced to Low, Very Low or Insignificant significance (Table 4.1).

The impact of greatest concern is the potential disturbance of marine mammals arising from underwater noise generated during geophysical surveys. The west coast of South Africa supports seasonally important populations of migrating humpback and southern right whales, while odontocetes such as dusky dolphins and Heaviside's dolphins may occur throughout the year. Of the proposed acoustic equipment, the chirp sub-bottom profiler (operating primarily between approximately 1 and 45 kHz) presents the greatest potential for interaction with mid-frequency cetaceans. However, provided recognised international mitigation measures are implemented, the residual impact is expected to be of low significance (Table 4.1).

Concession Area 6C also overlaps areas identified as Critical Biodiversity Areas (CBA: Natural) and may contain additional sensitive benthic habitats. Consequently, survey planning must prioritise avoidance of these areas wherever practicable, with seabed sampling undertaken only after habitat verification where avoidance is not possible.

Overall, the proposed prospecting programme is not considered to present a fatal flaw from a marine ecological perspective. Subject to implementation of the mitigation measures outlined below, the project is considered acceptable.

4.1 ESSENTIAL MITIGATION MEASURES

Marine mammal and seabird protection

The Joint Nature Conservation Committee (JNCC (2017)) Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys represent international best practice and shall be implemented throughout all geophysical survey operations. The following measures are consistent with the JNCC guidelines, together with recommendations by Mason (2017) and Koper and Plön (2012):

- Employ a minimum of two independent, designated, appropriately qualified Marine Mammal and Seabird Observers (MMSOs) experienced in marine mammal, seabird and turtle identification, to ensure compliance with mitigation measures during geophysical surveying – as per the JNCC 2017 guidelines. MMSOs shall be on duty throughout all daylight survey operations.
- Where surveys are undertaken during darkness, fog or other periods of poor visibility, the survey vessel shall be equipped with Passive Acoustic Monitoring (PAM) and operated by at least two suitably trained PAM operators.
 - Note, the PAM operators and MMSOs can be the same individual but a minimum of two (for both PAM and MMSO) are required.

- MMSOs/ PAM operators to implement the JNCC (2017) mitigation protocols before and during all geophysical survey operations. As prescribed below.
- Monitor a 500 m mitigation zone around the acoustic source before and during surveys.
- Undertake pre-survey visual and/or Passive Acoustic Monitoring (PAM) observations for 30 minutes in water depths <200 m and 60 minutes in water depths >200 m. PAM must supplement visual observations in deeper water to improve detection of deep-diving species.
- Commence all applicable acoustic sources using an approved soft-start (ramp-up) procedure. Where equipment design limits conventional soft starts (e.g. certain sub-bottom profilers), the closest practicable equivalent procedure shall be adopted.
- Delay commencement or recommencement of acoustic operations until marine mammals, turtles and diving seabirds have moved beyond the 500 m mitigation zone, with a minimum 20-minute delay from the last detection before initiating the soft start, in accordance with the JNCC guidelines.
- In accordance with the JNCC guidelines, there is no requirement to halt an ongoing survey should marine mammals, turtles or diving seabirds enter the mitigation zone once full-power operations have commenced.
- Record all observations of marine mammals, seabirds, turtles, seals and other notable marine fauna, including species, location, distance from the vessel, swimming direction, behaviour and any observable responses to survey activity. Seabird attraction and feeding behaviour around the survey vessel must also be recorded.
- Suspend survey operations immediately must any injury or mortality of marine fauna be observed.
- Prepare an MMSO survey close-out report for submission to DFFE and make marine fauna observation data and acoustic source information available, upon request, to the Marine Mammal Institute (MMI), DFFE and DMPR.
- Maintain dedicated visual watches for marine fauna during all vessel operations.

Survey timing and vessel operations

- Where practicable, avoid scheduling geophysical surveys during the peak migration period of baleen whales (i.e. southern right whales and humpback whales) (approximately June to November).
- Maintain vessel speeds below 12 knots offshore and below 10 knots within 25 km of the coast, with further speed reductions where marine megafauna are present.
- Consult with key marine stakeholders, including the fishing industry, prior to commencement of survey activities.

Benthic habitat protection

- A pre-survey verification of sensitive marine habitats before intrusive sampling is mandatory.
- Exclusion buffer zones must be implemented around sensitive habitats identified during geophysical surveys. The recommended exclusion buffer zone is 500 m.
- All sensitive benthic habitats identified during geophysical surveys should be avoided, including exclusion zone buffers (500 m recommended) around such habitats.

- The CBA Natural area must be clearly demarcated as a no-go area and be excluded from the prospecting footprint entirely, prior to prospecting. No prospecting may occur in the CBA.
- Dispose of sampled sediments only in areas demonstrated to be of low ecological sensitivity.
- Make any generated seabed imagery, habitat mapping and survey information available to DFFE and SANBI in a usable, geo-referenced format to improve future marine spatial planning, biodiversity mapping and refinement of Critical Biodiversity Areas.

Pollution prevention

- Ensure full compliance with applicable MARPOL requirements.
- Maintain a current Shipboard Oil Pollution Emergency Plan (SOPEP) and appropriate spill-response equipment onboard.
- Route deck drainage through oily-water treatment systems and ensure hydraulic systems are regularly maintained and inspected.
- Provide spill response training to all crew members and ensure immediate clean-up of accidental spills.
- Maintain an oil spill contingency capability appropriate for the high-energy west coast environment to minimise the risk of hydrocarbon contamination of coastal waters.

Collectively, these mitigation measures reduce the predicted environmental risks associated with the proposed prospecting programme to acceptable levels and support the conclusion that the project is environmentally acceptable from a marine ecological perspective. Table 4.1 summarises the significance ratings before and after mitigation.

4.2 SUGGESTED MONITORING

Annual benthic biodiversity monitoring must be undertaken to assess changes in ecological conditions and determine whether cumulative impacts are increasing over time, enabling the timely implementation of additional mitigation measures where required.

4.3 IMPACT ASSESSMENT SUMMARY

Table 4.1 Summary of potential marine ecological and fisheries impacts associated with diamond prospecting activities in South African Sea Area Concession Area 6C.

Impact	Extent	Intensity	Duration	Consequence	Probability	Significance	+/-	Reversibility	Degree impact can be avoided	Degree impact can be managed	Degree impact can be mitigated
MARINE ECOLOGY											
Impact 1a: Geophysical survey noise disturbance to plankton	Regional	Low	Short term	Very Low	Probable	VERY LOW	-ve	Reversible	Cannot be fully avoided	Not manageable	No mitigation needed/ possible
No mitigation available											
Impact 1b: Geophysical survey noise disturbance to benthic invertebrates	Local	Low	Short term	Very Low	Possible	INSIGNIFICANT	-ve	Reversible	Cannot be fully avoided	Not manageable	No mitigation needed/ possible
No mitigation available											
Impact 1c: Geophysical survey noise disturbance to marine fish	Regional	Low	Short term	Very Low	Probable	VERY LOW	-ve	Reversible	Cannot be fully avoided	Not manageable	No mitigation needed/ possible
No mitigation available											
Impact 1d: Geophysical survey noise disturbance to marine mammals	Regional	High	Short term	Medium	Probable	MEDIUM	-ve	Reversible	Can be partially avoided	Can be managed	n/a
With mitigation	Regional	High	Short term	Medium	Possible	LOW	-ve				Moderately effective
Impact 1e: Geophysical survey noise disturbance to seabirds	Regional	High	Short term	Medium	Probable	MEDIUM	-ve	Reversible	Can be partially avoided	Can be managed	n/a

Impact	Extent	Intensity	Duration	Consequence	Probability	Significance	+/-	Reversibility	Degree impact can be avoided	Degree impact can be managed	Degree impact can be mitigated
<i>With mitigation</i>	Regional	High	Short term	Medium	Possible	LOW	-ve				Moderately effective
Impact 2a: Impacts of Phase 2 coring and drilling noise on marine receptors.	Local	Medium	Short term	Very Low	Probable	VERY LOW	-ve	Reversible	Can be partially avoided	Can be managed	n/a
<i>With mitigation</i>	Local	Low	Short term	Very Low	Probable	VERY LOW	-ve				Moderately effective
Impact 2b: Impacts of Phase 3 coring and drilling noise on marine receptors.	Regional	Medium	Short term	Low	Probable	LOW	-ve	Reversible	Can be partially avoided	Can be managed	n/a
<i>With mitigation</i>	Local	Low	Short term	Very Low	Probable	VERY LOW	-ve				Moderately effective
Impact 3: Benthic impacts associated with prospecting activities (all phases)	Local	High	Medium term	Medium	Definite	MEDIUM	-ve	Reversible	Can be partially avoided	Can be managed	n/a
<i>With mitigation</i>	Local	Medium	Short term	Low	Definite	LOW	-ve				Moderately effective
Impact 4: Marine megafauna collisions with survey vessels.	Local	High	Short term	Low	Possible	VERY LOW	-ve	Reversible	Can be partially avoided	Can be managed	n/a
<i>With mitigation</i>	Local	High	Short term	Low	Improbable	VERY LOW	-ve				Moderately effective
Impact 5: Indirect impacts associated with tailings discharge and fine sediment plumes	Local	Medium	Short term	Low	Definite	LOW	-ve	Reversible	Can be partially avoided	Can be managed	n/a
<i>With mitigation</i>	Local	Low	Short term	Very low	Probable	VERY LOW	-ve				Moderately effective
Impact 6: Waste discharge during vessel operation.	Local	Low	Medium term	Very low	Probable	VERY LOW	-ve	Reversible		Can be managed	n/a

Impact	Extent	Intensity	Duration	Consequence	Probability	Significance	+/-	Reversibility	Degree impact can be avoided	Degree impact can be managed	Degree impact can be mitigated
<i>With mitigation</i>	Local	Low	Short term	Very low	Improbable	INSIGNIFICANT	-ve		Can be partially avoided		Moderately effective
Impact 7: Impacts on fisheries	Local	Medium	Short term	Very Low	Possible	INSIGNIFICANT	-ve	Reversible	Cannot be fully avoided	Not manageable	No mitigation needed/ possible
<i>No mitigation required</i>											

Table 4.2 Potential cumulative impacts associated with prospecting activities in Concession Area 6C identified during the marine ecology and fisheries assessment.

Impact	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Reversibility	Degree impact can be avoided	Degree impact can be managed:	Degree impact can be mitigated:
MARINE ECOLOGY											
Cumulative impacts	Regional	Medium	Medium term	Medium	Probable	MEDIUM	-ve	Reversible	Can be partially avoided	Can be partially managed	Moderately effective

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6 APPENDICES

APPENDIX I: IMPACT ASSESSMENT METHODOLOGY

The impact assessment methodology set out below is applied to all potential positive and negative direct impacts associated with the construction, operational, and decommissioning phases of the proposed project, as well as cumulative impacts and the no-go alternative. Indirect impacts are only considered where relevant and can be assessed qualitatively or using the formal impact assessment methodology described below.

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 Saldanha Bay 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

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

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

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

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

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 and achieve the management outcome.

Mitigation / impact management measures for reducing negative impacts must be classified as either:

Essential: Mandatory measures that must be implemented and are non-negotiable. These measures are assumed to be implemented in the “with mitigation” impact scenario and are therefore incorporated into the post mitigation impact assessment significance rating; or

Best Practice / Recommended: Non-mandatory measures that should be implemented where feasible and appropriate. Alternative measures or approaches may be adopted, provided that the required environmental outcome is still achieved and a clear and defensible motivation is provided for not implementing the recommended measure. These do not affect the overall impact rating if not implemented.

Optimisation measures aimed at enhancing potential benefits are generally considered Best Practice / Recommended and are non-mandatory.

Mitigation and optimisation measures must be inserted into the completed impact assessment table, with an indication on whether they are Essential or Recommended. The impact should be re-assessed with mitigation/ optimisation, by following Steps 1-5 again to demonstrate how the

extent, intensity, duration and/or probability change after implementation of the proposed mitigation measures.

Step 7 – Impact management outcomes

Next, also specify the desired **impact management outcome** that these measures aim to achieve.

To ensure that mitigation measures are effectively translated into EMPr actions, specialists should develop mitigation/ optimisation measures with an outcome-based approach in mind. These actions or measures should therefore not only reduce the significance of impacts but also contribute to achieving a clearly defined desired outcome. The outcome/s should be clearly indicated for each impact.

In many cases, a single overarching impact management outcome may apply to multiple impacts and may in some instances be applicable across all impacts assessed within a specialist report.

Examples:

Table 1: Describe the impact.

	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/ Recommended mitigation measures Xxxx Xxxxx								
With mitigation	Local 1	Low 1	Long-term 3	Low 5	Improbable	VERY LOW	-ve	High

Desired Impact Management Outcome to be achieved: xxx

OR (if impact is positive)

Table 1: Describe the impact.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without optimisation measures	Regional	Medium	Short term	Medium	Probable	MEDIUM	Positive	Med-High
Optimisation measures: xxx. xxxxx								
With optimisation measures	Regional	Medium to High	Short term	High	Probable	HIGH	Positive	Med-High

Desired Impact Management Outcome to be achieved: xxx

OR (if impact is insignificant and no mitigation required)

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional 2	Low 1	Medium term 2	Very low 4	Improbable	INSIGNIFICANT	-ve	High
Mitigation measures: Not considered to be necessary due to low significance.								

Desired Impact Management Outcome to be achieved: xxx

Step 8 – Prepare a summary table of all impact significance ratings as follows:

Phase	Impact identified	Significance	Status
xxxxxx	Impact 1: xxx	LOW	-ve
	With mitigation	VERY LOW	
	Impact 1: xxx	VERY LOW	-ve
	With mitigation	INSIGNIFICANT	-ve

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.

APPENDIX 2: DECLARATION OF INDEPENDENCE

Anchor Environmental Consultants (Pty) Ltd is an independent consultant and has no business, financial, personal or other interest in the activity, application or appeal in respect of which the company was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. No circumstances arose during the course of the project that compromised the objectivity of the specialists that performed the work.

APPENDIX 3: SPECIALIST DECLARATION

I, Adam Rees, as the appointed specialist hereby declare/affirm the correctness of the information provided as part of this report, and that:

- I act as the independent specialist in this matter;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I performed the work relating to the application in an objective manner, even if it results in views and findings that are not favourable to the applicant;
- I declare that there were no circumstances that compromised my objectivity in performing such work;
- I have expertise in conducting the specialist assessment relevant to this application, including knowledge of the National Environmental Management Act (Act 107 of 1998) (NEMA), regulations and any guidelines that have relevance to the proposed activity;
- I comply with the NEMA Act, regulations and all other applicable legislation; and
- I disclosed to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;

I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B (1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Dated at CAPE TOWN on this the 6th day of July 2026.



ADAM REES

Pr. Sci. Nat (141530)



TRANS ATLANTIC
DIAMONDS



ANCHOR
environmental

PART OF





CURRICULUM VITAE

ADAM REES – MARINE ECOLOGIST

Citizenship: British | SA Critical Skills Visa (Aquatic Scientist & Environmental Scientist)
Language: English

ACADEMIC QUALIFICATIONS:

PhD Marine Science (NQF 10), University of Plymouth
BSc (Hons) Marine Biology & Coastal Ecology (NQF 8), University of Plymouth

COUNTRY EXPERIENCE: United Kingdom; Europe and North Atlantic; Southern and West Africa and South Atlantic; Indian Ocean; Saudi Arabia and the Gulf

POSTAL ADDRESS: 8 Steenberg House, Silverwood Close, Tokai, Cape Town, South Africa 7945

PHONE: +27631286941 E-MAIL: adam@anchorenmvironmental.co.za DOB: 11/05/1991

EXPERIENCE

Feb 2022- present

Feb 2022- present

2020-2023

2018-2022

2018-2020

2017 (Feb-March)

2013 (May-Oct)

POSITION

Team lead: Fisheries & Aquaculture | Anchor Environmental Consultants (Pty) Ltd, South Africa

Visiting Researcher | University of Plymouth, UK

Research Project Consultant (Marine Ecology) | Blue Marine Foundation, London, UK

Postdoctoral Researcher (Marine Ecology) | University of Plymouth, UK

UK Project Coordinator | Blue Marine Foundation, London, UK

Field Research Assistant | Wildlife Conservation Society, Gabon &, GEOMAR

Helmholtz Centre for Ocean Research, Kiel.

Research Assistant | University of Plymouth, UK

Adam is a marine ecologist, fisheries and aquaculture expert specializing in sustainable ocean management, with over a decade of experience supporting conservation and fisheries governance initiatives across Europe, Africa, and the Indian Ocean. His work increasingly contributes to regional and global ocean initiatives, including marine spatial planning, biodiversity conservation, and fisheries management in offshore and transboundary contexts relevant to Areas Beyond National Jurisdiction (ABNJ). Adam has extensive experience working in coastal, offshore, and deep-sea ecosystems, with expertise spanning benthic ecology, fisheries management, marine protected area design and monitoring, and ecosystem-based management approaches applicable from national waters to high seas contexts. He possesses strong technical expertise in ecological survey design, community-level data analysis (R, Python, Primer and PERMANOVA+), GIS analytics (ArcGIS, QGIS), ecological impact assessments, and marine spatial planning, supported by extensive field experience including offshore surveys, underwater video, eDNA, fisheries observations, acoustic monitoring, and environmental sampling. Adam combines scientific and consulting experience to support evidence-based policy and management, having authored multiple peer-reviewed publications, over 50 technical reports, and a book chapter informing marine conservation and sustainable ocean governance internationally. He has managed fisheries and marine ecology projects for governments, NGOs, and private-sector clients, including work supporting large-scale ocean planning and conservation initiatives. Adam is also passionate about science communication, using media, infographics, and conservation photography to translate complex marine science into accessible knowledge that supports policy development and public engagement in global ocean stewardship. He is a SACNASP registered Professional Natural Scientist in Aquatic Science and Environmental Science (Registration Number: 141530), a Visiting Researcher at the University of Plymouth, and a member of the Royal Society of South Africa.

PEER-REVIEWED PUBLICATIONS

- Hutchings K., **Rees A.**, Pulfrich A., Clark B. (2025). Effects of diamond mining on sandy beaches in southern Namibia – the use of *Tylos granulatus* (Isopoda: Oniscidea) as an indicator species. *African Journal of Marine Science*, 47(3), 281–294. <https://doi.org/10.2989/1814232X.2025.2562031>
- Stamp T., Pittman S.J., Holmes L., **Rees A.**, Ciotti B.J., Thatcher H., Davies P., Hall A., Wells G., Olczak A., Sheehan E.V. (2024) Restorative function of offshore longline mussel farms with ecological benefits for commercial crustacean species. *Science of the Total Environment*. Vol. 951, Issue. 174987, <https://doi.org/10.1016/j.scitotenv.2024.174987>.
- Renn C., Rees S., **Rees A.**, Davies B.F.R., Cartwright A.Y., Fanshawe S., Attrill M.J., Holmes L.A., Sheehan E.V. 2024 Lessons from Lyme Bay (UK) to inform policy, management, and monitoring of Marine Protected Areas. *ICES Journal of Marine Science*. Vol. 0, Issue 0, 1–17
- Hickman J., Richards J., **Rees A.**, Sheehan E. V. 2023. Shipwrecks act as de facto Marine Protected Areas in areas of heavy fishing pressure. *Marine Ecology*. 00, e12782. <https://doi.org/10.1111/maec.12782>
- da Silva C., Samaai T., Kerwath S., Adams LA, Watson KM, Bernard AT, van der Heever GM, Angel A, Schoombie S, Frainer G, Franken M-L, **Rees A.**, Paterson A 2023. Leaping into the future: Current application and future direction of computer vision and artificial intelligence in marine sciences in South Africa. *Research Ideas and Outcomes*. 9: e112231. <https://doi.org/10.3897/rio.9.e112231>

- Easton BAA, Scott K, Richards J, **Rees A.** 2023. Catch per Unit Effort of Decapod Species, *C. pagurus* and *H. gammarus*, from a Voluntary Marine Reserve. *Fishes*. 2023; 8(8):390. <https://doi.org/10.3390/fishes8080390>
- Rees, A.**, Sheehan, E.V., Attrill, M.J. 2021. Optimal fishing effort benefits fisheries and conservation. *Scientific Reports* **11**, 3784 <https://doi.org/10.1038/s41598-021-82847-4>
- Davies, B.F.R., Holmes, L.A., Rees A., Attrill, M.J., Cartwright, A., Sheehan, E.V. 2021. Ecosystem Approach to Fisheries Management Works – how switching from mobile to static fishing gear improves populations of fished and non-fished species inside a Marine Protected Area. *Journal of Applied Ecology* <https://doi.org/10.1111/1365-2664.13986>
- Sheehan, E.V., Holmes, L.A., Davies, B.F.R., Cartwright, A., **Rees A.**, Attrill, M.J. 2021. Rewilding of Protected Areas Enhances Resilience of Marine Ecosystems to Extreme Climatic Events. *Frontiers in Marine Science* <https://doi.org/10.3389/fmars.2021.671427>
- Rees, S. E., Ashley, M., Evans, L., Mangi, S., Sheehan, E. V., Mullier, T., **Rees, A.**, Attrill, M. J. 2020. An evaluation of the social and economic impact of a Marine Protected Area on commercial fisheries *Fisheries Research* 235, 105819-105819 <https://doi.org/10.1016/j.fishres.2020.105819>
- Davies, B.F.R., Attrill, M.J., Holmes, L., **Rees, A.**, Witt, M.J., Sheehan, E.V. 2019. Acoustic Complexity Index to assess Benthic Biodiversity of a Partially Protected Area in the Southwest of the UK. *Ecological Indicators*. DOI: 10.1016/j.ecolind.2019.106019
- Sheehan, E.V. **Rees, A.**, Bridger, D., Hall-Spencer, J.M. 2017. Strandings of NE Atlantic gorgonians. *Biological Conservation*. DOI: 10.1016/j.biocon.2017.03.020

BOOK CHAPTERS

- Morgan, A., Sheehan, E., **Rees, A.**, Cartwright, A. 2020 Towards a Marine Socio-Ecology of Learning in the South West of England. In Joel B. Pontius, Michael P. Mueller, David A. Greenwood (eds). Hunting, Foraging, and Fishing for Food as Place-based Learning DOI:10.1007/978-3-030-42814-3

OTHER RELEVANT TRAINING & SKILLS:

Formal training: STCW Safety at Sea
GIS advanced methods
PERMANOVA and PRIMER 7
First Aid (general and outdoor)

SELECT PROJECT EXPERIENCE:

Period	Country	Client	Project/tasks
2026	Ghana	SLR/ Helios	Fisheries specialist: Environmental Carrying Capacity Due Diligence assessment for Nile tilapia aquaculture farming, Lake Volta, Ghana
2026	South Africa	ACER Africa	Team lead, marine ecologist: 3 x Fisheries Screening and Impact Assessments for proposed subsea telecommunication installations within South Africa’s EEZ.
2026	South Africa	SLR	Team lead, marine ecologist: Independent scientific reviewer of marine baseline reports conducted for green ammonia development in Egypt.
2025-2026	South Africa	Eskom	Team lead, marine ecologist: Marine Ecology and Avifauna specialist studies to support Environmental and Social Impact Assessment of two potential nuclear power plants in South Africa
2025-2026	South Africa	Department of Forestry, Fisheries and the Environment (DFFE), WILDTRUST	Team lead, marine spatial planning specialist: Development of Management Plan for the Namaqua Fossil Forest offshore Marine Protected Area, of South Africa.
2025-2026	Democratic Republic of Congo	DP World	Marine ecologist: Environmental monitoring of turtle nesting beaches (2025-2026 nesting season) within the Banana Seaport region, Democratic Republic of Congo
2025/2026	South Africa	SANParks	Team lead, marine ecologist: State of Knowledge reports for the Addo Elephant Park and Robben Island Marine Protected Areas.
2022, 2023, 2024, 2025, 2026	South Africa	Saldanha Bay Water Quality Trust	Marine ecologist, team lead in 2026: The State of Saldanha Bay and Langebaan Lagoon; ongoing annual ecological monitoring of Saldanha Bay and Langebaan Lagoon. Water quality analysis and reporting.
2025	Liberia	Conservation International	Team lead, marine spatial planning specialist: Development of technical guidance and implementation

			documentation for the development of Marine Spatial Planning in Liberia
2025	South Africa	Port Owen Marina Authority (POMA)	Team lead, marine ecologist: Assessment of invertebrate and fish fauna in the Berg Estuary channel and recommendations for disposal of dredge water
2025	South Africa	CES - Environmental and Social Advisory Services	Team lead, marine ecologist: Estuarine specialist studies, inclusion avifauna impact assessment and Delft3D hydrodynamic modelling for the development of a Liquefied Natural Gas Import Terminal at the Port of Richards Bay, Kwazulu-Natal.
2025	Namibia	De Beers Marine Namibia	Benthic ecologist: De Beers Marine Namibia Environmental Monitoring of offshore diamond mining in the Atlantic 1 Mining License Area
2025	Mozambique	Kenmare/Acer Africa	Marine fisheries specialist: Long-term water quality, coral reef, reef fish, turtle and fisheries monitoring programme at Caldeira and Njovo Islands, Mozambique
2025	South Africa	CES	Marine ecologist: Marine Specialist Study and Impact Assessment for proposed marine seawater gully intake locations within Namaqualand.
2025	South Africa	SLR Consulting (Africa)	Marine fisheries specialist, GIS lead: Block 11b/12b Environmental and Social Impact Assessment (ESIA): Marine Ecology Impact Assessment Specialist Study update
2025	South Africa	CSIR	Marine ecologist, GIS lead: Strategic Environmental Assessment for a green hydrogen and port development in the Northern Cape. Desktop review, mapping, reporting, environmental sensitivity analyses.
2025	South Africa	Infinity Environmental	Marine ecologist: Marine Specialist Study and Impact Assessment for the Granger Bay revetment, Port of Cape Town, Western Cape.
2025	South Africa	Lambert's Bay Foods (Pty) Ltd	Marine ecologist: Environmental and effluent monitoring, audit and dispersion modelling in fulfilment of the awarded Coastal Water Discharge Permit
2025	South Africa	Enviroworks	Team lead, marine ecologist: Marine Specialist Study and Impact Assessment lead for the development of two gas-to-power plants in the Coega IDZ, Eastern Cape.
2025	South Africa	Pisces Environmental Services	Marine ecologist, GIS lead: Strategic Environmental Assessment and Sensitivity Analysis for the marine and coastal environment, Boegoebaai in support of a proposed green hydrogen port facility development.
2025	South Africa	WNEL	Team lead, marine ecologist: Marine and Estuarine impact assessment for a campsite development in Kleinsee, Northern Cape.
2025	Mozambique	ACER Africa	Marine fisheries specialist, GIS lead: Assessment of changes to local fishing effort using survey and remotely sensed data to determine the socio-ecological changes and indirect environmental impacts of the Kenmare Moma mine, northern Mozambique.
2025	South Africa	ImveloBlue	Team lead, marine ecologist: Development and implementation of an offshore Tuna (Albacore) Pole and Line fisheries observer program within South Africa.
2024	South Africa	WSP Group Africa (Pty) Ltd	Marine ecologist: Environmental screening (marine ecology and fisheries) of PetroSA offshore assets in Block 9 and 11a
2024	Namibia	De Beers Marine Namibia	Benthic ecologist: De Beers Marine Namibia Environmental Monitoring Programme in the Atlantic 1 Mining License Area: 2023 Benthic Sampling Campaign. Chapter author: 'SkiMonkey' benthic tow camera benthic assessment of offshore diamond mining activities on benthic habitats. Survey design, image and statistical analyses, writing of report chapter.

2024	South Africa	GenesisHexicon	Team lead, marine ecologist: Shallow marine benthic ecological assessment and field survey for an offshore floating wind farm to be installed offshore of Richards Bay, KZN.
2024	South Africa	WWF	Team lead, marine ecologist: Development of an endangered, threatened and protection management plan for several wild capture and mariculture fisheries to undergo Marine Stewardship Council assessment. Stakeholder engagement and management plan writing lead.
2024	South Africa	CES	Team lead, marine ecologist: Field survey lead and marine/estuarine impact assessment within the Richards Bay estuary for a floating regasification unit and LNG terminal construction.
2024	South Africa	Department of Forestry, Fisheries and the Environment	Team lead, marine spatial planning specialist: Development of Management Plans for the Southeast Atlantic and Southwest Indian Seamounts offshore Marine Protected Areas of South Africa.
2024	South Africa	The Nature Conservancy, SANparks	Marine ecologist, GIS specialist: Marine invertebrate (diver data) and marine resource use data analysis (expert interviews, aerial survey data) within the Table Mountain National Park Marine Protected Area. Data analysis, GIS spatial analysis and mapping, reporting.
2023	Saudi Arabia	NEOM	Team lead, marine GIS components: Marine conservation spatial planning through Marxan, for the NEOM (Saudi Arabia) marine and coastal region to support regionwide conservation planning efforts. Marine lead on conception, analysis, presentations and reporting, and led the creation of a final marine conservation plan for NEOM.
2023-2024	Mozambique	ERM - Environmental Resources Management for DP World	Field survey lead, marine ecologist: Marine/estuarine specialist study and field survey for an Environmental and Social Impact Assessment (ESIA) application for proposed expansion of the Maputo container terminal in the Port of Maputo, Mozambique.
2023	South Africa	WILDOCEANS	Team lead, marine fisheries specialist: National assessment of the demersal inshore trawl. Socio-economic and legal assessment, resource exploitation assessment and spatial analysis to assess impacts of inshore trawl fishery on other coastal fisheries and legal and policy options available to reduce conflict and impacts.
2023	South Africa	Port Own Marina Authority (POMA)	Team lead, marine specialist: Assessment of invertebrate and fish fauna in the Berg Estuary channel and recommendations for disposal of dredge water
2023	Guinea	Dynamic Mining/ SLR Consulting	Marine specialist: Environmental assessment for a bauxite export facility in the prefecture of Boke, Republic of Guinea
2022-2023	South Africa	Lucky Star Limited, Pioneer Fishing (WC) (Pty) Ltd	GIS specialist: Dumping at Sea Permit application: marine environmental constraints analysis, site selection and impact statement.
2022	South Africa	TriplO4	Team lead, marine specialist: Proposed gas-to-power Powership Project at the ports of Ngqura, Saldanha and Richards Bay. Updates to marine ecology and fisheries Specialist Studies to support EIA
2022	South Africa	WSP Group Africa (Pty) Ltd	Marine specialist: Marine ecological Screening Analysis for proposed green hydrogen project, Boegoebaai, northern cape
2022	South Africa	SLR Consulting	Marine specialist: Constraints Analysis for a proposed 2-billion-litre throughput per year desalination plant on the Western Cape coast
2022	South Africa	Lambert's Bay Foods	Marine specialist: Baseline study to support coastal waters discharge permit requirements for the Lambert's Bay Food processing plant, Lambert's Bay

2022	South Africa	Transnet National Ports Authority	Marine specialist: Baseline survey of marine fauna, flora and antifouling contaminants - Port of Durban August 2022: Chapters 'Fish' & 'Water quality monitoring'.
2022	South Africa	Department of Environmental Affairs and Development Planning (DEA&DP)	Marine specialist: Situation Assessment report 2022 for the Berg River Estuary
2022	South Africa	Nemai Consulting & Ugu district municipality.	Estuarine specialist: Literature review of the hydrodynamic drivers of the uMzimkhulu Estuary, South Africa
2022	South Africa	World Wide Fund for Nature	GIS specialist: GIS spatial data analysis of reef presence for the Saldanha Bay sea-based Aquaculture Development Zone
2022	South Africa	Transnet	Marine specialist: Meta comparison of historical fish surveys inside the Port of Durban to inform baselines of fish assemblages in a system subjected to the impacts of ship hull cleaning
2022	South Africa/ Namibia	DebMarine Namibia	Marine specialist: Taxonomic ID of benthic macrofauna for diamond recovery operations on the South African/Namibian border
2021	UK	Blue Marine Foundation	Marine specialist: Feasibility study for siting on Marine National Parks around the UK. Collation of spatial data, social, economic and environmental data. GIS mapping, Marine Spatial Planning. Data analysis report writing
2021-2022	Maldives	Blue Marine Foundation	Team lead, marine and GIS specialist: GIS mapping and spatial analysis, quantitative analysis of resource use (fisheries, tourism, fish exporters, local councils). Fisheries use, Catch per unit effort, Vessel Monitoring Systems. Report writing, data collection, data analysis semi-quantitative interviews/questionnaires consultation with industry and stakeholders
2021-2022	Maldives	Blue Marine Foundation	Team lead, marine and GIS specialist: Socio-economic data collection, quantitative and qualitative data collection and analysis, reporting. Economic fisheries data
2013-2017	England	Department for Environment Food and Rural Affairs, UK Government	Team lead, marine specialist: Report to UK Government. Annual reporting regarding assessment of benthic impacts of inshore pot fishing on benthic ecosystems. Underwater video monitoring, baited remote underwater video monitoring, image and video analysis, data analysis, report writing and presentation.
2019	England	Blue Marine Foundation	Team lead, marine specialist: Field data collection of herring spawning events. Genetic comparison between herring populations. Identification of spawning events and habitat. Report writing and analysis
2021-2022	England	Blue Marine Foundation	Team lead, marine specialist: Feasibility assessment of oyster restoration. Particle dispersal, larval dispersal and Larval settlement models. GIS analysis, site assessment and report writing
2021	UK	Blue Marine Foundation	Team lead, marine fisheries specialist: Fisheries inside English Marine Protected areas. Review and analysis of fisheries management in England inshore and offshore MPAs. Mapping, report writing and presentation of results
2017,2018, 2021,2022	England	Natural England	Benthic ecologist: Lyme Bay reporting on annual monitoring. Long-term monitoring time series data from ecosystem assessment – underwater video. Multivariate data analysis and reporting
2017	Gabon	GEOMAR	Field scientist: Fieldwork tracking juvenile turtles in the nearshore waters of Gabon. Acoustic telemetry, spatial data, remote sensing.
2014-2021	England	Offshore shellfish Ltd	Marine and benthic specialist: Mariculture (offshore mussel farm) environmental impact. Underwater video, grab sampling, infaunal analysis, sediment status.

			Assemblage composition analysis – infaunal and epifaunal analysis. Video (towed video, ROV, baited video) analysis.
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CURRICULUM VITAE

LILY ASTRID BOVIM

ACADEMIC QUALIFICATIONS:

MSc Marine Biological Resources Management, 2020, Ghent University (Belgium), University of the Algarve (Portugal), Galway-Mayo Institute of Technology (Ireland)
BSc (Hons) Biological Sciences, 2015, University of Cape Town
BSc Marine Biology and Ocean & Atmosphere Sciences, 2014, University of Cape Town

OTHER QUALIFICATIONS AND TRAINING:

Class V Commercial/Scientific Diver, 2023, UCT Research Diving Unit
Marine Mammal Observer (MMO) Mitigation Training, 2024, JNCC
Basic Offshore Survival Induction Emergency Training (BOSIET) with CA-EBS, 2022, OPITO
SASS5 Biomonitoring Course, 2017, Freshwater Research Centre
WRC Seagoing Safety Familiarization (STCW A-VI/I) Certificate, 2016
Advanced Open Water Diver, PADI
Level 1 First Aid, 2023, MST & PEC

COUNTRY EXPERIENCE: South Africa, Guinea, Germany, Portugal, Mozambique, Nigeria, Madagascar, Ghana

LANGUAGE PROFICIENCY: English (Excellent), Afrikaans (Basic), French (Basic)

MEMBERSHIP OF PROFESSIONAL BODIES/ORGANISATIONS:

SACNASP Professional Natural Scientist (172158 Aquatic Science)

POSTAL ADDRESS: Suite 8 Steenberg House, Silverwood Close, Tokai 7945

PHONE: +27-21-7013420 **E-MAIL:** lily@anchorenvironmental.co.za

EMPLOYMENT HISTORY:

2022-present: Consultant: Marine Ecosystems & Resources (Anchor Environmental Consultants)
April-June 2019: Intern (Thünen Institute of Baltic Sea Fisheries, Germany)
2017-2018: DST-NRF Intern (Freshwater Research Centre)

SUMMARY PROFILE

Lily Bovim is a marine ecologist with a strong academic foundation and diverse field experience across Southern Africa and beyond. She holds an MSc in Marine Biological Resources Management (*magna cum laude*), awarded jointly by Ghent University, the University of the Algarve, and the Galway-Mayo Institute of Technology. She also holds a BSc Honours degree in Biological Sciences and a BSc in Marine Biology and Ocean & Atmosphere Sciences (Oceanography) from the University of Cape Town. She is a registered Professional Natural Scientist (SACNASP 172158). As a Consultant in Anchor's Marine Ecosystems & Resources team, Lily contributes to a wide range of marine and estuarine projects through impact assessments, environmental audits, baseline surveys, monitoring programme design, scientific diving, and specialist studies. Her fieldwork experience includes ichthyofauna and rocky intertidal surveys, benthic sampling, water and effluent quality sampling, and offshore oceanographic and deep-sea sampling. She has in-country scientific experience across South Africa and in Guinea, Mozambique, Portugal, and Germany. Lily is a medically fit Class V Scientific Commercial Diver and certified Marine Mammal Observer. Her technical skills include data analysis (R, PRIMER), GIS mapping, and basic graphic design.

SKILLS: R programming, MS Office Suite, PRIMER, GIS, Inkscape, MMO, scientific diving

SELECT PROJECT EXPERIENCE

Period	Country	Clients	Project, Tasks
2026	South Africa	Trans Atlantic Diamonds	Basic Assessment Report for the proposed prospecting in sea Concession Area 11C. Marine and fisheries specialist
2026	South Africa	Infinity Environmental	Hydrodynamic Modelling and Estuarine Impact Assessment for the dredging of the Zand Estuary, Cape Town Estuarine ecology specialist
2025-2026	South Africa	Gansbaai Marine	Marine survey report (water quality, effluent quality, rocky shore survey, toxicity testing and impact assessment) in fulfilment of CWDP conditions Project lead, marine ecology specialist
2026	Ghana	SLR/ Helios	Environmental Carrying Capacity Due Diligence assessment for Nile Tilapia aquaculture farming, Lake Volta, Ghana Co-author
2025-2026	South Africa	WSP Group Africa (Pty) Ltd	Thyspunt and Bantamsklip proposed Nuclear Power Plant Environmental and Social Impact Assessment (ESIA): Marine Ecology and Fisheries Impact Assessment Specialist Study Field scientist
2025	South Africa	CES - Environmental and Social Advisory Services	Marine Impact Assessment and Dispersion Model studies for a CWDP Application for a Brackish Water Reverse Osmosis Desalination Plant Discharge at Port Alfred Field scientist
2025	Mozambique	Kenmare/ Acer Africa	Long-term water quality, coral reef, reef fish, turtle and fisheries monitoring programme at Caldeira and Njovo Islands, Mozambique Marine ecology specialist
2025-2026	South Africa	uMngeni-uThukela Water	Biannual Coastal Waters Discharge Permit effluent quality compliance audits Data analyst, audit specialist
2025	Madagascar	ERM for Base Resources Limited	IFC compliant marine coastal specialist studies for the Base Toliara Project ESIA, Madagascar. Marine ecology specialist
2025	South Africa	ECA Consulting	Marine/Estuarine Impact Assessment for the proposed development of a Liquefied Petroleum Gas Terminal, Island View Precinct, Port of Durban Marine/estuarine ecology specialist
2023-2026	South Africa	Saldanha Bay Water Quality Trust	The State of Saldanha Bay and Langebaan Lagoon; ongoing annual ecological monitoring of Saldanha Bay and Langebaan Lagoon. Ichthyofauna specialist and co-editor
2024-2025	South Africa	WSP Group Africa (Pty) Ltd	Port of Durban Point Container Terminal Reconfiguration Environmental and Social Impact Assessment (ESIA): Marine Ecology and Avifauna Impact Assessment Specialist Study Marine ecology specialist
2025	South Africa	Gansbaai Marine	Development of a Marine Monitoring Programme Project lead and marine ecology specialist
2025	South Africa	Creocean Environnement & Océanographie	Total Energies E&P South Africa Offshore Environmental Baseline Study Benthic expert on board the Pacific Goldfinch, assisting with oceanographic data collection, benthic sampling and identification of deep-sea fauna from video footage.
2025	South Africa	Diamond Coast Abalone	Environmental monitoring and stock assessment for abalone ranching in Hondeklipbaai, Northern Cape. Marine ecology specialist and scientific diver
2025	South Africa	Port Nolloth Sea Farms	Abalone Ranching Concession Area NC3 Environmental Monitoring Survey Report Scientific diver and marine ecology specialist
2024-2027	South Africa	Department of Forestry, Fisheries and the Environment (DFFE)	Environmental Specialist Monitoring of the Saldanha Bay Aquaculture Development Zone. Scientific diver for the deployment and servicing of oxygen and nitrate probes, benthic macrofauna, Annual Chemical Survey and Reef survey in the ADZ.

2024-2025	South Africa	Infinity Environmental (Pty) Ltd	Estuarine Impact Assessment and Hydrodynamic Modelling study to assess impacts of the proposed dredging of Milnerton Lagoon on estuarine function and water quality. Marine/estuarine ecology specialist
2024	South Africa	Kleinzee Holdings	Marine and Coastal Impact Assessment for mining activities in the Buffels Marine Mining Area, Kleinzee, Northern Cape Field scientist, marine ecology specialist
2024	South Africa	Diamond Coast Aquaculture	Environmental monitoring and stock assessment for abalone ranching in Kleinzee, Northern Cape. Marine ecology specialist, scientific diver
2024	South Africa	Gansbaai Marine	Gansbaai Marine Effluent Analysis Compliance Audits Project lead, main audit author
2024	South Africa	Transnet National Ports Authority	Baseline survey for marine fauna and flora monitoring, Port of Mossel Bay Scientific diver, field scientist, ichthyofauna specialist
2024	South Africa	Two Oceans Aquarium Foundation	Baseline survey of Marine Fauna and Flora, Granger Bay. Scientific diver
2024	South Africa	Zingce Environmental Solutions/ Transnet	Baseline survey of marine fauna, flora and antifouling contaminants, Port of Ngqura. Marine ecology specialist, scientific diver, field scientist.
2024	South Africa	CES/ Vopak/ Transnet	Estuarine specialist studies in support of an EIA for the development of a Liquefied Natural Gas Import Terminal at the Port of Richards Bay, KwaZulu-Natal. Co-author, ichthyofauna specialist, field scientist.
2023-2024	Mozambique	ERM - Environmental Resources Management for DP World	Marine/estuarine specialist study for an Environmental and Social Impact Assessment (ESIA) application for proposed expansion of the Maputo container terminal in the Port of Maputo, Mozambique. Marine/estuarine ecology specialist
2023	South Africa	Gansbaai Marine	Water Quality and Marine Ecology Impact Assessment for Gansbaai Marine, Western Cape, in Fulfilment of awarded CWDP conditions. Project manager, marine ecologist & field scientist
2023-2024	South Africa	SANParks	Aerial survey of marine users of Table Mountain National Park Marine Protected Area and Subtidal surveys of commercially important invertebrates and indicator species within the Table Mountain Marine Protected Area. Field scientist (helicopter survey) & scientific diver.
2023-2024	South Africa	Nemai Consulting & Ugu District Municipality.	Estuarine offset/Compensation Plan: Assessment of the proposed development of the weir component of UBWSS in the uMzimkhulu Estuary GIS specialist
2023	Mozambique	Consultec – Consultores Associados, Lda.	Best Practicable Environmental Option (BPEO) and Marine Impact Assessment study of elevated phenol content in produced water discharge for Coral South FLNG, Mozambique. Marine ecology specialist
2023	Nigeria	ERM - Environmental Resources Management	Gap analysis and desktop estuarine component of Environmental and Social Impact Assessment (ESIA) for the MM Port FZE Project at the Federal Ocean Terminal, Onne Port Complex, Nigeria Marine ecologist, lead author
2023	South Africa	SANParks	Robben Island rocky shore survey Field scientist
2023	Mozambique	Consultec – Consultores Associados, Lda.	Best Practicable Environmental Option (BPEO) and Dispersion Modelling Study for Inshore Drilling Water Discharge, Pemba Bay Moçambique Field scientist, marine ecology specialist
2023	South Africa	Transnet	Port of Richards Bay estuary baseline ecological study, with focus on the fish community. Ichthyofauna specialist, co-author
2023	South Africa	Port Own Marina Authority	Assessment of invertebrate and fish fauna in the Berg Estuary channel and recommendations for disposal of dredge water Field scientist
2023	Guinea	Dynamic Mining/ SLR Consulting	Environmental assessment for a bauxite export facility in the prefecture of Boke, Republic of Guinea In-country field scientist, marine/estuarine ecologist

2022-2023	South Africa	Lucky Star Limited, Pioneer Fishing (WC) (Pty) Ltd	Dumping at Sea Permit application: marine environmental constraints analysis, site selection and impact statement. Marine ecology specialist
2022-2023	South Africa	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)/ IWS	Economic, technical, legal, environmental, and social assessment of the suitability of desalination plants as water source for green hydrogen projects in South Africa Primary author, marine ecology specialist
2022-2023	South Africa	Total Energies/WSP	Marine and fisheries study as part of an ESHIA for an offshore production right and environmental authorisation applications for Block 11b/12b Marine ecology specialist
2022-2024	Sierra Leone	Iluka/ Sierra Rutile/ Digby Wells/ Jones & Wagener	Environmental, Safety and Health Impact Assessment (ESHIA) and environmental Flow Assessment studies for mining of the Sembahun group of deposits in the Southern Province of Sierra Leone. Marine and estuarine specialist
2022-2023	South Africa	SAMSA/ Impact Economix	Assessment of opportunities, challenges and risks associated with growing the maritime economy with off-shore Bunkering in St Helena Bay Marine ecology and fisheries specialist
2022	South Africa	Ugu District Municipality/ Nemai	Estuarine impact assessment and environmental flow assessment for the development of a weir on the uMzimkhulu estuary, KZN province Marine/estuarine ecology specialist
2022	South Africa	ECA Consulting	Estuarine Specialist Study for Development of Erf 578, uMzimkhulu Estuary Marine/estuarine ecology specialist
2022	South Africa	Impact Economix	Environmental Status Quo Report for Potential Ship-to-Ship Bunkering Operations in St Helena Bay Marine ecology and fisheries specialist
2022-2024	South Africa	Mhlathuze Water	Biannual Coastal Waters Discharge Permit effluent quality compliance audits Data analyst, co-author
2022	South Africa	Karpowership SA/ Triplo4	Marine, estuarine, fisheries and avifauna specialist studies for EIAs three power stations in the Port of Saldanha, Coega and Richards Bay Marine ecology specialist

PUBLICATION RECORD

Winkler AC, **Bovim L**, Macena BC, Gandra M, Erzini K, Afonso P, Abecasis D. 2023. Depth and temperature preferences of meagre, *Argyrosomus regius*, as revealed by satellite telemetry. Plos one, 18(11):e0288706.

Bragg CJ, Paxton BR, Shelton JM, **Bovim LA** and Dallas HF. 2017. Freshwater Fishes of the Cape Fold Ecoregion and Climate Change: Volume 2: Policy Uptake Strategy. Prepared on behalf of the Table Mountain Fund by the Freshwater Research Centre. 14pp.

THESES

Bovim LA. 2020. Depth and temperature preferences of satellite-tagged meagre, *Argyrosomus regius*, in the NE Atlantic. MSc Thesis, University of the Algarve, 43 pp.

Bovim LA. 2015. Stomatal response to smoke – could it prevent hydraulic death? BSc Hons. Thesis, University of Cape Town, 23 pp.

Bovim LA. 2015. Patterns of abundance and diversity among intertidal fishes of Struisbaai, South Africa. BSc Hons. Thesis, University of Cape Town, 34 pp.

CURRICULUM VITAE**EMILY GAMMON**

Consultant at Anchor Environmental Consultants

Citizenship: South African

Language: English

ACADEMIC QUALIFICATIONS:**MSc** Oceanography, 2025, University of Cape Town**BSc** (Hons) Marine Biology, 2021, University of Cape Town**BSc** Marine Biology, Ecology and Evolution, 2020, University of Cape Town**COUNTRY EXPERIENCE:** South Africa, Namibia, Angola, Mozambique**POSTAL ADDRESS:** 8 Steenberg House, Silverwood Close, Tokai 7945**PHONE:** +27-21-701-3420 **E-MAIL:** emily@anchorenvironmental.co.za **DOB:** 15/09/1999**EXPERIENCE**

2025-present

2024-2025

2022

2018-2022

2019-2021

2019

POSITION

Consultant (Anchor Environmental Consultants)

Junior Consultant (Anchor Environmental Consultants)

Senior Lab Technician (Anchor Environmental Consultants)

Reference management (A to Z of Medicines, Part time)

Biological Sciences Practical demonstrator (Part time)

Intern (Lower Breeder River Conservancy Trust)

SUMMARY PROFILE

Emily has experience in marine ecology, physical oceanography, water quality monitoring, and benthic macrofauna taxonomy, with a specific interest in fish. She obtained a BSc Hons in Marine Biology and an MSc in Operational Oceanography at the University of Cape Town. Her honours thesis focused on the diets of juvenile deep sea hake (*Merluccius paradoxus*) off the coast of Namibia and South Africa and was published in *African Journal of Marine Science*. Her master's thesis centered around the validation of an ocean current prediction model using *in situ* data collected by an ADCP in southern Namibia. She is proficient in multivariate analysis of large quantitative datasets (PRIMER, R), boat and lab fieldwork and data collection, benthic macrofauna taxonomy, and physical oceanography.

PEER-REVIEWED PUBLICATIONS

- **Gammon E**, Moloney C, Lipinski M. 2022 Diet and condition of juvenile deep-water hake *Merluccius paradoxus* on the west coast of southern Africa. *African Journal of Marine Science*. Vol. 44, Issue 4, 311-320.

OTHER RELEVANT TRAINING & SKILLS:

Formal training: First Aid (general and outdoor)

MS Office Suite, R Studio, Primer

SELECT PROJECT EXPERIENCE

Period	Country	Client	Project/tasks
2025	South Africa	AMSOL	Ship-to-Ship Bunkering EMP Update Project management, reporting
2025	Namibia	Namdeb	Intertidal Rocky-Shore and Sandy Beaches Ecological Monitoring Reports Statistical analysis, graphing
2025	Mozambique	Kenmare	Long-term coral reef monitoring programme Fish ID, statistics, reporting
2025	South Africa	AGES Omega Group	Estuarine Health and Impact assessment for the Mzamba Estuary North Eastern Cape Field work, reporting
2025	South Africa	L'Office Français de la Biodiversité (OFB) & SANParks	Krom Estuary Situation Assessment Report Field Work, reporting
2025	Angola	Block 47 marine biodiversity	Reporting
2025	South Africa	Promac Paints & Gensol	Whole Effluent Ecotoxicity Testing using sea urchins for liquid samples from Global Environmental Solutions (Glensol) Ecotoxicity testing
2025	South Africa	WNELL – Campsites	Project management, reporting
2025	South Africa	WCNES	
2025-2027	South Africa	City of Cape Town and Infinity Environmental	Mussel moorings, drop camera analysis, reporting, ecotoxicity testing, field work
2025	Namibia	Pisces	Data analysis
2024-2025	South Africa	Overstrand Municipality	Data collection Meeting minutes for Authorities Meeting Stakeholder summaries
2024	South Africa	CSIR – Boegoebaai	Field sampling (Tylos, sandy beaches, rocky shores, fish trekking, WQ) Report writing Crediting that vulnerable habitat nonsense Field work, Statistical analysis, Reporting
2024	South Africa	Richards bay windfarms	GPS location data preparation and analysis Statistical analysis
2024	South Africa	WKNW Desalination Plant	Data processing, report writing, compilation
2024	South Africa	City of Cape Town	Building microplastics sampling equipment Equipment creation and testing
2024, 2025	South Africa/Namibia	Debmarine Namibia	Water Quality analysis Transect Measure analysis of SkiMonkey footage Statistical analysis of community data Report writing Data processing, Statistical analysis, writing

2022, 2023, 2024, 2025	South Africa	Saldanha Bay Water Quality Trust	The State of Saldanha Bay and Langebaan Lagoon; ongoing annual ecological monitoring of Saldanha Bay and Langebaan Lagoon. Fish and rocky shore data capture and reporting. Field work, Identification, Reporting, Compilation
2023	South Africa	Endangered Wildlife Trust	Collecting survey data.
2022	South Africa	Creocean Environment	Taxonomic sorting and identification. Identification, Lab work
2022	South Africa	Nemai Consulting & Ugu district municipality.	Sample and data collection for baseline monitoring of the uMzimkhulu Estuary, South Africa. Chlorophyll a, Identification, Field work
2022	South Africa/Namibia	Debmarine Namibia	Taxonomic ID of benthic macrofauna for diamond recovery operations on the South African/Namibian border. Sediment particle size analysis. Identification, Statistical analysis, Lab work
2022	South Africa/Namibia	NAMDEB	NAMDEB's offshore environmental monitoring programme in the midwater mining license area: annual benthic sampling campaign. Identification, Lab work
2022	South Africa	City of Cape Town	Outflow monitoring, assisted with the deployment and retrieval of ocean moorings. Field work
2022	South Africa/Namibia	Debmarine Namibia	Development of frame and mooring for ADCP deployment. Instrumentation development
2022	South Africa	Mhlathuze Water	Statistical analysis and graphing for annual reporting. Statistical analysis
2022	South Africa	City of Cape Town	Trace metal analysis of fish in Zandvlei, Rietvlei, and Zeekovlei. Sample collection and reporting. Field work, Project management, Lab work, Reporting
2022	South Africa	Steenberg Office Park	Sample collection and report compilation for water quality monitoring. Field work, Reporting
2022	South Africa	Stonehurst Mountain Estate	Environmental compliance monitoring. Site inspection, Stakeholder meeting
2022	South Africa	ECA Consulting	Data cleaning and processing for avifauna impact assessment. Data processing

CURRICULUM VITAE**YI-TING HO – MARINE ECOLOGIST/ENVIRONMENTAL DATA SCIENTIST**

Citizenship: South Africa and Taiwan (dual citizenship)

Language Proficiency: English (Excellent), Afrikaans (Conversational), Mandarin (Good)

ACADEMIC QUALIFICATIONS:**MSc** in Biological Sciences, University of Cape Town**BSc (Hons)** in Biological Sciences, University of Cape Town**BSc** in Applied Biology and Marine Biology, University of Cape Town**OTHER RELEVANT TRAINING & SKILLS:**

First Aid Level 1 (General and Outdoor)

Medically in-date scientific/commercial (class V) diving

Sea safety: Personal Survival Techniques, 2024

R (statistical computing)

Molecular techniques (genetics)

PERMANOVA and PRIMER 7

Biostatistics and bioinformatics

COUNTRY EXPERIENCE: South Africa, Mozambique, Angola, Madagascar**POSTAL ADDRESS:** 8 Steenberg House, Silverwood Close, Tokai, Cape Town, South Africa 7945**PHONE:** +27 21 701 3420**E-MAIL:** yiting@anchorenvironmental.co.za**EXPERIENCE:**2023 – Present
2023

2021 – 2023

2019 – 2021

POSITION:*Consultant, Anchor Environmental Consultants**Research Assistant (temporary), Biological Sciences Department, University of Cape Town**Biological Sciences Demonstrator, University of Cape Town**Laboratory and field assistant, Percy Fitzpatrick Institute of African Ornithology, University of Cape Town***SUMMARY PROFILE**

Yi-Ting holds an MSc degree in Biological Sciences, a BSc (Hons) in Biological Sciences, and a BSc in Applied Biology and Marine Biology from the University of Cape Town. She is a Marine Ecologist at Anchor Environmental Consultants and professionally registered Natural Scientist (SACNASP 183430) with experience in environmental research, marine environmental monitoring, and impact assessments in systems across South Africa, Namibia, Mozambique, Angola, and Madagascar. Her expertise includes ecological and biological statistics, benthic taxonomy, systematics, and population genetics, complemented by proficiency in molecular techniques such as DNA extractions, PCR, and next-generation sequencing. Yi-Ting has extensive experience in biological sampling and scientific diving, with direct involvement in numerous specialist studies and environmental monitoring programmes across subtidal, estuarine, and offshore systems. She is currently developing her skills in two- and three-dimensional hydrodynamic modelling of marine and estuarine systems using the Delft3D modelling suite and CorMIX, to inform impact assessments, regulatory compliance, and monitoring programme design and implementation. Her role at Anchor covers data collection (including scientific diving), data manipulation and wrangling, advanced statistical analyses, taxonomic identification of benthic macrofauna, and technical report authorship. She has contributed as lead or co-author to marine specialist reports, baseline studies, compliance statements, and environmental monitoring outputs for a

wide range of projects, including dredging operations, aquaculture, desalination, offshore mining, oil and gas, biodiversity monitoring, and coastal engineering developments.

SELECT PROJECT EXPERIENCE

Period	Country	Clients	Project, Tasks
2026	South Africa	Rheinmetall Denel Munition	Co-author, marine ecologist Marine Impact Assessment, Coastal Waters Discharge Permit amendment application, and Delft3D Dispersion Modelling for Rheinmetall Denel Munition effluent discharges, Somerset West
2026	South Africa	SRK Consulting (South Africa) (Pty) Ltd	Co-author, marine ecologist Coastal Water Discharge Permit Application for the Fishwater Flats Waste Water Treatment Works, Nelson Mandela Bay Municipality
2025–2026	South Africa	WSP Group Africa (Pty) Ltd	Co-author Thyspunt and Bantamsklip proposed Nuclear Power Plant Environmental and Social Impact Assessment (ESIA): Marine Ecology and Fisheries Impact Assessment Specialist Study
2025–2027	South Africa	uMngeni-uThukela Water	Co-author, audit team member Bi-annual Coastal Waters Discharge Permit effluent quality compliance audit.
2025	South Africa	AMSOL	Co-author, marine ecologist Oil spill dispersion modelling (GNOME) and fate assessment for ship-to-ship bunkering in Algoa Bay
2025	South Africa	African Marine Solutions	Co-author Preparation of an Environmental Management Plan (EMP) for ship-to-ship transfers required in terms of the Regulations for the Environmental Management of Offshore Ship-To-Ship Transfer (GN No. R. 6551, 28 August 2025)
2025	South Africa	Guillaume Nel Environmental Consultants	Lead author, estuarine ecologist Estuarine Constraints Study for Proposed Dreyersdal Development
2025	South Africa	Savannah Environmental (Pty) Ltd	Co-author, marine ecologist Scoping Report: Marine Impact Assessment for Proposed Garden Route Gas to Power Project, Western Cape
2025	South Africa	AECOM	Co-author, field scientist Ngqenga Estuary Site Sensitivity Verification for Proposed Subsea Cable Landing at the East London IDZ
2025	South Africa	CES Environmental and Social Advisory Services	Co-author, marine ecologist Marine Impact Assessment and Dispersion Model for Brackish Water Reverse Osmosis Desalination Plant Discharge at Port Alfred

Period	Country	Clients	Project, Tasks
2026	South Africa	Rheinmetall Denel Munition	Co-author, marine ecologist Marine Impact Assessment, Coastal Waters Discharge Permit amendment application, and Delft3D Dispersion Modelling for Rheinmetall Denel Munition effluent discharges, Somerset West
2026	South Africa	SRK Consulting (South Africa) (Pty) Ltd	Co-author, marine ecologist Coastal Water Discharge Permit Application for the Fishwater Flats Waste Water Treatment Works, Nelson Mandela Bay Municipality
2025	South Africa	Savannah Environmental (Pty) Ltd	Co-author Site Suitability Assessment for the Proposed PTXSA Desalination Plant Within the Freeport Area of the Saldanha Bay IDZ
2025	Madagascar	Base Resources Toliara/ERM Group	Co-author, marine specialist Marine coastal related specialist studies for the Base Toliara Project, Madagascar
2025	South Africa	Sea Harvest Corporation (Pty) Ltd	Data scientist, marine specialist, co-author Annual environmental monitoring as per the awarded coastal waters discharge permit and the 2020 environmental monitoring plan
2025	South Africa	Belton Park Trading 127 (Pty) Ltd/Trans Hex Group	Data scientist, co-author Belton Park Impact Monitoring Survey 2025
2025	South Africa	Infinity Environmental/City of Cape Town	Co-author Hydrodynamic modelling and estuarine impact assessment for the dredging of the Zandvlei Estuary, Cape Town
2025	South Africa	Guillaume Nel Environmental Consultants	Lead author, marine ecologist Estuarine compliance statement for proposed bulk water supply pipeline traversing the Jakkalsvlei Estuary in Lambert's Bay
2025	Angola	HCV Africa/SoapPro Group/Azule Energy	Co-author, marine specialist Marine specialist and biodiversity report for Block 47 offshore Angola
2023–2025	South Africa	Saldanha Bay Water Quality Forum Trust (SBWQMFT)	Scientific commercial diver, data scientist, co-author Annual State of the Bay Monitoring programme (Saldanha and St. Helena Bay)
2023–2025	Namibia	De Beers Marine Namibia	Data scientist, taxonomist, co-author De Beers Marine Namibia Environmental Monitoring Programme in the Atlantic 1 Mining License Area: Annual Benthic Sampling Campaign
2024–2027	South Africa	Department of Forestry, Fisheries and the Environment (DFFE)	Scientific commercial diver Environmental Specialist Monitoring of the Saldanha Bay Aquaculture Development Zone

Period	Country	Clients	Project, Tasks
2026	South Africa	Rheinmetall Denel Munition	Co-author, marine ecologist Marine Impact Assessment, Coastal Waters Discharge Permit amendment application, and Delft3D Dispersion Modelling for Rheinmetall Denel Munition effluent discharges, Somerset West
2026	South Africa	SRK Consulting (South Africa) (Pty) Ltd	Co-author, marine ecologist Coastal Water Discharge Permit Application for the Fishwater Flats Waste Water Treatment Works, Nelson Mandela Bay Municipality
2024	Namibia	NAMDEB	Data scientist, marine ecologist, co-author Namdeb's offshore environmental monitoring programme in the midwater mining license area: bi-annual benthic sampling campaign
2024	South Africa	WSP Group Africa (Pty) Ltd	Data scientist, co-author Strategic Environmental Assessment (Marine Ecology)
2024	South Africa	Infinity Environmental/City of Cape Town	Co-author, data scientist, marine ecologist, scientific commercial diver City of Cape Town Marine Outfall Monitoring Programme
2024	South Africa	Acer (Africa)/ GenesisHexicon	Scientific commercial diver Marine benthic ecological assessment and impact assessment
2024	South Africa	DCA Sea Harvest	Co-author, marine ecologist, data scientist, scientific commercial diver Environmental monitoring and stock assessment
2024	Suriname	Creocean Environment and Oceanography/ TotalEnergies	Co-author, data scientist Ecological Baseline Study (EBS) – Taxonomic identification of Benthic Macrofauna from offshore Suriname, and description of the benthic community health
2024	South Africa	The Nature Conservancy/South African National Parks	Scientific commercial diver Subtidal surveys of commercially important invertebrates and indicator species within the Table Mountain Marine Protected Area.
2024	Kenya	World Bank	Data scientist High-level assessment of priority areas for implementation of Nbs (natural-based solutions) interventions in Kenya
2024	South Africa	SLR Consulting/WKN Windcurrent	Scientific commercial diver Marine baseline study for proposed desalination plant
2023–2024	Papua New Guinea	Creocean Environment and Oceanography/ TotalEnergies	Data scientist, co-author Ecological Baseline Study (EBS) - Taxonomic Identification of Benthic Macrofauna and description of the benthic community health.

Period	Country	Clients	Project, Tasks
2026	South Africa	Rheinmetall Denel Munition	Co-author, marine ecologist Marine Impact Assessment, Coastal Waters Discharge Permit amendment application, and Delft3D Dispersion Modelling for Rheinmetall Denel Munition effluent discharges, Somerset West
2026	South Africa	SRK Consulting (South Africa) (Pty) Ltd	Co-author, marine ecologist Coastal Water Discharge Permit Application for the Fishwater Flats Waste Water Treatment Works, Nelson Mandela Bay Municipality
2023	Congo	Creocean Environment and Oceanography/ TotalEnergies	Co-author Ecological monitoring study - Taxonomic Identification of Macrofauna from offshore of Angola (2306 EAME Angola)
2023	Mozambique	Eni Rovuma Basin (ERB); Consultec – Consultores Associados, Lda	Co-author Best Practicable Environmental Option and Dispersion Modelling Study for Onshore Drilling Water Discharge
2023	South Africa	South African National Parks	Field scientist Baseline Rocky Shore Biodiversity Survey, Robben Island
2023	South Africa	World Wide Fund (WWF) for Nature	Co-author Saldanha Bay Sea-based Aquaculture Development Zone Annual Benthic Chemical Survey

THESIS

Ho, Y. 2020. Macroparasites of jacobever *Helicolenus dactylopterus* (Delaroche, 1809) off the South African West Coast. BSc (Hons) Minor dissertation. University of Cape Town (UCT). p.45

Ho. Y. 2023. Population genetics of the endemic red-chested sea cucumber, *Hemiodon insolens*, along the southern coastline of Africa. MSc thesis. University of Cape Town (UCT). p.79

CONFERENCES/PRESENTATIONS

2022 Poster presentation: “Population genetics of endemic red-chested sea cucumber *Hemiodon insolens* along the southern coastline of Africa”. Southern African Marine Science Symposium (SAMSS). Elangeni Hotel, Durban.

2022 Presentation: “Population genetics of endemic red-chested sea cucumber *Hemiodon insolens* along the southern coastline of Africa”. Marine Chatties. Biological Sciences Department, University of Cape Town.

2025 Presentation: “Saldanha Bay DNA-based Monitoring: Biodiversity and Detection of Alien Species”. BlueRemediomics Educators Outreach (Institute for Microbial Biotechnology and Metagenomics, IMBM). DIPLOMICS, Woodstock, Cape Town.

2025 Presentation: “Sea of Skills: Diving into Environmental Consulting”. BlueRemediomics Learner Outreach for Careers in Marine Sciences (Institute for Microbial Biotechnology and Metagenomics, IMBM). DIPLOMICS, Woodstock, Cape Town.

2025 Conference and Presentation: “Beneath the Surface: eDNA Reveals Hidden Biodiversity off Southern Namibia and South Africa”. Southern African Marine Science Symposium (SAMSS). Southern Sun (Cape Sun), City Centre, Cape Town.

CURRICULUM VITAE

AMY GRACE WRIGHT

ACADEMIC QUALIFICATIONS:

MSc Biological Sciences, 2017, University of Cape Town

BSc (Hons) Biological Sciences, 2013, University of Cape Town

BSc Marine Biology and Applied Biology, 2012, University of Cape Town

OTHER TRAINING:

Deltares Academy Delft3D Environmental Modelling, 2019, Deltares, Netherlands

First aid (Level 1)

COUNTRY EXPERIENCE: South Africa, Namibia, Mozambique, Mauritius, Nigeria, Kenya, Angola, Tanzania, Madagascar, Ghana

LANGUAGE PROFICIENCY: English (Excellent), Afrikaans (Basic)

POSTAL ADDRESS: 8 Steenberg House, Silverwood Close, Tokai 7945

PHONE: +27-21-7013420

E-MAIL: amy@anchorenvironmental.co.za

EMPLOYMENT HISTORY:

2026-current: Practice Manager Marine Systems and Hydrodynamics (Anchor Environmental Consultants Part of SLR)

2025-2026: Senior Associate: Marine Ecosystems & Resources (Anchor Environmental Consultants)

2021-2025: Senior Consultant (Anchor Environmental Consultants)

2017-2021: Marine Consultant (Anchor Environmental Consultants)

2014: Intern Consultant (Capricorn Marine Environmental)

SUMMARY PROFILE

Amy is Practice Manager for Marine Systems and Hydrodynamics at Anchor Environmental and a professionally registered Natural Scientist (SACNASP 131256). Her current role involves strategic leadership of coastal processes and hydrodynamic modelling team working to derive evidence-based solutions to improve sustainability and regulatory compliance. Her work involves marine and estuarine ecological and physical process specialist impact and sustainability assessments (ESIA), environmental law, environmental auditing and permitting requirements (including IFC Performance Standards), environmental monitoring program design and implementation. She has a background in ecology with an MSc degree in Biological Sciences and BSc. Hons. degrees in Marine Biology and Applied Biology from the University of Cape Town. Her areas of expertise include maritime and estuarine engineering; reverse osmosis/desalination operations; industrial and small-scale intake, discharge and cooling systems (including gas to power, green hydrogen and fisheries processing); offshore oil and gas operations; land- and sea-based mariculture; dredging and offshore mining operations; and shipping (ballast, antifoulants). She has worked extensively across temperate and tropical African systems with experience in South Africa, Namibia, Mozambique, Mauritius, Nigeria, Kenya, Angola, Tanzania, Madagascar and Ghana.

TECHNICAL SKILLS: Delft3D modelling suite (FLOW, SWAN, WAQ, PART), CorMIX, Delft3D FM, Deltares MAMPEC, Ancylus MOM, WRPLot, SEATerm, Statistica, SPSS, BGIS, BEAM-Visat, OceanView, MS Suite.

MEMBERSHIP OF PROFESSIONAL BODIES/ORGANISATIONS:

- Professional Natural Scientist, the South African Council for Natural Scientific Professions (Registration Number: 131256) (2021-)
- NF-POGO Alumni Network for the Ocean (2015-)
- Golden Key Honour Society (2011-)

SELECT PROJECT EXPERIENCE

Period	Country	Clients	Project, Tasks
2026	South Africa	Rheinmetall Denel Munition	Team lead Marine Impact Assessment, Coastal Waters Discharge Permit amendment application, and Delft3D Dispersion Modelling for Rheinmetall Denel Munition effluent discharges, Somerset West.
2026	South Africa	SRK Consulting (South Africa) (Pty) Ltd	Team lead, marine ecologist Coastal Waters Discharge Permit Application for the Fishwater Flats Waste Water Treatment Works, Nelson Mandela Bay Municipality.
2026	Ghana	SLR Consulting for Helios Capital	Hydrodynamic modelling team lead Environmental and Social Due Diligence (ESDD) for a commercial Nile Tilapia aquaculture operation in Lake Volta, Ghana.
2025-2026	South Africa	WSP Group Africa (Pty) Ltd	Marine ecology team lead Thyspunt and Bantamsklip proposed Nuclear Power Plant Environmental and Social Impact Assessment (ESIA): Marine Ecology and Fisheries Impact Assessment Specialist Study
2025-2030	South Africa	Eskom	Project manager Provision of continuous marine engineering, monitoring and evaluation on an as and when required basis at Koeberg Nuclear Power Plant Operating Unit
2025	South Africa	African Marine Solutions	Marine ecologist and permitting specialist Preparation of an Environmental Management Plan (EMP) for ship-to-ship transfers required in terms of the Regulations for the Environmental Management of Offshore Ship-To-Ship Transfer (GN No. R. 6551, 28 August 2025).
2025	South Africa	DNV South Africa (Pty)	Marine ecology team lead Environmental screening (marine ecology and fisheries) of PetroSA offshore assets in Block 9 and 11a
2025	South Africa	PRDW Africa	Hydrodynamic modelling team lead Bed level change flood scenario analysis for the Milnerton Estuary under dredging scenarios. Included Delft3D sediment transport modelling.
2025	South Africa	WML Coastal Engineering	Project manager, marine ecologist Environmental Specialist Services in support of the Transnet National Ports Authority Foreshore Coastal Protection Project for the Port of Port Elizabeth.
2025	South Africa	Guillaume Nel Environmental Consultants	Project manager, estuarine ecologist Estuarine Constraints Analysis for the proposed Dreyersdal housing development, Zand estuary.

Period	Country	Clients	Project, Tasks
2025	South Africa	Savannah Environmental (Pty) Ltd	Team lead Marine Environmental Constraints Analysis and High-Level Impact Assessment for the Garden Route Gas to Power Project, Western Cape Province.
2025	South Africa	CES - Environmental and Social Advisory Services	Estuarine ecologist, hydrodynamic modelling team lead Estuarine specialist studies, inclusion avifauna impact assessment and Delft3D hydrodynamic modelling for the development of a Liquefied Natural Gas Import Terminal at the Port of Richards Bay, Kwazulu-Natal.
2025	South Africa	CES - Environmental and Social Advisory Services	Marine ecology specialist Marine Impact Assessment and Dispersion Model studies for a CWDP Application for a Brackish Water Reverse Osmosis Desalination Plant Discharge at Port Alfred
2025	South Africa	Infinity Environmental/ City of Cape Town	Team lead Hydrodynamic modelling and estuarine impact assessment for the dredging of the Zandvlei Estuary, Cape Town
2025	South Africa	Guillaume Nel Environmental Consultants	Team lead Coastal Impact Assessment study (including marine assessment and coastal erosion study) for development of houses and erosion control measures at Schyvershoek, Langebaan Lagoon
2025-2027	South Africa	uMngeni-uThukela Water	Project manager, audit team lead Bi-annual Coastal Waters Discharge Permit effluent quality compliance audit.
2025	South Africa	CSIR	Reviewer Strategic Environmental Assessment for a green hydrogen and port development in the Northern Cape.
2025	South Africa	WSP Group Africa (Pty) Ltd	Biodiversity specialist team lead Animal and terrestrial sensitivity specialist verification report for the proposed upgrade and deepening of the Maydon Wharf Berths 5-11 & 15 in the Port of Durban.
2025	Madagascar	ERM for Base Resources Limited	Marine ecology specialist IFC compliant marine coastal specialist studies for the Base Tolliara Project ESIA, Madagascar.
2025	South Africa	Savannah Environmental (Pty) Ltd	Team lead Site selection assessment (Delft3D hydrodynamic dispersion modelling study) for the desalination infrastructure of a proposed green hydrogen and ammonia production plant in Saldanha Bay, Western Cape Province
2025	South Africa	Guillaume Nel Environmental Consultants	Project manager, estuarine ecologist Estuarine compliance statement for proposed bulk water pipeline crossing of the Jakkals River Estuary, Lambert's Bay
2025	South Africa	V&A Waterfront	Marine ecology specialist Basic Assessment Process for a Mixed-Use Development at the V&A Waterfront, Cape Town, Western Cape.
2025	Angola	HCV Africa	Marine ecology team lead Marine Biodiversity Assessment and Ecosystem Services Assessment (ESIA, IFC compliant) for deep-water exploratory drilling in Block 47, Lower Congo Basin, Angola

Period	Country	Clients	Project, Tasks
2025	Zanzibar	ERM Consulting Tanzania Ltd	Marine ecology specialist Health, Safety, Environmental and Social Due Diligence Services for Zanzibar Ferry Terminal. IFC PS1 and PS6 compliance ESIA review
2025	South Africa	Infinity Environmental (Pty) Ltd / V&A Waterfront	Marine ecology team lead Marine Impact Assessment for and EIA Amendment process the proposed Granger Bay reclamation/revetment, V&A Waterfront, Cape Town
2024-2025	South Africa	Rheinmetall Denel Munition	Team lead Marine Impact Study and CorMix Dispersion Modelling for Rheinmetall Denel Munition effluent discharges, Somerset West
2025	South Africa	ECA Consulting	Project lead, Marine/estuarine ecology team lead Marine/Estuarine Impact Assessment for the proposed development of a Liquefied Petroleum Gas Terminal, Island View Precinct, Port of Durban
2025	South Africa	ECA Consulting/ Transnet	Marine ecologist Marine ecology, avifauna and water/sediment quality specialist studies for the proposed development of a Liquefied Natural Gas (LNG) Terminal at the Port of Ngqura
2025	South Africa	Enviroworks (Pty) Ltd	Marine ecologist Marine Ecology Impact Assessment for a Gas to Power Project at the Port of Ngqura
2025	South Africa	SLR Consulting (Africa)	Marine ecology team lead Block 11b/12b Environmental and Social Impact Assessment (ESIA): Marine Ecology Impact Assessment Specialist Study update
2025	South Africa	Lambert's Bay Foods (Pty) Ltd	Project manager, environmental auditor, marine ecology and hydrodynamic modelling team lead Environmental and effluent monitoring, audit and dispersion modelling in fulfilment of the awarded Coastal Waters Discharge Permit
2024-2026	South Africa	WSP Group Africa (Pty) Ltd	Marine ecology team lead Port of Durban Point Container Terminal Reconfiguration Environmental and Social Impact Assessment (ESIA): Marine Ecology and Avifauna Impact Assessment Specialist Study
2024	South Africa	WSP Group Africa (Pty) Ltd	Marine ecology team lead Environmental screening (marine ecology and fisheries) of PetroSA offshore assets in Block 9 and 11a
2024	South Africa	Infinity Environmental (Pty) Ltd	Project manager, estuarine ecologist, hydrodynamic modelling team lead Estuarine Impact Assessment and Hydrodynamic Modelling (Delft3D) to assess impacts of the proposed dredging of Milnerton Lagoon on estuarine function and water quality
2024	South Africa	V&A Waterfront	Marine systems team lead Compilation of Marine Monitoring Plans in accordance with two awarded CWDPs (brine and cooling water) and compilation of the Operational Environmental Management Program (OEMPr) for the operational phase of the V&A Waterfront Desalination Plant
2024	South Africa	Pioneer Fishing (Pty) Ltd	Project manager, marine ecologist, hydrodynamic modelling team lead Dispersion model and marine assessment in support of a Dumping at Sea Permit Application for the disposal of fish bloodwater at sea in Algoa Bay

Period	Country	Clients	Project, Tasks
2024	South Africa	Zutari	Project manager Aquatic ecology impact and risk assessment for the proposed Rooipoort renewable energy project, Klerkdrorp, Northwest Province
2024	South Africa	SLR Consulting (Africa)	Co-author and field scientist Marine Baseline Study for WKN Benguela H2 Project, Doringbaai.
2024	South Africa	Guillaume Nel Environmental Consultants	Project manager, estuarine ecologist Estuarine constraints analysis and impact assessment for the proposed upgrading of the Onrus Main Pump Station, Hermanus
2024	South Africa	GCS Water and Environmental Consultants	Project manager, estuarine ecologist Compliance statement for the Transnet National Ports Authority 22 MW Dual Fuel Generator project, Richards Bay
2024	South Africa	WSP Group Africa (Pty) Ltd	Project manager, marine ecologist Compliance statements for various development sites within the Port of Cape Town (three separate appointments)
2024	South Africa	Zutari	Project manager, water quality specialist, field scientist Ambient water quality monitoring in Table Bay for the proposed City of Cape Town desalination project
2024	South Africa	Gansbaai Marine	Senior environmental auditor Gansbaai Marine Effluent Analysis Compliance Audit
2024	South Africa	CES/Vopak/ Transnet	Estuarine ecologist, hydrodynamic modelling team lead Estuarine specialist studies, inclusion dispersion modelling in support of an EIA for the development of a Liquefied Natural Gas Import Terminal at the Port of Richards Bay, Kwazulu-Natal
2024	South Africa	ECA Consulting/ Transnet	Project manager, marine ecologist Marine and water quality specialist studies (monitoring and permit applications) for the construction of the marine infrastructure at the Port of Ngqura
2024	South Africa	M2 Environmental Connections (Pty) Ltd/ Astron Energy	Project manager, marine ecologist, hydrodynamic modelling team lead Marine specialist study, dispersion modelling and impact assessment a Coastal Waters Discharge Permit application for Astron Energy, Port Elizabeth
2024	South Africa	Port Nolloth Sea Farms	Project manager, marine scientist General Discharge Authorisation (GDA) application as per Section 69 of the National Environmental Management: Integrated Coastal Management Act (Act 24 of 2008)
2023	South Africa	SANParks	Field scientist Aerial survey of marine users of Table Mountain National Park Marine Protected Area
2023-2024	South Africa	r3 Green/Afro Fishing (Pty) Ltd	Project manager, marine ecologist, hydrodynamic modelling team lead Marine specialist study, dispersion modelling and impact assessment to inform a Coastal Waters Discharge Permit renewal application for the discharge fish processing water and cooling water in the Port of Mossel Bay

Period	Country	Clients	Project, Tasks
2023-2024	South Africa	De Beers Marine (Pty Ltd	Project manager, marine ecologist Design and conduct Environmental Monitoring as per awarded Coastal Waters Discharge Permit (CWDP) requirements for an outfall in the Port of Cape Town. Includes water quality (moored in situ instrumentation and CTD profiles), sediment quality and benthic macrofauna assessment
2023-2024	Mozambique	ERM - Environmental Resources Management for DP World	Project manager, estuarine ecologist, hydrodynamic modelling team lead Marine/estuarine specialist study and Delft-3D hydrodynamic dispersion modelling for an Environmental and Social Impact Assessment (ESIA) application for proposed expansion of the Maputo container terminal in the Port of Maputo, Mozambique
2023	Nigeria	ERM - Environmental Resources Management	Project manager, estuarine ecologist Gap analysis and desktop estuarine component of Environmental and Social Impact Assessment (ESIA) for the MM Port FZE Project at the Federal Ocean Terminal, Onne Port Complex, Nigeria
2023-2025	South Africa	Zutari	Project manager, marine ecologist Marine specialist for the EIA process for the Sea Water Desalination Project at the Cape Town Port Industrial Park (PIP)
2023	South Africa	ECA Consulting	Project manager, marine ecologist Maydon Wharf Channel Deepening in the Port of Durban- Update CSMP Berth 203 to 205
2023	South Africa	SANParks	Field scientist Robben Island Rocky Shore Survey
2023	Mozambique	Consultec – Consultores Associados, Lda.	Project manager, marine ecologist, hydrodynamic modelling team lead Best Practicable Environmental Option (BPEO) and dispersion modelling study for Coral South drilling water discharge/treatment options in Pemba Bay, Mozambique
2023	Mozambique	Consultec – Consultores Associados, Lda.	Project manager, marine ecologist, hydrodynamic modelling team lead Best Practicable Environmental Option (BPEO) and dispersion modelling study for EA amendment for the Coral South FLNG, Mozambique
2023	Mozambique	Consultec – Consultores Associados, Lda.	Project manager, marine ecologist, hydrodynamic modelling team lead International Association of Oil & Gas Producers (IOGP) Risk Based Assessment of offshore produced water discharge and Best Practicable Environmental Option (BPEO) for Coral South FLNG operations, Mozambique
2023	South Africa	Guillaume Nel Environmental Consultants	Project manager, estuarine ecologist Estuarine specialist study for the proposed upgrading of TR77/1 (R27), Velddrif
2023	South Africa	West Point Processes	Project manager, marine ecologist, hydrodynamic modelling team lead Update of marine specialist study and dispersion modelling for effluent discharge permits for the West Point fish meal processing plant, St Helena Bay. Liaison with marine engineers for pipe and diffuser design
2022-2023	South Africa	Lucky Star Limited, Pioneer Fishing (WC) (Pty) Ltd	Project manager, marine ecologist Dumping at Sea Permit application: marine environmental constraints analysis, site selection and impact statement

Period	Country	Clients	Project, Tasks
2022-2023	South Africa	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Impact Water Solutions (Pty) Ltd	Marine ecologist, hydrodynamic modelling team lead GIZ Green Hydrogen Desalination Study to provide strategic information on the technoeconomic, legal, environmental, and social applicability of desalination plants as water source for green hydrogen projects in South Africa. Decision-support analyses for four locations. Review of ESIA report. CorMIX model to assess effluent dispersion for preferred ESIA scenario and inform outfall design
2022	South Africa	ECA Consulting	Ecologist Avifauna impact assessment for the Maydon Wharf Deepening and Widening Project, Port of Durban
2022	South Africa	WSP Group Africa (Pty) Ltd	Marine ecologist Marine ecological screening analysis for proposed green hydrogen project, Boegoebaai, Northern Cape
2022	South Africa	Infinity Environmental (Pty) Ltd.	Estuarine ecologist Zandvlei Dredge Assessment: Current Ecological Status
2022	South Africa	SLR Consulting	Project manager, marine ecologist Marine environmental early phase screening /constraints analysis for a proposed large scale desalination plant on the West Coast of South Africa
2022	South Africa	Lucky Star Limited, Pioneer Fishing (WC) (Pty) Ltd	Project manager, marine ecologist, hydrodynamic modelling team lead Marine Impact Assessments and associated Coastal Waters Discharge Permit applications for the offloading of fish processing water in the Port of Mossel Bay
2022	South Africa	Transnet National Ports Authority	Marine ecologist Marine baseline report Port of Durban, fauna, flora and antifoulant contaminants
2022	South Africa	Johan Neethling Environmental Services cc	Project manager, estuarine ecologist Estuarine Specialist site visit for Pre-Compliance Notice ground truthing
2022	South Africa	Guillaume Nel Environmental Consultants	Project manager, estuarine ecologist Estuarine Impact Assessment and Constraints Analysis study of the Berg River Estuary, Western Cape
2022-2024	Namibia	DebMarine Namibia/ Anglo American	Hydrodynamic modelling team lead Development of a predictive model and monitoring system to inform real-time operational and environmental risk assessment
2022	South Africa	PHS Consulting	Project manager, marine ecologist, hydrodynamic modelling team lead Marine specialist study and dispersion modelling for a proposed Reverse Osmosis plant operation and discharge at the West Point fish meal processing plant, St Helena Bay
2022-2024	South Africa	Marine Living Resources Fund, Department of Environment, Forestry and Fisheries	Project manager Independent Environmental Control Officer (ECO) for the Saldanha Bay sea-based Aquaculture Development Zone
2022	South Africa	WSP Africa/ DNG Energy (Pty) Ltd	Project manager, ecologist Marine Ecology and Terrestrial/Aquatic Impact Assessment for the proposed gas-to-power facility and associated infrastructure in Mosselbay, Western Cape Province

Period	Country	Clients	Project, Tasks
2022-2023	South Africa	Lambert's Bay Foods (Pty) Ltd	Project manager, environmental auditor, marine ecology and hydrodynamic modelling team lead Environmental and effluent monitoring, audit and dispersion modelling in fulfilment of the awarded Coastal Waters Discharge Permit, and permit renewal application
2022	South Africa	SRK Consulting (South Africa) (Pty) Ltd	Project manager & marine ecology specialist Marine Ecology Impact Statement for expansion of a sea water intake at Tronox Mineral Sands (Pty) Ltd
2021-2023	South Africa	Nemai Consulting	Project manager & hydrodynamic modelling team lead Delft-3D hydrodynamic dispersion modelling study of the Mzimkhulu Estuary (Kwa Zulu Natal) to assess salinity distributions and hydrodynamic impacts of a proposed weir development
2022	South Africa	Sea Harvest (Pty) Ltd	Project manager, water quality specialist Development and assessment of monitoring program to evaluate water quality in support of proposed Coastal Waters Discharge Permit amendment
2022	South Africa	Guillaume Nel Environmental Consultants	Project manager, estuarine ecologist Estuarine Impact Assessment and Constraints Analysis study of the Goukou Estuary in Stilbaai, Western Cape
2021-2023	South Africa	WSP Group Africa (Pty) Ltd	Project manager, marine ecologist Total Energies Block 11b/12b Environmental and Social Impact Assessment (ESIA): Marine Ecology Impact Assessment Specialist Study
2021-2022	South Africa	Department of Environment, Forestry and Fisheries	Co-author Saldanha Bay Aquaculture Development Zone Environmental Monitoring: Inception report, Progress reports, Quarterly Monitoring reports
2021-2022	South Africa	Nemai Consulting	Field scientist, water quality specialist Ecological Water Requirements (EWR) update and estuarine impact assessment for the Mzimkhulu Estuary, Kwa Zulu Natal
2021-2022	South Africa	Exigent Engineering Consultants	Project manager, marine ecologist & hydrodynamic modelling team lead Marine Impact Assessments and hydrodynamic dispersion modelling for proposed FSRU facilities and associated infrastructure in Saldanha Bay
2021	South Africa	V&A Waterfront	Co-author Economic Assessment of Recreational Sailing in Cape Town
2021	South Africa	EcoMo Homes	Project manager Freshwater Assessment: Wetland Delineation for Erf 325, Franschoek
2021	South Africa	Mossel Bay Municipality	Co-author Amendments to the Environmental Maintenance Management Plan (EMMP) for the Great Brak Estuary, Mossel Bay
2021-2023	South Africa	Mhlathuze Water	Project manager, audit team lead Annual Coastal Waters Discharge Permit effluent quality compliance audit
2021	South Africa	PHS Consulting	Project manager, marine ecologist, hydrodynamic modelling team lead Marine specialist study and dispersion modelling for the proposed expansion of the West Point fish meal processing plant, St Helena Bay

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2021	South Africa	SLR Consulting (South Africa) (Pty) Ltd	Project manager, marine ecologist Marine Ecology Specialist Assessment for the import and export of refined petroleum products at Berth 104 in Big Bay, Saldanha
2021	South Africa	V&A Waterfront	Co-author Economic impact analysis of the proposed Granger Bay Marina
2021	South Africa	SRK Consulting (South Africa) (Pty) Ltd	Project manager Olifants estuarine baseline and ephemeral system hydrological modelling study to inform sensitivity study for De Punt prospecting site
2021	South Africa	Proxa Water (Pty) Ltd	Project manager, audit team lead Coastal Waters Discharge Permit compliance audit as requested by the Department of Forestry, Fisheries and the Environment
2021	South Africa	Bigen Africa Services (Pty) Ltd	Project manager Bioassay toxicity testing in line with the requirements of the Caledon Waste Water Treatment Works Water Use License
2021	Namibia	Benguela Current Commission	Project manager (South African team) Drafting of national legislation for the effective implementation of the Ballast Water Convention in Namibia
2021	South Africa	Nsovo Environmental Consulting	Project manager, marine ecologist Marine Impact Assessments for proposed gas-to-power facilities (FSRU) and associated infrastructure development in Saldanha Bay, Mossel Bay and Coega
2021	South Africa	Allan Gray (Pty) Ltd	Project manager, audit team lead Coastal Waters Discharge Permit compliance audit
2021	South Africa	PetroSA	Water quality specialist Assessment of the inshore subtidal environment in the vicinity of the PetroSA Outfall at Vleesbaai, Mossel Bay
2020-2021	South Africa	V&A Waterfront	Project manager & hydrodynamic modelling team lead Marine specialist study and dispersion modelling for the East Pier District cooling plant outfall at the V&A Waterfront
2020-2021	South Africa	De Beers Marine (Pty) Ltd	Project manager & hydrodynamic modelling team lead Far field dispersion modelling (Delft 3D FLOW) and impact statement for proposed desalination outfalls in the Port of Cape Town. Amendment to CWDP
2020, 2023	South Africa	St Helena Bay Water Quality Trust	Co-author The State of St Helena Bay, ongoing physico-chemical and ecological monitoring of St Helena Bay
2020	Kenya, Tanzania	Swedish Agency for Marine and Water Management	Specialist Poverty and gender considerations in Marine Spatial Planning: review and conceptual framework
2020	South Africa	Doug Jeffery Environmental Consultants	Project manager Wetland Rehabilitation plan for the Stillbay arterial roadway, Western Cape, South Africa
2020-2021	South Africa	CES - Environmental and Social Advisory Services	Project manager, marine ecologist Marine Impact Assessment for the proposed marine pipeline servitude at the Coega Industrial Development Zone, Port of Ngqura, South Africa
2020	South Africa	Guillaume Nel Environmental Consultants	Project manager, estuarine ecologist Estuarine Impact Assessment study for the development 222 and 223 Weir Road Milnerton

Period	Country	Clients	Project, Tasks
2020	South Africa	Chand Environmental Consultants	Project manager, marine ecologist Marine Specialist Study for the Proposed Transnet 2.5 Ml/D Reverse Osmosis Plant in the Port of Cape Town – Baseline Study and Impact Assessment Report
2020	South Africa	Transnet National Ports Authority	Marine ecology team lead Amendment to Environmental Authorisation of Transnet Berths 203-205 on the Port of Durban – Marine Ecology Impact Assessment of new proposed dredging activities
2020, 2022-2023, 2024	South Africa	Rheinmetall Denel Munition	Project manager, marine ecologist Coastal Waters Discharge Permit environmental monitoring and impact assessment (beach macrofauna, sediment, water quality)
2020	South Africa	City of Cape Town	Project manager, marine ecologist Marine ecology monitoring plans (MEMPs) for the Helderberg Marine Protected Area, Milnerton Lagoon and Zandvlei Estuary
2020	South Africa	City of Cape Town	Marine ecology specialist Biodiversity assessment/survey and public information programme for five tidal pools around the Cape Peninsula
2020, 2021	South Africa	SRK Consulting (South Africa) (Pty) Ltd	Marine ecology specialist Marine Ecology Impact Assessment for expansion of a sea water intake at Tronox Mineral Sands (Pty) Ltd
2020	South Africa	ATKV	Marine ecology team lead Hartenbos (Mossel Bay) dune stabilisation specialist study and impact assessment
2020	South Africa	Lake Michelle Estate	Marine ecology specialist Fish community survey of Lake Michelle, Noordhoek
2019-2020	South Africa	Department of Environmental Affairs and Development Planning (DEA&DP)	Hydrodynamics, sediment dynamics and biota Specialist Environmental flows and the health and value of the Berg River Estuary: Potential trade-offs between estuary value and regional water supply under a changing climate
2019-2022	South Africa	Sea Harvest (Pty) Ltd	Project manager, hydrodynamic modelling team lead and marine ecologist Development and undertaking of monitoring program (sediment, water quality and benthic macrofauna) to both fulfil CWDP conditions and validate the CorMIX hydrodynamic modelling study that informed the application
2019-2020	South Africa	Bivalve Shellfish Farmers Association of South Africa – Saldanha Bay Chapter	Marine ecology team lead Sanitary Survey Report for Saldanha Bay in accordance with guidelines stipulated in the South African Live Molluscan Shellfish Monitoring and Control Programme (2017)
2019-2020	South Africa	ArcelorMittal Saldanha	Project manager, marine ecologist Design and implementation of the environmental monitoring program in accordance with the CWDP
2019	South Africa	De Beers Marine (Pty) Ltd	Project manager, hydrodynamic modelling team lead and marine ecologist Dispersion modelling (CorMix) and specialist marine impact statement for a desalination discharge in the Port of Cape Town
2019	South Africa	De Beers Marine (Pty) Ltd	Project manager Review of environmental permitting requirements for the De Beers Port of Cape Town desalination plant

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2019	South Africa	Doug Jeffery Environmental Consultants	Project manager, hydrodynamic modelling team lead and marine ecologist Delft 3D (FLOW, WAQ) hydrodynamic modelling, CorMIX dispersion modelling and specialist marine impact studies for a proposed Atlantic Salmon farm the Port of Cape Town
2019-2021	Mauritius	International Ocean Institute; Mauritius Oceanography Institute	Hydrodynamic modelling team lead and marine ecologist Development of a Deltares MAMPEC dispersion model to capture marine pollutant dispersion resulting from in-water hull cleaning in Port Louis. Included training of the MOI staff in the use, set up and calibration of the model, as well as in collection, interpretation and implementation of the requisite oceanographic data
2019	Mozambique	JG Afrika	Project manager, estuarine ecologist Estuarine specialist report for proposed MOZAL Matola River pipeline
2018-2019	South Africa	Planet Capital (Pty) Ltd	Project manager & hydrodynamic modelling team lead Dispersion modelling of effluent outfall (CorMix), baseline study, impact assessment and CWDP application for the discharge of land-based aquaculture effluent
2018	South Africa	NuLeaf Planning & Environmental	Estuarine ecology team lead Marine impact assessment for the establishment of an aquaculture development zone in Amatikulu Estuary, Kwa-Zulu Natal
2018-2019	South Africa	Lwandle Technologies (Pty) Ltd	Marine ecology specialist City of Cape Town small scale desalination plant monitoring program marine ecology baseline, operational and post-operational monitoring report
2018	South Africa	Marine Living Resources Fund, Department of Agriculture, Forestry and Fisheries	Team lead (Hydrodynamic modelling team lead) Ancylus MOM dispersion modelling of finfish cage aquaculture in Algoa Bay to determine impacts and carrying capacity
2018	South Africa	Marine Living Resources Fund, Department of Agriculture, Forestry and Fisheries	Hydrodynamics and marine ecology specialist Algoa Bay Sea-Based Aquaculture Development Zone: Basic Assessment Process in Terms of the National Environmental Management Act, 1998 (Act No. 107 Of 1998) - Pre-Application Basic Assessment Report Appendix D: Marine Specialist Impact Assessment
2018, 2024	South Africa	SeaVuna Fishing Company (Pty) Ltd	Project manager & hydrodynamic modelling team lead Dispersion modelling of effluent outfall (CorMix), baseline study and impact assessment for the discharge of brine effluent into the Port of Mossel Bay as per the awarded CWDP
2018, 2023	South Africa	V&A Waterfront	Project manager, marine ecologist Development and implementation of an Environmental Monitoring in accordance with CWDP 2013/002/WC/Victoria & Alfred to both fulfil CWDP conditions and validate the hydrodynamic modelling study that informed the application
2018	South Africa	Chand Environmental Consultants	Project manager, marine ecologist Marine specialist study and impact assessment for a CWDP application for a reverse osmosis plant at the Cape Town International Convention Centre (CTICC)

Period	Country	Clients	Project, Tasks
2018-2019	South Africa	Sea Harvest (Pty) Ltd	Project manager, hydrodynamic modelling team lead and marine ecologist Dispersion modelling of effluent outfall (CorMix), baseline study, impact assessment and CWDP application for the discharge of brine effluent into Saldanha Bay
2018	South Africa	City of uMhlathuze	Team lead (estuarine ecology) Estuarine ecology impact assessment for construction of a new bridge over the Mzingazi Canal at the Richards Bay Waterfront
2018	South Africa	Turnkey Water Solutions, Hessequa Local Municipality	Estuarine ecology specialist Marine ecology impact assessment and dispersion modelling for the discharge of brine from a Reverse Osmosis Plant in the Breede River Estuary
2018	South Africa	Khula Environmental Services	Team lead (marine ecology) Marine ecology impact assessment for the maintenance management plan for the rock revetment at East Pier, Port of Cape Town
2018-2021	South Africa	Mhlathuze Water	Marine ecology and effluent specialist Marine Environment Impact Assessment for Mhlathuze Water Effluent Pipelines, in Richards Bay
2018	South Africa	WSP, Environment & Energy, Africa	Project manager, marine ecologist Marine ecology impact assessment for sea water cooling system intake discharge in the Port of Cape Town
2018	Mozambique	JG Afrika	Project manager, hydrodynamic modelling team lead and estuarine ecologist Dispersion modelling of effluent outfall (CorMix), baseline study and impact assessment for the discharge of brine effluent into Maputo Bay
2018	South Africa	SRK Consulting (South Africa) (Pty) Ltd	Project manager, hydrodynamic modelling team lead and marine ecologist Dispersion modelling of effluent outfall (CorMix), baseline study and impact assessment for the discharge of brine effluent into Saldanha Bay. Preparation of the Coastal Waters Discharge Permit
2018	South Africa	Sun International, Table Bay Hotel; GCX Analytics GCX Water	Project manager, hydrodynamic modelling team lead and marine ecologist Dispersion modelling of effluent outfall (CorMix), baseline study and impact assessment for the discharge of brine effluent into Table Bay. Preparation of the Coastal Waters Discharge Permit; registration as a Water Services Intermediately with the Department of Water and Sanitation; registration as a private sector water provision intervention under the City of Cape Town S30A Directive
2018	South Africa	ArcelorMittal Saldanha	Project manager, hydrodynamic modelling team lead and marine ecologist Dispersion modelling of effluent outfall (CorMix), baseline study and impact assessment for the discharge of brine effluent into Saldanha Bay. Preparation of Coastal Waters Discharge Permit application
2018	South Africa	Mainport Africa	Marine ecology specialist Assessment of biofouling community collected from NM Cherry Blossom
2017	South Africa	Viking Fisheries	Fisheries specialist Socio-economic assessment of the impacts in a reduction of quota on a small commercial fishery

Period	Country	Clients	Project, Tasks
2017	South Africa	SRK Consulting (South Africa) (Pty) Ltd	Marine ecology specialist Tormin Mine EIA assessment, West Coast, South Africa; marine specialist report: baseline scoping report and marine environmental impact assessment
2017	South Africa	GIBB	Marine ecology team lead Marine specialist report for Table Bay and the Port of Cape Town; review of the known data regarding the oceanographic and ecological conditions of Table Bay and the Port of Cape Town
2017	South Africa	GIBB	Marine ecology specialist CorMIX modelling of effluent outfall for storm surge scenario for Cape Recife WWTW
2017	South Africa	Oiltanking MOGS (Pty) Ltd and Advisian	Marine ecology team lead Impact assessment for the proposed expansion of the crude oil jetty and construction of the associated pipeline system, Saldanha Bay, Western Cape; marine specialist report: baseline scoping report and marine environmental impact assessment
2017	South Africa	Nsovo Environmental Consulting	Project manager Impact assessment for the proposed design and construction of the IOT stormwater system Saldanha Bay, Western Cape; marine specialist report: baseline scoping report and marine environmental impact assessment
2017	South Africa	Eco Impact Legal Consulting (Pty) Ltd.	Estuarine ecology team lead Estuarine specialist study and impact assessment for the proposed expansion of Kliphoek Resort, Velddrif
2017	South Africa	Advisian, City of Cape Town	Marine ecology specialist Marine ecology impact assessments for eleven desalination plants for the Cape Town Emergency Water Resilience Project
2017, 2018, 2021-2025	South Africa	Saldanha Bay Water Quality Forum Trust	Marine ecology specialist The State of Saldanha Bay and Langebaan Lagoon; ongoing annual physico-chemical and ecological monitoring of Saldanha Bay and Langebaan Lagoon
2017	Namibia	NAMDEB	Invertebrate taxonomy specialist Annual benthic sampling campaign: NAMDEB's offshore environmental monitoring programme in the midwater mining license area
2017	Namibia	De Beers Marine Namibia	Invertebrate taxonomy specialist Annual benthic sampling campaign: De Beers Marine Namibia environmental monitoring programme in the Atlantic 1 mining license area for 2016
2017	Namibia	De Beers Marine Namibia	Invertebrate taxonomy specialist Annual benthic sampling campaign: De Beers Marine Namibia environmental monitoring programme in the Atlantic 1 mining license area for 2015

STUDENT CO-SUPERVISION

Year	Name	Institution	Degree	Thesis title
2017	Arno Botha	UCT	BSc (Hon)	Build or rent? Advantages and disadvantages of pseudo shells to two deep-water hermit crab species.

PUBLICATION RECORD

- Wright, A.G.**, Griffiths, C.L. & Fairweather, T. 2020. Distribution and abundance patterns of two parapagurid hermit crabs (Crustacea: Decapoda: Anomura) along the west and south coasts of South Africa. *African Journal of Marine Science* 42(2): 177-183.
- Wright, A.G.**, Botha, T.P.A. & Griffiths, C.L. 2019. Population structure and morphology of South African deep-water parapagurid hermit crabs. *Acta Zoologica*: 1–15.
- Pillay, D., Moyo, R., **Wright, A.G.** 2018. Density- vs trait-mediated responses of a symbiont (*Betaeus jucundus*) to burrows of a burrowing crustacean (*Callichirus kraussi*). *Estuarine, Coastal and Shelf Science* 209: 183-190.
- Wright, A.G.**, Perez-Portela, R., Griffiths, C.L. 2016. Determining the correct identity of South African Marthasterias (Echinodermata: Asteroidea). *African Journal of Marine Science* 8(3): 443-455.

THESES

- Wright, A.G. (In process). *Dispersion modelling applications to inform management and assessment of anthropogenic discharges impacts to coastal marine systems*
- Wright, A.G.** 2017. *Deep water parapagurid hermit crabs: their distribution, abundance population structure and associations in the Southern Benguela*. MSc Thesis, University of Cape Town, 120 pp.
- Wright, A.G.** 2013. *Drivers of burrow symbiont distribution in a soft-sediment system: host abundance or burrow trophic environment?* BSc Hons. Thesis, University of Cape Town, 33 pp.
- Wright, A.G.** 2013. *Resolution of the Marthasterias Taxonomic "Disar-star"*. BSc Hons. Thesis, University of Cape Town, 32 pp.

CONFERENCES

- 2025 Southern African Marine Science Symposium. Applicability of a near-field model to inform impacts to and management of land derived coastal discharges on coastal marine systems
- 2019 Deltares Delft Software Days. Hydrology and hydrodynamics; Coastal morphodynamics; Water quality and ecology.
- 2016 International Benguela Symposium. Long-term changes in distribution and population structure of deep water hermit crabs in the southern Benguela (awarded Best Poster)
- 2015 Zoological Society of South Africa (ZSSA). Deep water hermit crab–zoanthid associations
- 2014 Southern African Marine Science Symposium. The Marthasterias "disar-star"

CURRICULUM VITAE

AIDEN BICCARD

ACADEMIC QUALIFICATIONS:

- MSc. Marine Zoology, 2012, University of Cape Town
- BSc. (Hons) Marine Ecology, 2007, University of Cape Town
- BSc. Botany and Zoology, 2006, University of Cape Town

OTHER QUALIFICATIONS:

- Medically in date scientific/commercial class IV diver, class IV diving supervisor, category C small craft skipper with dive endorsement, VHF short-range radio operator, advanced level 3 first aid, basic offshore survival induction emergency training (BOSIET) including safety induction, Heli Safety & Escape (HUET & CA-EBS), sea survival & first aid, firefighting and self-rescue (OPITO Approved).

COUNTRY EXPERIENCE: South Africa, Namibia, Mozambique, Republic of Congo, Seychelles, Sierra Leone, Somaliland, Suriname.

LANGUAGE PROFICIENCY: English (Excellent), Afrikaans (Good)

POSTAL ADDRESS: 8 Steenberg House, Silverwood Close, Tokai 7945

PHONE: +27-21-7013420/+27-72-497 1512 **E-MAIL:** aiden@anchorenvironmental.co.za

EMPLOYMENT HISTORY: 2026-present: Practice Manager, Benthic Science, Anchor Environmental Consultants Part of SLR

2012-2026: Senior Associate, Anchor Environmental Consultants

2007-2012: Part-time Research Assistant/Demonstrator, University of Cape Town & Anchor Environmental

SUMMARY PROFILE

Aiden has 20 years of research and consulting experience in ecological and biodiversity surveys of marine, estuarine, and freshwater benthic habitats, with expertise in invertebrate taxonomy and systematics, specialist marine impact assessments, biofouling, hydrocarbon and antifoulant contamination, trace metal pollution, and physico-chemical surveys. He is presently Practice Manager (Benthic Science) for an Environmental Consultancy firm (Anchor Environmental Consultants, part of the SLR Group). At Anchor, he leads a team specialising in benthic marine studies for a range of local and international clients. He is the author of six peer-reviewed scientific publications and numerous specialist reports in his capacity as a benthic invertebrate biologist. Aiden has conducted biodiversity field surveys and assessments across South Africa, Namibia, the Republic of Congo, Sierra Leone, Somaliland, and Mozambique. He also has more than 19 years of experience as a Class IV scientific diver/supervisor and small craft skipper.

MEMBERSHIP OF PROFESSIONAL BODIES/ORGANISATIONS:

- Professional Natural Scientist, the South African Council for Natural Scientific Professions (2024-present)
- African Network of Deep-water Researchers (2023 -)
- Member of The South African Society of Systematic Biology (2008-)
- Member of The Golden Key Honour Society (2007-)

SELECT PROJECT EXPERIENCE

Date	Country	Client	Task
2026	South Africa	DFFE	Fishery Independent Abalone Surveys Survey logistics and execution of in-field abalone dive surveys as a scientific diver, supervisor and small craft skipper.
2025-2026	Namibia	Namdeb	Namdeb Coastal Monitoring Programme Intertidal (rocky shore, sandy beach) surveys – project management, survey design, survey logistics, field work, identification of infauna, data analysis and reporting.
2025	South Africa	Beltan Park/Transhex	2025 Benthic Monitoring Campaign Project leader – project management, survey design, survey logistics, identification of benthic invertebrate macrofauna, analysis of underwater video footage, statistical analyses and writing of report.
2025-2026	South Africa	City of Cape Town	End of Pipe Environmental Assessment and Monitoring Programme for the City's designated wastewater Marine Outfalls. Survey logistics, collection of bio-monitoring samples (fish, mussels and lobsters). Scientific diver/supervisor and small craft skipper.
2014-present	Namibia	De Beers Marine Namibia	De Beers Marine Namibia Environmental Monitoring Programme in the Atlantic 1 Mining License Area: Annual Benthic Sampling Campaign Project Leader – Survey techniques include the use of a Van Veen grab, sediment and water quality instruments, manned submersible surveys, drop camera and benthic tow camera systems. Identify benthic invertebrate macrofauna, analysis of underwater video footage, statistical analyses and writing of report.
2021-2025	South Africa	Diamond Coast Abalone	Environmental Monitoring and stock assessment for abalone ranching concession Area NC4, Northern Cape. Scientific diver, supervisor and small craft skipper.

Date	Country	Client	Task
2021-present	Namibia	Anglo American/NatureMetrics	DNA-based sampling (eDNA & metabarcoding) analyses for marine benthic fauna and sediment fauna at the Atlantic 1 marine mining site operated by Debmarmine Namibia (DBMN). Project Leader – Sampling techniques include the use of a Van Veen grab and various sediment and water quality instruments; collection and preservation of water and sediment eDNA samples; collection, preservation, and identification of voucher specimens for metabarcoding.
2024	South Africa	WSP Group Africa	Boegoebaai Strategic Environmental Assessment – Marine Ecology Specialist report Identification of invertebrate infauna, statistical analyses and reporting.
2022	South Africa	Transnet National Ports Authority	Baseline survey marine fauna, flora and antifouling contaminants Port of Durban. Invertebrate specialist - collection, preservation and identification of invertebrates. Data analysis and report writing.
2021-present	Somaliland	WSP/ DP World	Coral relocation feasibility study as part of the upgrade of Berbera Port, Somaliland (Phase 1) Marine biologist and scientific diver.
2015, 2016, 2021, 2023	Namibia	NAMDEB	NAMDEB's Offshore Environmental Monitoring Programme in the Midwater Mining License Area: Annual Benthic Sampling campaign Project leader - Conceptualisation of study involving site selection and experimental design. Lead a team of 9 assistants to collect and preserve grab and sediment samples aboard a survey vessel for 1 month at sea. Identify benthic invertebrate macrofauna. Analyse data and prepare report.
2022-2025	South Africa	Anglo Shipping	Saldanha Bay DNA-Based Monitoring: Biodiversity and Detection of Non-Native Species. Invertebrate specialist, scientific diver and supervisor, sample collection, preservation, identification of fouling biota, data analysis and reporting.
2021-2022	South Africa	Trans Atlantic Diamonds	Marine Specialist Impact Assessment for Exploration and Prospecting Activities In Concession 7C, 11C, 12B, 14A and 14C, South Africa Marine Specialist – Conducting Marine Ecological Impact Assessments. Compiling reports

Date	Country	Client	Task
2021	South Africa	WWF-South Africa	Environmental Specialist Benthic Monitoring programme for the Saldanha Bay Aquaculture Development Zone. Invertebrate specialist - collection, preservation and identification of invertebrates.
2020-present	South Africa	Department of Environment Forestry and Fisheries (DEFF)	Environmental Specialist Monitoring of the Saldanha Bay Aquaculture Development Zone. Invertebrate specialist, scientific diver.
2019-present	South Africa	South African National Parks	Subtidal surveys of commercially important and indicator invertebrate and fish species within the Table Mountain Marine Protected Area. Scientific diver and supervisor.
2014-present	Namibia	Pisces Environmental	Sandy beach macrofauna and sediment quality monitoring programme for the Elizabeth Bay and Southern Coastal Mining License Areas, Namibia. Intertidal rocky shore, sandy beach and subtidal field surveys – data collection, collect and preserve invertebrate samples.
2018	The Biodiversity Company, Sintoukola Potash	Republic of Congo	Oceanographic and benthic surveys and ecotoxicity trials to assess potential impacts of proposed potash processing discharge, jetty construction and transhipment of product. Invertebrate specialist - collection, preservation and identification of invertebrates.
2012-present	South Africa	Saldanha Bay Water Quality Forum Trust (SBWQMFT)	Annual State of the Bay Monitoring programme (Saldanha and St. Helena Bay). Project Leader and invertebrate specialist - collection, preservation and identification of invertebrates. Rocky shore intertidal surveys. Initiating new data collection and survey programmes. Statistical analyses and writing of report.
2018	South Africa	Council for Geoscience /Department of Mineral Resources	Desktop study of the potential impacts of marine and coastal mining on marine ecosystems and marine biota in South Africa Project Leader and Principal Author.
2018	South Africa	Mainport Africa Shipping	Assessment of Biofouling Community of the NM Cherry Blossom. Project Leader – Supervision of team for project execution. Identify benthic invertebrate macrofauna, statistical analyses and writing of report.
2012-2022	South Africa	Umhlatuze Water	Environmental monitoring of the Richards Bay Pipelines. Senior consultant. Invertebrate specialist.

Date	Country	Client	Task
2016-2017	South Africa	Department of Water and Sanitation	Classification of and resource quality objectives for the water resources of the Berg and Breede water management areas. Senior consultant responsible for status quo descriptions of estuaries in the two study areas and invertebrate specialist for ecological reserve determination studies on nine estuaries.
2016	Namibia	De Beers Marine Namibia/University of Namibia	The use of underwater video footage as a tool in the assessment of mining related impacts on the hard-bottom benthic environment in Southern Namibia Student supervisor for a Masters Project at the University of Namibia – experimental design and development of a method to assess video footage collected aboard the manned submersible, JAGO.
2016	Namibia	De Beers Marine Namibia	Screen monitoring on De Beers Marine Namibia mining vessels in the Atlantic 1 Mining Licence Area: a pilot study. Project Leader – Experimental design and conceptualisation. Development and implementation of screen monitoring protocol of biota aboard mining vessels.
2016	South Africa	Tongaat Hulett Developments	Marine ecology impact assessment for a proposed beach enhancement initiative at Tinley Manor. Intertidal Sandy beach field surveys – collect and preserve invertebrate samples, photographic survey of intertidal and subtidal habitat.
2015	South Africa	Department of Water and Sanitation	Determination of the Ecological Reserve for the Klein Estuary Invertebrate Specialist – collect, preserve and identify invertebrate specimens and assess health of the estuary based on results. Present findings at a workshop.
2015	Mozambique	Bergstan South Africa Consulting and Development Engineers	Environmental scoping study for proposed upgrades to the cruise liner landing facilities at Portuguese Island, Mozambique Project Leader - photographic survey of intertidal and subtidal habitat, data analysis, report write-up.
2015	Namibia	Pisces Environmental Services	Gecko Namibia Vision Industrial Park Development. Conduct baseline field survey of ichthyofauna using beach seine net.

Date	Country	Client	Task
2014-2016	South Africa	Transnet National Ports Authority/Nemai Consulting	Baseline Environmental Monitoring of Sand Banks in the Port of Durban Field survey assistant for the implementation of a water, sediment quality and biological monitoring programme in the Port of Durban.
2014	South Africa	SRK Consulting	Marine Ecology Specialist Study and Impact Assessment for Upgrades to Seawater Intake and Transfer Infrastructure at the Tronox Namakwa Sands Mine Project Leader – photographic survey of rocky shore habitat, data analysis, report write-up.
Bergstam	South Africa	Coastal & Environmental Services	Zirco Roo de Heuvel Mine, Northern Cape, South Africa. Marine Specialist Study and Impact Assessment Project Leader - transect and quadrat sampling of rocky shore habitat, data analysis, report write-up.
2014-present	South Africa	Port Nolloth Sea Farms Ranching (PTY) LTD.	Baseline survey and monitoring plan for abalone ranching concession area NC3 Subtidal ecological surveys, scientific diver and supervisor.
2013	South Africa	Cape Nature, Department of Environmental Affairs	Assessment of impacts of an oil spill on sandy beach and rocky intertidal communities in the Goukamma MPA. Invertebrate specialist – collect, preserve and identify invertebrates, train interns at DAFF on identification techniques.
2013	South Africa	Transnet National Ports Authority	TNPA Alien Invasive Species Survey (Coega) Collection, preservation and identification of invertebrates.
2013, 2015-2016	South Africa	Department of Agriculture, Forestry & Fisheries (DAFF)	Diving Surveys of the Eastern Cape Abalone Resource. Subtidal abalone counts (transects)
2012	South Africa	A. R. Brink and Associates	Identification and Age Estimation of Fouling Cirripedia Collected from M. V. “DD Vogue” Project leader. Sample collection and preservation, identification of fouling biota, data analysis and reporting.
2012	South Africa	Department of Agriculture, Forestry & Fisheries (DAFF)	Algoa Bay fin fish mariculture (DAFF) Deployment, recovery and servicing of ADCP’s and thermistor strings. Single-beam echo bathymetry survey. Grab sample collection of benthic macrofauna. Preservation and identification of invertebrate fauna.
2012	South Africa	Ethekwini Municipality	Baseline Survey and EIA for Umhlanga Rocks tidal pool. Transect and quadrat sampling of rocky shore habitat.

Date	Country	Client	Task
2012	South Africa	Henwood & Nxumalo Consulting Engineers	Environmental Impact Assessment of Mzinto Bridge Repair. Project Leader - collection, preservation and identification of invertebrates. Statistical analyses and writing of report.
2012	South Africa	Nemai Consulting	Specialist study to assess marine ecological impacts of offshore sand winning associated with the deepening, lengthening and widening of berth 203 to 205, container terminal, Port of Durban. Research and analysis of data, report writing.
2012	South Africa	Cape Action Plan for People & the Environment/ Cape Nature/Marine & Coastal Management	Gouritz Estuary Management Plan Review. Review and evaluate proposed EMP according to the National Estuary Management Protocol. Present findings at a workshop.
2012	Namibia	Pisces Environmental	Annual Rocky intertidal and sandy beach biota of Namibia’s Pocket Beaches (NAMDEB Diamond Company, Namibia). Field work, statistical analyses and report writing.
2012	Namibia	Pisces Environmental	Scientific Diver and Supervisor for Bogenfels subtidal reef survey (NAMDEB Diamond Company, Namibia). Field work (identify and quantify subtidal reef species).
2012	South Africa	Cape Action Plan for People & the Environment/ Cape Nature/Marine & Coastal Management	Rapid determination of the Environmental Water Requirements for the Uilkraals Estuary. Identify invertebrate specimens and assess health of the estuary based on results. Present findings at a workshop.
Feb 2012	South Africa	Various companies	Marine specialist report and impact assessment for the reverse osmosis plant at Plettenberg Bay. Fish counts on SCUBA. Collection, preservation and identification of invertebrates. Statistical analyses and writing of report.

PUBLICATION RECORD

Amoré Malan, Aiden Biccard, Jessica Dawson, Robyn Payne, Kevin Schmidt, Kirti N. Gihwala, Ken Hutchings, Deon Louw, Josef Shikeva, Blessing Kamwi, Lapaka Kaimbi, Julien Vumazonke, Megameno Mutaleni, Thomas Shannon, Sarah Chordekar & Vere Ross-Gillespie. (2025). Diversity, distribution and knowledge gaps of Polychaeta on the continental shelf of southern Namibia. African Zoology, 60(1–2), 163–178.
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Whitehead O, Biccard A & Griffiths CL. (2011). South African pelagic goose barnacles: substratum preferences and influence of plastic debris on abundance and distribution. *Crustaceana* 84 (5-6), 635-649.

Biccard A & Midgley JJ. (2009). Rodent pollination in *Protea nana*. *South African Journal of Botany* 75, 720– 725.

THESES

Biccard, A. 2012. Taxonomy, Systematics and Biogeography of South African Thoracic Cirripedia. MSc. Thesis, University of Cape Town, 160 pp.

CONSULTING RESEARCH REPORTS

Biccard, A., Rees, A., Ho, Y., Gammon, E.J., Malan, A., Le Gall, L., Payne, R., Henry, T. Cook, J., Schmidt, K.M., Nkwentsha, O., Malgas, M., Joja, E., Haihambo, W., Januarie, D., Kanyemba, J., Gazeau, B., Clark, B. & Wright, A.G. 2026. De Beers Marine Namibia Benthic Environmental Monitoring Programme: Atlantic 1 Mining Licence Area 2024 Sampling Campaign. Report no. 2210/2 prepared by Anchor Environmental Consultants (Pty) Ltd for De Beers Marine Namibia (Pty) Ltd. 209 pp.

Biccard A, Hutchings K, and W. Haihambo 2025. Sandy Beach Ecological Monitoring Report: Southern Coastal Mines. Report no. 2250/2 prepared by Anchor Environmental Consultants (Pty) Ltd for NAMDEB Diamond Corporation (Pty) Ltd. 81 pp.

Biccard A, Payne RP, Henry T, Ho Y, Malan A, Gammon E, Rees A, Schmidt KM, Wright A, Rajeev H, Nashima P, Nkwentsha O, Malgas M, Joja E, Januarie D, Kanyemba J, Bovim LA and Clark BM. 2025. De Beers Marine Namibia Benthic Environmental Monitoring Programme: Atlantic 1 Mining Licence Area 2023 Sampling Campaign. Report prepared for De Beers Marine Namibia (Pty) Ltd by Anchor Environmental Consultants (Pty) Ltd. Report no. AEC2137.

Clark BM, Ho Y-T, Gammon E, Biccard A, Rees A., Pulfrich A, and AG Wright. 2024. Boegoebaai Strategic Environmental Assessment – Marine Ecology. Report no. 2212/1 prepared by Anchor Environmental Consultants (Pty) Ltd and Pisces Environmental Services (Pty) Ltd for WSP Group Africa (Pty) Ltd. 131 pp.

Malan A. and Biccard A. 2024. Summary Report and Assessment of Environmental Monitoring and Diamond Mining Recovery in Sea Concession 2C. Report no. 2228/1 prepared by Anchor Environmental Consultants (Pty) Ltd for Belton Park Trading 127 (Pty) Ltd. 43 pp.

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Anchor Environmental Consultants (AEC). 2023. The State of Saldanha Bay and Langebaan Lagoon 2023. Technical Report Series of reports from 2012 to 2022. Prepared for the Saldanha Bay Water Quality Forum Trust. Cape Town.

Payne R, Biccard A, Swart C, Mtsokoba S & Clark B. 2024. Saldanha Bay DNA-Based Monitoring: Biodiversity and Detection of Non-Native Species. Report no. 2028/1 prepared by Anchor Environmental Consultants (Pty) Ltd for Anglo American. 76 pp.

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Biccard A, Payne RP, Ho Y, Malan A, Hutchings K, Clark BMC, Schmidt KM, Henry TT and S Mtsokoba. 2024. De Beers Marine Namibia Benthic Environmental Monitoring Programme: Atlantic 1 Mining Licence Area 2022 Sampling Campaign. Report prepared for De Beers Marine Namibia (Pty) Ltd by Anchor Environmental Consultants (Pty) Ltd. Report no. AEC205

Biccard A, Payne RP, Ariefdien R, Schmidt KM, Gihwala KN, Gammon E and S Mtsokoba. 2022. NAMDEB Diamond Corporation (Pty) Ltd Environmental Monitoring Programme in the Midwater Mining Licence Area: 2021 Benthic Sampling Campaign. Report prepared for NAMDEB by Anchor Environmental Consultants. Report no. 1994/1

Hutchings K, Biccard A, Armitage MPA, Schmidt K, and Clark BM. 2022. Marine specialist impact assessment for exploration and prospecting activities in South African Sea Area 7C. Specialist Report no. 2038/2 prepared by Anchor Environmental (Pty) Ltd for Trans Atlantic Diamonds (Pty) Ltd. 91 pp.

Hutchings K, Biccard A, Schmidt and Clark BM. 2022. Marine specialist impact assessment for exploration and prospecting activities in South African Sea Area 14C. Specialist Report no. 2006/2 prepared by Anchor Environmental (Pty) Ltd for Trans Atlantic Diamonds (Pty) Ltd. 83 pp.

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Biccard A, Hutchings K, Schmidt K and BM Clark 2021. Marine specialist impact assessment for exploration and prospecting activities in South African Sea Area 14A. Specialist Report no. 1987/1 prepared by Anchor Environmental (Pty) Ltd for Trans Atlantic Diamonds (Pty) Ltd. 55 pp.

Hutchings K, Biccard A and Clark BM. 2021. Marine specialist impact assessment for exploration and prospecting activities in Concession 12B Western Cape, South Africa. Specialist Report no. 1962/1 prepared by Anchor Environmental (Pty) Ltd for Trans Atlantic Diamonds (Pty) Ltd. 65 pp.

- Biccard A, Hutchings K, Wright AG, Mostert BM, Sedick S and Clark BM. 2020. The State of St Helena Bay 2020. Report No. AEC 1908/1 prepared by Anchor Environmental Consultants (Pty) Ltd for the St Helena Bay Water Quality Trust. Pp 113.
- Biccard, A., K. Gihwala, B.M. Clark, S. Sedick, C. Swart, E.A. Brown, B.P. Mostert, J. Dawson, S Mtsokoba, A. Makhosonke and K. Schmidt. 2021. De Beers Marine Namibia Benthic Environmental Monitoring Programme: Atlantic 1 Mining Licence Area 2019 Sampling Campaign. Report prepared for De Beers Marine Namibia by Anchor Environmental Consultants (Pty) Ltd. Report no. AEC 1840/2
- Biccard, A., K. Gihwala, B.M. Clark, S. Sedick, E.A. Brown, B.P. Mostert, C. Swart, S Mtsokoba, B. Tshingana, A. Masosonke and J. Dawson. 2020. De Beers Marine Namibia Environmental Monitoring Programme: Atlantic 1 Mining Licence Area 2018 Benthic Sampling Campaign. Report prepared for De Beers Marine Namibia by Anchor Environmental Consultants (Pty) Ltd. Report no. AEC 1807.
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- Biccard A, Gihwala K, Clark BM, Harmer RW, Brown EA, Mostert BP, Wright AG & A Masosonke. 2018. De Beers Marine Namibia Environmental Monitoring Programme: Atlantic 1 Mining Licence Area 2016 Benthic Sampling Campaign. Report prepared for De Beers Marine Namibia by Anchor Environmental Consultants (Pty) Ltd. Report no. 1726/1.
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- Biccard A & BM Clark. 2016. De Beers Marine Namibia Environmental Monitoring Programme in the Atlantic 1 Mining Licence Area: 2013 Benthic Sampling Campaign. Report prepared for De Beers Marine Namibia by Anchor Environmental Consultants (Pty) Ltd. Report no. 1527/3.
- Biccard A & BM Clark. 2015. Environmental Scoping Study for Proposed Upgrades to the Cruise Liner Landing Facilities at Portuguese Island, Mozambique. Report prepared for Bergstan South Africa Consulting and Development Engineers.
- Biccard A. 2014. Snowgoose 2014 Grab Sampling Campaign – Observations and Review. Report prepared for De Beers Marine Namibia by Anchor Environmental Consultants (Pty) Ltd. pp. 8.
- Clark BM, Hutchings K, Swart C, Bovim LA, Dawson J, Payne R, Biccard A, Schmidt K, Rees A, Armitage M, Ho Y, Christensen Z, Ndou J, Henry T, Malan A, Mtsokoba S, Dalasile S, Parker A & Conrad J. 2023. The State of Saldanha Bay and Langebaan Lagoon 2023. 2023. Report no. 2088 prepared by Anchor Environmental Consultants (Pty) Ltd. Prepared for the Saldanha Bay Water Quality Forum Trust. 516 pp.
- Clark BM, Wright AG, Rees A, Biccard A, Armitage M, Ho Y, Hutchings K, Bovim LA & Swart C. 2023. The State of St Helena Bay 2023. Report no. 2112 prepared by Anchor Environmental Consultants (Pty) Ltd for St Helena Bay Water Quality Trust. 144 pp.
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- Clark BM, Hutchings K, Biccard A, Brown E, Dawson J, Laird M, Gihwala K, Swart C, Makhosonke A, Sedick S, Turpie J. and Mostert B. 2020. The State of Saldanha Bay and Langebaan Lagoon 2020, Technical Report. Report No. AEC 1876/1 prepared by Anchor Environmental Consultants (Pty) Ltd for the Saldanha Bay Water Quality Forum Trust, October 2020.
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- Duna O, Clark BM, Biccard A, Hutchings K, Harmer R, Mostert B, Brown E, Massie V, Makunga M, Dlaku Z & A Makhosonke. 2016. Assessment of mining-related impacts on macrofaunal benthic communities in the Northern Inshore Area of Mining Licence Area MPT 25-2011 and subsequent recovery. Technical Report. Report prepared for De Beers Marine Namibia by Anchor Environmental Consultants (PTY) Ltd. Report no. 1646/1.
- Hutchings, K. & A Biccard 2015. Gecko Namibia Vision Industrial Park Development Baseline Field Survey Report: Surf Zone Fish. Prepared for: Pisces Environmental Services (Pty) Ltd.
- Laird MC, Biccard A & BM Clark. 2013. Marine Alien Invasive Species Survey Within the Port of Ngqura. Report prepared for Transnet National Ports Authority.
- Mostert BP, Biccard A, Duna O & BM Clark. 2016. Baseline survey of the benthic marine environment in the South African diamond mining Concession areas: 1B and 1C. Report prepared for Alexkor and Placer Resource Management by Anchor Environmental Consultants. Report no. 1696/1.
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Biccard A. and B. M. Clark. 2013: Zirco Roode Heuvel Mine, Northern Cape, South Africa. Marine Specialist Study and Impact Assessment, Anchor Environmental Consultants (AEC), Cape Town.

Biccard A, Tunley KL and BM Clark. 2012. Mzinto Bridge Repair Estuarine Ecology Monitoring Report. Prepared for Henwood & Nxumalo Consulting Engineers. Pp 28.

CURRICULUM VITAE

BARRY MALCOLM CLARK

BORN: 25 August 1968; Livingstone, Zambia

AGE: 57 YEARS

NATIONALITY: South African, British

ACADEMIC QUALIFICATIONS:

Ph.D. Marine Biology, 1997, University of Cape Town

BSc (Hons) Marine Biology, 1991, University of Cape Town

BSc Zoology and Ocean & Atmosphere Science, 1990, University of Cape Town

OTHER QUALIFICATIONS: Scientific diver, Diving supervisor, Small boat skipper

LANGUAGE PROFICIENCY: English (Excellent), Afrikaans (Good)

COUNTRY EXPERIENCE: South Africa, Namibia, Lesotho, Mozambique, Tanzania, Kenya, Mauritius, Seychelles, Angola, Ghana, Cote d'Ivoire, Nigeria, Liberia, Sierra Leone, Somaliland, Republic of Congo, Egypt, United Arab Emirates, Azerbaijan

POSTAL ADDRESS:

8 Steenberg House, Silverwood Close, Tokai 7945

PHONE: +27-21-7013420

MOBILE: +27-82 3730521

E-MAIL: barry@anchorenvironmental.co.za

FAX: +27 (0)-21-7015280

EMPLOYMENT HISTORY:

1991-1993	Scientific Officer, University of Cape Town
2000-2002	Marine Coordinator, Cape Peninsula National Park
1996-2026	Director, Anchor Environmental Consultants (Pty) Ltd
2026-Present	Technical and Business Development Director, Anchor Environmental Consultants (Pty) Ltd
2002-Present	Research Associate, University of Cape Town

SUMMARY PROFILE

Dr Barry Clark has thirty-five years' experience in marine biological research and consulting on coastal zone and marine issues. He has worked as a scientific researcher, lecturer and consultant and has experience in tropical, subtropical and temperate ecosystems. He is presently Technical and Business Development Director of an Environmental Consultancy firm (Anchor Environmental Consultants, part of the SLR Group). As a consultant has been concerned primarily with conservation planning, monitoring and assessment of human impacts on estuarine, rocky shore, sandy beach, mangrove, and coral reef ecosystems as well as coastal and littoral zone processes, aquaculture and fisheries. Dr Clark is the author of 27 scientific publications in class A scientific journals as well as numerous scientific reports and popular articles in the free press. Geographically, his main area of expertise is southern Africa (South Africa, Lesotho, Namibia, Mozambique, Tanzania, Seychelles, Mauritius, Madagascar and Angola), but he also has working experience from elsewhere in Africa (Republic of Congo, Sierra Leone, Republic of Guinea, Liberia, Cote d'Ivoire, Ghana, Nigeria), the Middle East (UAE, Saudi Arabia) and Europe (Azerbaijan, Greenland).

MEMBERSHIP OF PROFESSIONAL BODIES/ORGANISATIONS

- Professional Natural Scientist, registered with the South African Council for Natural Scientific Professions (2004-)
- Professional member of the South African Institute of Ecologists and Environmental Scientists (2000-)
- South African representative to the SURVAS Network (Synthesis and Upscaling of Sea-level Rise Vulnerability Assessment Studies) (2000-)
- Member of the International Association of Impact Assessors (IAIA) (2000-)
- Member of the Subsistence Fisheries Task Group (1999-2000)
- Member of the Subsistence Fisheries Advisory Group (2000-2002)
- Member of the South African Network for Coastal and Oceanic Research (SANCOR) Economics Task Team

STUDENT SUPERVISION

Name	Institution	Degree	Thesis title	Year
Vici Napier	UCT	MSc	Value and management of the subsistence fishery at Knysna Estuary, South Africa	2004-2005
Khara Shine	UCT	MSc	Biogeographic Patterns and Diversity in Demersal Fish off the south and west coasts of South Africa: Implications for Conservation	2006-2007
Bomikazi Tshingana	UKZN	MSc	Relating flora, fauna and environmental parameters of Durban Bay Sandbanks	2017-2018
Josef Shikeva	UNAM	MSc	The use of underwater video footage as a tool in the assessment of mining related impacts on the hard-bottom benthic environment in southern Namibia	2018-2019
Nomcebo Dhlalani	US	MSc	ICP-MS analysis of trace metals in Pacific Oysters (<i>Crassostrea gigas</i>) within the Port of Saldanha, South Africa	2019-2020

SELECTED PROJECT EXPERIENCE

Period	Country	Client	Project, Tasks
2026	South Africa	Confluence Strategic Development/ Tinley Manor	Environmental Impact Assessment for installation of share net and drum lines at Tinley Manor, KZN.
2025-2026	South Africa	Gansbaai Marine (Pty) Ltd	Environmental Impact Assessment and Marine Monitoring programme, including effluent quality assessment, Whole Effluent Toxicity testing, water quality monitoring, and rocky intertidal ecological surveys.
2025-2026	Namibia	Hyphen	Baseline and Environmental Impact Assessment for the development of a large-scale Green Hydrogen project in Lüderitz, Namibia
2025-2026	South Africa	IFA Hotels & Resorts	Environmental Impact Assessment for the extension of the Zimbali Lakes Development and Zimbali Country Estate on the uThongathi Estuary

Period	Country	Client	Project, Tasks
2025	Mozambique	ERM/ExxonMobil	Assessment of impacts of dredging a pipeline corridor on coral reef ecosystems in Pemba Bay, Mozambique and feasibility of relocating coral affected by the development
2024-2025	South Africa	Department of Forestry, Fisheries and Environment/ WILDTRUST	Development of a management plan for the Southeast Atlantic Seamount, Southwest Indian Seamount Namaqua Fossil Forest Marine Protected Areas
2024-2025	South Africa	RCE Consultants, Transnet National Ports Authority	Climate risk and marine ecology impact assessment for Berths 802 and 803, Port of Richards Bay
2025	South Africa	AMSOL	Environmental Management Plan for Ship-to-Ship Bunkering operations in Algoa Bay, South Africa. Included oil spill modelling and response plan, noise management plan, and an oiled wildlife preparedness and response plan
2025	South Africa	ASN/Acer Africa	Environmental Impact Assessment for three submarine telecommunications cable landings in South Africa for the GAFAM projects
2025	Mozambique	Kenmare/Acer Africa	Long-term water quality, coral reef, reef fish, turtle and fisheries monitoring programme at Caldeira and Njovo Islands, Mozambique
2025	South Africa	CSIR/SANEDI/NCEDA/TNPA	Strategic Environmental Assessment for development of a deep water port off Boegoebaai, South Africa
2025	Madagascar	ERM/Base Resources Limited	Marine Coastal Related Specialist Studies for the Base Toliara Mineral Sands Project, Madagascar.
2025	Angola	HCV Africa	Marine Biodiversity Assessment and Ecosystem Services Assessment for deep-water exploratory drilling in Block 47, Lower Congo Basin, Angola
2025	South Africa	Richards Summers Inc.	Delineation of the position of the high water mark in Clifton, Cape Town
2025	South Africa	SLR Consulting (Africa)	Block 11b/12b Environmental and Social Impact Assessment (ESIA): Marine Ecology Impact Assessment Specialist Study update
2024-2026	South Africa	Dube Tradeport	Environmental Impact Assessment of the KZN Automotive Supply Park (ASP) on the Msimbazi and Illovo estuaries
2024-2026	South Africa	Overstrand Local Municipality	Onrus Catchment to Coast (C2C) Programme: Estuarine Ecological Health Assessment Report and Maintenance Management Plan (MMP), Rehabilitation of the Main Onrus palmiet peat wetland
2025	South Africa	L'Office Français de la Biodiversité (OFB) & SANParks	Krom & Wildevoelvis Estuary Situation Assessment Reports (SARs), State of Knowledge Reports for Addo, Robben Island & Namaqua Marine Protected Areas (MPA)
2024-2027	South Africa	City of Cape Town and Infinity Environmental	Receiving Environment Monitoring Programme for the City of Cape Town Deepwater Marine Outfalls – water quality, sediment quality, contaminants of emerging concern (CEC) microplastics, toxicity testing and ecological indicators
2025	South Africa	City of Cape Town and Infinity Environmental	Description of Receiving environment, impact assessment and development of a Monitoring programme for the City of Cape Town small marine outfalls.

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2025	South Africa	ECA Consulting	Marine/Estuarine Impact Assessment for the proposed development of a Liquefied Petroleum Gas Terminal, Island View Precinct, Port of Durban
2025	Zanzibar	ERM Consulting Tanzania Ltd	Health, Safety, Environmental and Social Due Diligence Services for Zanzibar Ferry Terminal. IFC PS1 and PS6 compliance ESIA review
2024-2025	South Africa	WSP Group Africa (Pty) Ltd	Port of Durban Point Container Terminal Reconfiguration Environmental and Social Impact Assessment (ESIA): Marine Ecology and Avifauna Impact Assessment Specialist Study
2024-2025	South Africa	National Sea Rescue Institute (NSRI)	Environmental Impact Assessment for the Proposed Upgrades the NSRI Bakoven Rescue Base.
2024	South Africa	SLR/Genesis	Marine and avifauna specialist studies for a Scoping assessment for proposed Offshore Windfarms off Durban, Port Elizabeth and Namaqualand, South Africa
2024	South Africa	Infinity Environmental (Pty) Ltd	Estuarine Impact Assessment and Hydrodynamic Modelling (Delft3D) to assess impacts of the proposed dredging of Milnerton Lagoon on estuarine function and water quality
2024	South Africa	CES/Vopak/Transnet	Estuarine specialist studies, including dispersion modelling in support of an EIA for the development of a Liquefied Natural Gas Import Terminal at the Port of Richards Bay, Kwazulu-Natal
2023-2024	South Africa	The Nature Conservancy/Table Mountain National Park	Marine invertebrate surveys and marine resource use assessment within the Table Mountain National Park Marine Protected Area.
2023	Saudi Arabia	NEOM	Marine conservation spatial planning through Marxan, for the NEOM (Saudi Arabia) marine and coastal region to support regionwide conservation planning efforts
2023	Kenya	UNEP/ University of Nairobi	Mapping and valuation of ecosystem services and ecosystem assets of Kenya's marine and coastal environment
2023	South Africa	TNPA/MPA MOT/ Exigent	Strategic Environmental Assessment for the Port of Richards Bay Masterplan
2023	Puntland, Somalia	DP World	Environmental assessment for the Phase 1 expansion of the Port of Bosaso, Somaliland
2023	South Africa	GIZ/Institute for Water Studies(IWS)	Assessment of the economic, technical, legal, environmental, and social suitability of desalination plants as a water source for Green Hydrogen projects in South Africa
2023	Sierra Leone	Sierra Rutile/Jones & Wagener/HACH	Environmental Flow Assessment for a new rutile mine in the Southern Province of Sierra Leone
2023	Angola	ENI/Saipem/ Shelter	Development of a Biodiversity Action Plan (BAP) for offshore LNG mining and an onshore Gas Treatment Plant in Soyo, Angola
2023	Guinea	Dynamic Mining/SRL	Environmental assessment for a bauxite export facility in the prefecture of Boke, Republic of Guinea
2023	Somaliland	DP World	Implementation of a coral relocation programme to transplant coral threatened by the expansion of the Port of Berbera, Somaliland
2022-2023	Sierra Leone	Iluka/Sierra Rutile/Digby Wells	Environmental, Safety and Health Impact Assessment (ESHIA) for mining of the Sembehun group of deposits in the Southern Province of Sierra Leone

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2022-2023	South Africa	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Impact Water Solutions (Pty) Ltd	GIZ Green Hydrogen Desalination Study to provide strategic information on the technoeconomic, legal, environmental, and social applicability of desalination plants as water source for green hydrogen projects in South Africa. Decision-support analyses for four locations. Review of ESIA report. CorMIX model to assess effluent dispersion for preferred ESIA scenario and inform outfall design.
2022	South Africa	Sasol/WSP	Screening analysis for proposed green hydrogen project, at Boegoebaai, Northern Cape
2022	South Africa	ECA Consulting	Avifauna impact assessment for the Maydon Wharf Deepening and Widening Project, Port of Durban.
2022	Somaliland	DP World	Development of a Biodiversity Action Plan (BAP) and Biodiversity Offset Management Plan (BOMP) for the Phase 1 expansion for the Port of Berbera, Somaliland
2022	South Africa	City of Cape Town/ Lukhozi Engineers	Update of the Mouth Management Plan for the Zandvlei estuary, South Africa
2022	South Africa	Karpowership SA/ Triplo 4	Marine, estuarine, fisheries and avifauna specialist studies for EIAs three power stations in the Port of Saldanha, Coega and Richards Bay
2022	South Africa	City of Cape Town/Infinity Environmental	Updating of the Zandvlei and Diep Estuary Management Plan
2022	Namibia	DeBeers Group/Anglo American	Design and development of a sediment generation control and long-term effects predictive model & monitoring system for Debmarmine Namibia
2022	South Africa	Genesis-Hexicon/Acer Africa	Marine and avifauna environmental assessment and seabird monitoring programme for a proposed Offshore Windfarm in KZN, South Africa
2022	South Africa	SAMSA/Impact Economix	Assessment of opportunities, challenges and risks associated with growing the maritime economy with offshore Bunkering in St Helena Bay
2022, 2025	Mozambique	Kenmare/Acer Africa	Long-term coral reef monitoring programme at Caldeira and Njovo Islands, Mozambique
2022	South Africa	Ugu District Municipality/ Nemaï	Estuarine impact assessment and environmental flow assessment for the development of a weir on the Umzimkhulu estuary, KZN province
2021-2023	South Africa	WSP Group Africa (Pty) Ltd	Total Energies Block 11b/12b Environmental and Social Impact Assessment (ESIA): Marine Ecology Impact Assessment Specialist Study.
2021-2022	South Africa	Transnet National Ports Authority	Baseline survey of marine fauna and flora, sediment and water in the Port of Durban for monitoring of in-water hull cleaning activities
2021-2022	Namibia	Benguela Current Commission	Development of national legislation for the effective implementation of the Ballast Water Convention in Namibia
2021, 2025	South Africa	Mossel Bay Municipality, SERAG	Preparation of a Maintenance Management Plans for the Great Brak Estuary
2021	South Africa	Nsovo Environmental Consulting	Marine ecology impact assessment for proposed DNG Energy (Pty) Ltd Busisiwe (Coega 1) and Cheyeza (Coega 2) Gas to Power facilities and associated infrastructure.
2021	Somaliland	DP World/WSP	Marine specialist study as part of an ESHIA for the Phase 2 expansion of the Port of Berbera, Somaliland
2021	South Africa	V & A Waterfront	Economic impact analysis of the proposed Granger Bay Marina

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2021	Greenland	DeBeers Marine (Pty) Ltd	Environmental Mitigation Assessment for geophysical surveys off West Greenland
2021	South Africa	Cliff Path Action Group/Ecosense	Environmental impact assessment for a proposed pedestrian path connecting the two parts of the Hermanus Cliff Path
2021	South Africa	IDM Consultants	Environmental impact assessment for the proposed Msimbazi River Estate in KwaZulu-Natal
2020-2021	South Africa	Department of Economic Development, Tourism and Environmental Affairs (EDTEA) KZN	Development of an Estuary Management Plan for the Uthongathi Estuary, KwaZulu-Natal
2020-2026	South Africa	Department of Forestry, Fisheries and the Environment	Environmental assessment and monitoring for a sea-based Aquaculture Development Zone (ADZ) in Saldanha Bay
2020	South Africa	DeBeers Marine (Pty) Ltd	Near- and far-field effluent dispersion modelling study and impact assessment for a proposed SWRO plant in the Port of Cape Town
2020	South Africa	V&A Waterfront	Dispersion modelling study and environmental impact assessment and for the East Pier District cooling plant in the Port of Cape Town
2020	South Africa	IFC World Bank/ Royal Haskoning DHV	Technical, environmental and social due diligence for the Umdloti and Umkhomazi wastewater treatment works (WWTW)
2020	Kenya	Ministry of Water, Sanitation and Irrigation of Kenya / Aurecon	Kenya Water Security And Climate Resilience Project - Development and piloting of a resource directed measures (RDM) Framework for Kenya
2020	South Africa	DeBeers Marine (Pty) Ltd	Specialist environmental assessment of the Namaqua Fossil Forest Marine Protected Area and proposed Ecologically or Biologically Significant Marine Area (EBSA)
2020	South Africa	ATKV/Cape EA Prac	Comparative ecological impact assessment for the ATKV Hartenbos dune stabilisation study
2020	South Africa	Diamond Coastal Aquaculture	Design and implementation of an environmental monitoring programme for an abalone ranching operation at Kleinsee, Northern Cape.
2020	South Africa	TNPA/Chand Environmental	Environmental Impact Assessment for a Reverse Osmosis Desalination Plant in the Port of Cape Town
2020	South Africa	Department Forestry Fisheries & Environment	Implementation of an environmental monitoring programme for the Saldanha Bay Aquaculture Development Zone
2020	South Africa	V&A Waterfront	Environmental impact assessment and dispersion modelling study for the East Pier District cooling plant outfall at the V&A Waterfront, Port of Cape Town
2019-2020	South Africa	South African National Parks	Subtidal surveys of commercially important and indicator invertebrate and fish species within the Table Mountain Marine Protected Area. Project leader.
2019-2020	South Africa	City of Cape Town	Design and implementation of an environmental monitoring programme for domestic effluent outfalls offshore of Hout Bay, Camps Bay and Green Point in Cape Town

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2019	Mozambique	Golder Mozambique/ Sasol Petroleum Mozambique Exploration Limitada	Marine specialist impact assessment for proposed offshore explorations in shallow water portions of blocks 16 & 19, Inhambane and Sofala provinces, Mozambique.
2019	South Africa	Vopak/SRK Consulting	Environmental Impact Assessment for Vopak-Reatile Terminal Richards Bay, a bulk liquid storage and handling facility
2019	South Africa	Rheinmetall Denel Munition	Design and implementation of an environmental monitoring programme for the Rheinmetall Denel Munitions facility in Helderberg
2019	Somaliland	WSP/DP World	Marine specialist study for an Environmental and Social Impact assessment (ESIA) for the upgrade of Berbera Port, Somaliland
2018/2019	Sierra Leone	Iluka/Sierra Rutile/SRK Consulting	Environmental, Safety and Health Impact Assessment (ESHIA) for mining of Rutile in Area 1 in the Southern Province of Sierra Leone
2018-2019	Mozambique	Golder/ Sasol	Environmental impact assessment for 2D and 3D seismic surveys and exploratory drilling in Block 16 & 19, offshore in Inhambane Province, Mozambique
2018-2021	South Africa	Mhlathuze Water	Toxicity testing, water, sediment and flora and fauna monitoring for Mhlathuze Water Effluent Pipelines, in Richards Bay, South Africa
2018	South Africa	City of Mhlathuze	Environmental Impact Assessment for construction of a new bridge over the Mzingazi Canal at the Richards Bay Waterfront
2018	Republic of Congo	Kola Potash	Marine ecology impact assessment, baseline studies and toxicity testing for the Kola Potash project, Republic of Congo
2018	South Africa	Sun International/ GCX Analytics	Marine ecology impact assessment for discharge of brine effluent from a Reverse Osmosis desalination plant in Granger Bay
2018	Mozambique	JG Afrika/ Mozal	Estuarine impact assessment for discharge of brine effluent from a Reverse Osmosis desalination plant into Maputo Bay
2018	South Africa	Kleinsee Mariculture	Environmental Impact Assessment for construction and operation of abalone holding tanks and associated infrastructure at Kleinsee.
2018	South Africa	ArcelorMittal Saldanha	Marine ecology impact assessments for the discharge of brine effluent from a Reverse Osmosis desalination plant
2018	South Africa	Diamond Coast Abalone	Environmental Impact Assessment for an Aquaculture Farm in Kleinsee, Northern Cape
2018	South Africa	G7 Renewable Energies (Pty) Ltd	Marine ecology impact assessment for discharge of brine effluent from a Reverse Osmosis desalination plant in Gordon's Bay, South Africa
2018	South Africa	Mainport Africa	Assessment of biofouling community collected from MV Cherry Blossom
2017-2018	Sierra Leone	Iluka/Sierra Rutile (Ltd)	Marine and estuarine specialist studies for an Environmental, Social and Health Impact Assessment (ESHIA) for proposed expansions to Sierra Rutile Limited's mining operations in Sierra Leone
2017	South Africa	Adviesan, City of Cape Town	Marine ecology impact assessments for nine desalination plants for the Cape Town Emergency Water Resilience Project
2017	South Africa	Hospitality Property Fund	Marine ecology impact assessment and Coastal Waters Discharge Permit application for a desalination plant at the Westin Hotel, Cape Town.

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2017	South Africa	GIBB, Transnet National Ports Authority	Strategic Environmental Assessment for Port of Cape Town - Oceanographic and ecological significance and sensitivity of the Port of Cape Town and surrounding areas
2017	South Africa	Shell Downstream South Africa (Pty) Ltd	Specialist marine ecology report for coastal water discharge permit application for Shell Downstream South Africa (Pty) Ltd Bulk Chemicals Storage Facility, Port Elizabeth
2017	South Africa	Viking Fishing (Pty) Ltd	Socio-economic assessment of a 60% reduction in Viking fishing group's allocation in the inshore demersal trawl fishery
2016-2019	South Africa	Department of Water & Sanitation	Classification of and determine the Resource Quality Objectives for significant water resources within (1) the Berg Water Management Area and (2) the Breede Gouritz Water Management Area (2 separate appointments). Project leader on the estuaries component of both projects.
2016-2017	South Africa	SIROCCON Consulting Engineers & Project Managers	Specialist marine impact studies for a proposed Atlantic Salmon farm at Dwarskroersbos
2016-2017	South Africa	CEN Environmental Management Unit, Nelson Mandela Metro	Dispersion modelling for the Driftsands Waste Water Treatment Works, Port Elizabeth, South Africa
2016-2017	South Africa	Tongaat Hullet	Marine ecology impact assessment for a proposed beach enhancement initiative at Tinley Manor
2016-2017	South Africa	Nemai Consulting, Transnet National Ports Authority	Marine Impact Assessment for the proposed offshore sand winning for developments within the Port of Durban, KwaZulu Natal
2016-2017	South Africa	Department of Environmental Affairs	Revision and update of the South African Water Quality Guidelines for Coastal and Marine Waters – 2017. Natural Environment, Mariculture and Industrial Use
2016-2017	South Africa	Royal Society for Protection of Birds	Assessment of the effects of exposure to brodifacoum pellet bait on Tristan Rock Lobster Jasus paulensis
2016-2017	South Africa	Elandsfontein Exploration and Mining (Pty) Ltd	Assessment of the impacts of the Elandsfontein Phosphate Mine on Langebaan Lagoon
2016-2017	South Africa	Department of Agriculture, Forestry, Fisheries	Assessment of catch and effort in the West Coast Rock Lobster recreational fishery
2016-2017	Namibia	Namdeb Diamond Company	Benthic macrofauna and sediment quality monitoring programme for the Mid-water license region, Namibia
2016	South Africa	Department of Water & Sanitation	Reserve determination study of selected surface water and groundwater resources in the Usuthu/Mhlathuze Water Management Area. Lake St Lucia Intermediate EWR Assessment
2016	South Africa	DeBeers Group of Companies	Assessment of mining-related impacts on macrofaunal benthic communities in the Northern Inshore Area of Mining Licence Area MPT 25-2011 and subsequent recovery
2016	South Africa	Advisian, Oiltanking Mogs Saldanha (RF) (Pty) Ltd	Marine ecological specialist study for the proposed HDPE pipeline and sea water intake and discharge for Oiltanking Mogs Saldanha (RF) (Pty) Ltd
2016	Republic of Congo	Southern Waters, International Finance Corporation	Aquatic Biodiversity Assessment for the Sounda Hydropower Project

Period	Country	Client	Project, Tasks
2016	South Africa	Southern Cross Salmon	Marine specialist environmental impact report for a proposed salmon and trout sea cage farm Jutten Island Saldanha -
2016	South Africa	Port Owen Marina Authority	Assessment of currents and invertebrate and fish fauna in the Berg Estuary channel and recommendations for disposal of dredge water
2014-2016	South Africa	Coega Development Corporation	Assessment of impacts of wastewater discharge from Coega Industrial Development Zone, Algoa Bay. Conduct oceanographic data analysis, marine and marine baseline study.
2016	Lesotho	Lesotho Highlands Development Authority	Specialist study of freshwater fish populations present in rivers and streams adjacent to the proposed Polihali Dam in the Lesotho Highlands
2016	South Africa	Transnet National Ports Authority	Baseline ecological assessment of marine and estuarine fauna and flora at Pier 1 and Salisbury Island, Port of Durban and an assessment of the potential impacts associated with the upgrade and expansion of the terminal.
2016	South Africa	Transnet National Ports Authority	Assessment of ecosystem goods and services associated with Durban Bay any assessment of potential impacts associated with the development of the Container Terminal at Pier 1 and Salisbury Island
2016	South Africa	ACC Agriculture	Risk assessment for introduction of Cameline savitina as a commercial crop into South Africa
2015	Liberia	Conservation International	Identification and profiling of priority mangrove sites in Liberia through remote sensing and field surveys and identification and delineation of two coastal and marine protected areas
2015	South Africa	AquaTech	Risk assessment for in-water hull cleaning operations in the Port of Durban, South Africa
2015	Tanzania	Aurecon, Schlumberger	Environmental impact assessment for a supply base for Schlumberger in Mtwara port, Tanzania
2015	South Africa	Cape Nature	Environmental flows assessment for the Klein River estuary, South Africa
2015	South Africa	Mossel Bay Municipality	Preparation an estuary management plan for the Hartenbos Estuary
2015	South Africa	Department of Environmental Affairs	Development of an assessment framework for management of effluent discharged from land-based sources to the marine environment in South Africa
2015	Seychelles	Raffles Hotel, Aurecon	Assessment of impacts of diesel spill on a mangrove forest community on Praslin Island, Seychelles
2014-2026	Namibia	DeBeers Marine Namibia	Benthic macrofauna and sediment quality monitoring programme for the Atlantic 1 Mining Licence Area, Namibia
2014-2016	South Africa	Transnet National Ports Authority	Baseline monitoring programme for all sandbank areas in the Port of Durban.
2014-2015	South Africa	Transnet National Ports Authority	Design and implementation of a water and sediment quality monitoring programme in the Port of Durban
2014-2015	South Africa	Oceana/SRK	Application for a coastal water discharge permit for the Lucky Star Fish Processing Plant, St Helena Bay
2014-2015	South Africa	Coega Development Corporation	Assessment of impacts of wastewater discharge from Coega Industrial Development Zone, Algoa Bay
2014-2015	South Africa	Cape Nature	Environmental flow assessment for the Heuningnes estuary, South Africa

Period	Country	Client	Project, Tasks
2014-2015	South Africa	South African Pelagic Fishing Industry Association	Assessment of the socio-economic impacts of a reduction in the sardine minimum Total Allowable Catch (TAC)
2014-2015	South Africa	Nelson Mandela Bay Metro, GIBB	Assessment of impacts of waste water discharge from a new WWTW at Cape Recife, Algoa Bay
2014	Seychelles	USAID	Implementation of the "reef gardening" approach for restoration of coral reefs on Praslin Island, Seychelles, lost as a result of El Nino and global warming induced bleaching events.
2014	South Africa	Molapong Aquaculture	Risk Assessment for culture of King and Coho salmon in South Africa
2014	South Africa	NWJ Environmental	Impact assessment for a proposed sand mining operation on the Umzumbe Estuary, KwaZulu-Natal
2014	Mozambique	Marine Stewardship Council	Scoping study to assess potential impacts of upgrading the cruise liner facilities at Portuguese Island, Mozambique
2014	South Africa	Bayside Aluminium, WSP	Environmental impact assessment for the decommissioning of the Bayside Aluminium Smelter, Richards Bay
2014	South Africa	Tronnox Namaqua Sands, SRK	Assessment of impacts of a seawater intake for the Tronnox Namaqua Sands mineral processing facility, Northern Cape
2014	South Africa	AquaConcepts	Risk assessment for import of ornamental marine fish species into South Africa
2014	South Africa	Dormac, WSP	Assessment of impact associated with the development of a floating dry dock in the Port of Durban, South Africa
2014	South Africa	Transnet National Ports Authority	Assessment of potential impacts of the proposed Durban Dig Out Port of the annual sardine migration up the East coast of South Africa
2014	South Africa	WWF-SA	Design and development of a Fisheries Improvement Project for Small Scale Fisheries in the Kogelberg
2014	South Africa	Tronnox Namaqua Sands, Matzikamma Municipality, SRK	Environmental impact assessment for an aquaculture facility at Doringbaai, Northern Cape
2014	Tanzania	Aurecon	Development of a Spatial Development Framework for the coastal environment in the Mtwara/Mikandani Municipal area, Tanzania
2014	South Africa	WSP/ Engen	Assessment of the impacts of an oil spill on mangrove forest communities in the Port of Richards Bay, South Africa
2014	South Africa	Frontier Rare Earths, Coastal Environmental Services	Assessment of impacts of a seawater intake for the Frontier Rare Earths mineral processing facility, Northern Cape
2014	South Africa	Cape Nature	Rezoning and realignment of borders for Betty's Bay, Goukamma and Robberg marine protected areas in South Africa
2013-2014	South Africa	Paardevelei Properties	Assessment of the likely impacts of associated with a new stormwater management system at Paardevelei
2013-2014	South Africa	iSimangaliso Wetland Park Authority	Assessment of the hydrological, hydrodynamic and ecological functioning of the Lake St Lucia Estuarine System and formulation of recommendations for rehabilitation and improved management of the system.
2013-2014	Lesotho	Lesotho Highlands Development Authority	Assessment of the impacts of land use changes and other pressures related to the construction and operation of the Katse and Mohale Dams on its catchment area and attendant fish populations

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2013	South Africa	Cape Nature, Department of Environmental Affairs	Assessment of impacts of an oil spill on sandy beach and rocky intertidal communities in the Goukamma MPA
2013	South Africa	Transnet National Ports Authority	Marine specialist study as part of an EIA for upgrading the General Maintenance Quay (GMQ) in the Port of Saldanha Bay
2013	Namibia	LL Namibia Phosphates	Review and update of a Scoping Report and Environmental Management Plan for prospecting for phosphorus deposits in Mining Licence Area 159 off the coast of Namibia
2012-2013	South Africa	Department of Agriculture, Forestry & Fisheries	Biodiversity Risk and Benefit Assessments (BRBAs) for the seven most important alien species used in the aquaculture industry in South Africa including Pacific oyster Crassostrea gigas, Mediterranean mussel Mytilus galloprovincialis, sharptooth catfish Clarius gariepinus, rainbow trout Onchorhynchus mykiss, brown trout Salmo trutta, Nile Tilapia Oreochromis niloticus and Marron Cherax tenuimanus.
2012-2013	South Africa	Abagold (Pty) Lt	Environmental Impact Assessment for the construction and operation of a wave energy converter (WEC), pump assistance pond and effluent pipe turbine for the Abagold abalone farm.
2012-2013	South Africa	East London Industrial Development Zone	Feasibility study for the establishment of an Aquaculture and Biotechnology Business Incubator for the East London Industrial Development Zone.
2012	Mozambique	Consultec Lda	Water quality assessment and toxicity testing for a proposed coal transfer facility in Beira, Mozambique
2012	Mauritius	Mauritius Oceanography Institute	Alien species, and water and sediment quality assessment of Port Louis, Mauritius.
2012	Namibia	Ministry of Environment and Tourism	Study to identify a set of Core National Environmental Indicators Network (NCEIS), Integrated State of Environment Baseline Report (ISOER) for Namibia's Protected Area Network (PAN), and Coastal and Marine Ecosystems.
2012	South Africa	uMkhanyakude District Municipality/ Nema Consulting	District-Wide Environmental Management Framework for the uMkhanyakude District Municipality
2012	South Africa	ACE Coastal Environmental Services	Cable Route Study and Marine Specialist study as part of an Environmental Impact Assessment (EIA) for the installation of the proposed ACE telecommunications cable landing at Yzerfontein, South Africa
2012	South Africa	Transnet National Ports Authority	Assessment of potential impacts of iron ore oxide (Fe2O3) on the marine flora and fauna of Saldanha Bay.
2012	South Africa	Department of Water Affairs/ Nema Consulting	Environmental Impact Assessment for the Ncwabeni OCS Dam on the Mzimkhulu estuary
2012	South Africa	East London Industrial Development Zone	Seawater Quality Monitoring Program for aquaculture developments in the East London Industrial Development Zone
2012	South Africa	Transnet National Ports Authority/ Nema Consulting	Environmental Impact Assessment for the deepening, lengthening and widening of Pier 2 in the container terminal of the Port of Durban.
2011	South Africa	City of Cape Town	Development of water quality indices and related reporting tools for Inland and coastal waters of the City of Cape Town

Period	Country	Client	Project, Tasks
2011	South Africa	Overstrand District Municipality/ SSI	Environmental impact assessment for a Waste Water Treatment Works in the Overstrand District Municipality
2010-2013	South Africa	Department of Agriculture, Forestry & Fisheries (DAFF)	Environmental impact assessment for four Marine Aquaculture Development Zones (MADZs) in the Eastern Cape, South Africa.
2010	South Africa	Department of Agriculture, Forestry & Fisheries (DAFF)	Strategic Environmental Assessment (SEA) to identify potential sea-based finfish aquaculture development zones (ADZ) off the South African coastline.
2010	South Africa	Doug Jeffery Environmental Consultants	Environmental impact assessment for an illegal tide pool constructed at Danger Point, Gansbaai.
2010	South Africa	Department of Environmental Affairs & Development Planning, Western Cape Government	Evaluation of boat launching sites in the Western Cape.
2010	South Africa	Department of Environmental Affairs & Development Planning, Western Cape Government	Assessment of the effects of heavy metal accumulation from land based sources on the Diep River Estuary.
2010	South Africa, Namibia	UNDP-GEF Orange-Senqu Strategic Action Programme	Assessment of the impact of changes in the flow regime of the Orange-Senqu River and its impacts on the degradation of the estuary and the broader Benguela Current System.
2010	Tanzania	BRL/ SWECO/ SADC	Baseline description and health assessment for the Rovuma Basin, Tanzania.
2010	South Africa	Water Research Commission, Department of Water Affairs	Update of methods for estimation of freshwater flow requirements for estuaries in South Africa.
2010	South Africa	Chand Environmental	Assessment of the status and sensitivity of the coastal marine environment off Partridge Point on the Cape Peninsula, and likely impacts that would arise from development of the site.
2010	South Africa	Element Consulting Engineers (Pty) Ltd	Environmental impact assessment for a proposed residential and resort development at Trekoskraal on the marine environment.
2009-2011	South Africa	Various companies	Environmental impact assessments for a suite of desalination plants at Sedgefield, Plettenberg Bay, Witsands, Saldanha Bay, and Port Nolloth. (Five separate appointments.)
2009-2011	South Africa	Cape Action Plan for People & the Environment (C.A.P.E.)/Cape Nature/Marine & Coastal Management (MCM)	Development of Situation Assessment Reports and Estuary Management Plans for the Olifants, Verlorenvlei, Berg, Uilkraals, and Great Brak Estuaries, South Africa. (Five separate appointments).
2009-2011	South Africa	WWF-SA, Lotto Programme	Recreational fisheries monitoring programme coordinating a team of 20 fisheries monitors at 6 sites on the South and East coasts of South Africa.
2009-2010	Azerbaijan	United National Development Programme, Azerbaijan Country Office	International consultant appointed to prepare Project Identification Form (PIF) and Project Preparation Grant (PPG) for a GEF medium-size project on the expansion of the marine and coastal protected area network in Azerbaijan.

Period	Country	Client	Project, Tasks
2009-2010	South Africa	Department of Water Affairs & Forestry	Assessment of the nature, distribution and value of aquatic ecosystem services of the Olifants, Inkomati And Usutu To Mhlathuze Water Management in South Africa.
2009-2010	South Africa	WWF-SA/Cape Action for People and the Environment (C.A.P.E.)	Project leader responsible for the preparation of marine and coastal spatial plans and socio-economic assessments for the Kogelberg Biosphere Reserve and Garden Route Initiative.
2009-2010	South Africa	Department of Water Affairs	Environmental Flow Assessment for the Berg Estuary which including preparing scenario assessments of the likely environmental and socio-economic consequences variable freshwater allocation for the estuary.
2009	South Africa	West Coast District Municipality, Jeffares & Green (Pty) Ltd	Environmental assessment of the Jakkalsvlei estuary, and of ecological impacts of illegal excavation and infilling activities
2009	Global	UNDP	Researcher on an assessment of the impact of climate change on the Global Fisheries sector and opportunities and incentives required for adaptation
2009	South Africa	City of Cape Town	Design of a Coastal Monitoring Programme for the City of Cape Town (City of Cape Town).
2009	South Africa	Sturrock Shipping (Pty) Ltd	Marine ecological expert responsible for assessment of marine fouling on vessel, Rita Knutsen.
2009	South Africa	Doug Jeffery Environmental Consultants	Assessment of the status and sensitivity of the coastal marine environment off Oudekraal on the Cape Peninsula
2008-2011	South Africa	Century City Property Owners Association	Assessment of the effectiveness of a fish eradication programme conducted in the Century City wetlands and canals using the ichthyocide rotenone.
2008-2009	Tanzania, Kenya	Programme for the Sustainable Management of the Coastal Zone of the Countries of the Indian Ocean	Design and implementation of training courses and workshops on Information for Fisheries Co-Management in Dar es Salaam, Tanzania and Mombassa, Kenya.
2008	South Africa	Water Research Commission, Fresh Water Consulting Group	Marine specialist on a project to develop a classification system for wetlands in South Africa.
2008	South Africa	Water Research Commission (WRC)	Design and development of an integrated ecological-economic model to be used to assess freshwater flow requirements for the East-Kleinemonde estuary, a temporally open-closed estuary on the East coast of South Africa.
2008	South Africa	DCD-Dorbyl (Pty) Ltd	Environmental audit of Globe Engineering Works (Pty) Ltd, DCD-Dorbyl (Pty) Ltd and Natulus Marine (Pty) Ltd (Nautilus), three engineering companies based in the Port of Cape Town, South Africa
2008	Angola	Tullow Oil Plc	Environmental Impact Assessment, Environmental Overview and identification of Environmental Best Management Practise (BMP) required for seismic surveying and exploratory drilling for offshore oil and gas resources in Blocks 1, Angola.
2008	South Africa	Department of Environmental Affairs & Development Planning/SRK Consulting	Marine and coastal specialist contributing to the preparation of the State of the Environment Report (SoER) for the Western Cape Province, South Africa.

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2008	South Africa	CSIR/Transnet National Ports Authority (Transnet-NPA)	Independent consultant appointed to review an Environmental Impact Assessment and Environmental Management Plan for dredging and dredge spoil disposal for the Ben Schoeman Dock, Port Of Cape Town.
2008	South Africa	Transnet National Ports Authority (Transnet-NPA)/SRK/PD Naidoo & Associates	Independent consultant appointed to review Marine Specialist study components of an Environmental Impact Assessment for extension of the iron ore export terminal and associated ore handling facilities in Saldanha Bay, South Africa
2007-2011	South Africa	Resource Ballast Technology (Pty) Ltd	Independent assessor of efficacy of a newly developed ballast water treatment system and evaluation (risk assessment) of the residual toxicity of ballast water treated with the system.
2007-2011	South Africa	Department of Environmental Affairs & Tourism: Marine and Coastal Management (DEAT: MCM)	Shore based fisheries monitoring programme designed to assess levels of fishing mortality, stock abundance indices and to evaluate the effectiveness of management measures for the commercial and recreational linefishery, tuna pole and hake handline fishing in South African waters.
2007-2011	South Africa	Department of Environmental Affairs & Tourism: Marine and Coastal Management (DEAT: MCM)	Offshore, boat-based fisheries monitoring programme designed to supply and deploy aboard fishing vessels, competent, suitably trained and equipped scientific observers for the inshore trawl, hake longline and west coast rock lobster fisheries.
2007-2010	Ghana	Tullow Oil Plc	Environmental Impact Assessment, Environmental Overview and identification of Environmental Best Management Practice (BMP) required for seismic surveying and exploratory drilling for offshore oil and gas resources in the Tano shallow water and Deep water blocks in Ghana. (Three separate EIA studies).
2007	South Africa	Shelley Point Breakwater (Pty) Ltd/Doug Jeffery Environmental Consultants	Environmental Impact Assessment for the Shelly Point Small Craft Harbour.
2007	South Africa	University of Cape Town	Project supervisor on a study on fish populations in three False Bay estuaries (Zandvlei, Eerste and Lourens).
2006-2011	Tanzania	International Conservation Union (IUCN)/Pangani Water Basin Office, Tanzania	International mentor of the Estuary Team for a project entitled "Flows for People and the Environment: Supporting Sustainable Land Management in the Pangani Basin (Tanzania)".
2006-2007	South Africa	Cape Action Plan for People & the Environment (C.A.P.E.) and World Wildlife Foundation (WWF)	Project leader responsible for development of a fine scale conservation plan for the Agulhas Marine Bioregion.
2006-2007	South Africa	Department of Science and Technology (DST) and the South African Environmental Observation Network (SAEON)	Consultant appointed to lead the process of developing a data management facility for the South African National Antarctica Programme (SANAP) in consultation with the SANAP research and management community.

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2006	South Africa	Seaton Thompson and Associates and Tintswalo Atlantic (Pty) Ltd	Environmental Impact Assessment for a proposed guest lodge development at Koelbaai, under Chapman's Peak Drive, in the Table Mountain National Park (TMNP)
2006	Mozambique	Ministry of Co-ordination of the Environment/ World Bank/European Union	Team leader (Expert level I) appointed to prepare a Country Environmental Profile for Mozambique.
2005-2008	South Africa	Port Nolloth Sea Farms (Pty) Ltd/ Department of Environmental Affairs and Tourism (DEAT)	Assessment of ecological impacts and biological and economic viability of abalone ranching in South African west coast.
2005-2007	Angola	BCLME Programme/ United Nation Development Programme (UNDP)/ UNOPS/Global Environment Facility (GEF)	Assessment of the status of biodiversity along the Angola coastline.
2005-2007	South Africa	Cape Action Plan for People & the Environment (C.A.P.E.), Cape Nature, and Department of Environmental Affairs & Tourism: Marine and Coastal Management (DEAT: MCM)	Biodiversity and economic assessment and development of an integrated conservation plan for CAPE estuaries.
2005-2007	Angola, Namibia, South Africa	BCLME Programme/ United Nation Development Programme (UNDP)/ UNOPS/Global Environment Facility (GEF)	Assessment of human capacity, training and infrastructure available within the three countries bordering the BCLME – Angola, Namibia and South Africa.
2007, 2005	South Africa	Transnet-National Ports Authority (Transnet NPA)	Ballast water, flora and fauna survey in the Ports of Durban and Port Elizabeth.
2005	South Africa	Department of Environmental Affairs and Tourism (DEAT)	National State of the Environment Report (SoER) for South Africa.
2005	South Africa	Department of Environmental Affairs and Tourism (DEAT)	Assessment of the marine and coastal tourism potential for the Arniston fishing harbour.
2005	Angola, Namibia, South Africa	Benguela Current Large Marine Ecosystem (BCLME) Programme (UNDP/World Bank)	Development of and operationalisation of an affordable, sustainable and user-friendly State of Ecosystem Information System (SEIS) for the BCLME region (Angola, Namibia, South Africa).
2005	South Africa	National Empowerment Fund (NEF)	Due diligence (feasibility) study to assess the feasibility of a proposed eel aquaculture and processing operation in the Eastern cape, South Africa.

Period	Country	Client	Project, Tasks
2005	South Africa	Department of Environmental Affairs & Tourism	Supervisor on a project to assess the socio-economic value and ecological impacts of the subsistence fishery for sand and mud prawns, and fish in the Knysna estuary, South Africa
2004-2026	South Africa	Saldanha Bay Water Quality Forum Trust (SBWQMFT)	Preparation of a series of "State of the Bay" Monitoring Programme and Reports for Saldanha Bay and Langebaan Lagoon in 2004, and annually between 2008 and 2017.
2004-2008	South Africa	WWF-SA/South African National Parks	Development and implementation of a coastal monitoring programme for the Table Mountain National Park Marine Protected Area.
2004-2005	South Africa	Department of Environmental Affairs and Tourism (DEAT)	Formulation of recommendations on an appropriate permit fees and permitting systems for recreational SCUBA divers and SCUBA diving tour operators in Aliwal Shoal, Pondoland, Bird Island, Tsitsikamma and Table Mountain National Park Marine Protected Areas (MPAs).
2004	South Africa	I & J	Environmental Impact Assessment for an abalone farm at Danger Point, Western Cape.
2004	DRC, Angola, Namibia, South Africa, Mozamb., Tanz., Mauritius, Seychelles	EU-SADC MCS Fisheries Programme	Production of instructional material and the holding of a seminar on the effects of pollutants, illegal fishing methods and the requirements of relevant conventions signed by the SADC states.
2004	South Africa	City of Cape Town	Environmental Impact Assessment for a coastal walkway between St James and Kalk Bay, in False Bay, South Africa.
2004	South Africa	City of Cape Town	Environmental Impact Assessment to assess impacts of an education centre and tidal pool, at Bordjiesrif in False Bay, South Africa.
2004	Mozambique	Southern African Development Community/ Government of Mozambique	Production of a policy document and strategy for fisheries Monitoring Control Surveillance in Mozambique.
2004	South Africa	Botanical Society of South Africa	Preparation of guidelines to assist environmental assessment practitioners in selecting biodiversity specialists for involvement in Environmental Impact
2004	Southern Africa	IPCC/ START Programme	Desktop assessment of the likely impacts of climate change on estuaries in southern Africa.
2004	South Africa	EKZN Wildlife Service/ Department of Environmental Affairs and Tourism (DEAT)	Review and assessment of the management of subsistence fisheries in KwaZulu-Natal, South Africa.
2003-2005	South Africa	Department of Water Affairs & Forestry (DWAF)	Project manager, estuarine coordinator and fisheries specialist on the Berg River Baseline Monitoring Programme.
2003-2004	South Africa/ Namibia/ Angola	BCLME Programme/ UNDP/ UNOPS/ GEF	Capacity and Needs Assessment for the Benguela Current Large Marine Ecosystem (BCLME) Project involving three countries – Angola, Namibia and South Africa.
2003-2004	South Africa	Makana Marine and Projects	Environmental Impact Assessment for the development of a new ship repair facility in the Port of Cape Town.
2003-2004	South Africa	World Wildlife Fund, South Africa (WWF-SA)	Production of a business plan for the proposed Kogelberg Marine Park.

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2003-2004	South Africa	Department of Environmental Affairs and Tourism (DEAT)	Strategic Environmental Assessment to guide the implementation of regulations promulgated under the National Environmental Management Act 1998: Control of Vehicles in the Coastal Zone.
2003	South Africa	Globalballast Programme/ IMO/UNDP/ GEF	Development of a Ballast Water Management Plan for the Port of Saldanha, South Africa.
2003	South Africa, Namibia and Angola	Global International Waters Assessment (GIWA) Programme/ GEF	Global International Water Assessment (GIWA) for the Benguela region (South Africa, Namibia and Angola).
2002-2003	South Africa	Cape Action for People and the Environment / World Bank/ UNDP	Lead consultant on the Marine and Coastal Component of the Cape Action for People and the Environment (C.A.P.E.) programme responsible for the developing components of the Project Concept Document (PCD) and Project Implementation Plan (PIP).
2002-2003	Namibia	Namdeb Diamond Company	Environmental Impact Assessment for the Wet Overburden Mining System in Mining Area 1, Oranjemund, Namibia.
2002-2003	South Africa	Department of Environmental Affairs & Tourism	Assessment of the quantity of abalone caught by recreational fishers during the 2002/2003 fishing season.
2002-2003	South Africa	Water Research Commission, Department of Water Affairs & Forestry	Assessment of the relative contribution and importance of individual estuaries to overall estuarine biodiversity in South Africa.
2002-2003	South Africa	National Ports Authority/ Globalballast Programme	Baseline survey of subtidal reef biota and reef fish off Jaheel & St Croix Islands, Algoa Bay.
2002	Africa	GEF/UNDP UNESCO/IOC/ACOPS	Regional Technical Coordinator for the Working Group on Sustainable Use of Living Resources as part of Phase 2 of the GEF MSP Sub-Saharan Africa Project (GF/6010-0016): Development and Protection of the Coastal and Marine Environment in Sub-Saharan Africa.
2002	South Africa	Department of Environmental Affairs & Tourism	Acoustic tracking study of the West Coast rock lobster (Jasus lalandii) in the Hermanus Whale Sanctuary, on the south-west coast of South Africa.
2002	Namibia	Namdeb Diamond Company	Environmental assessment of sandy beaches in Mining Area 1, Oranjemund, Namibia and an environmental baseline study in a previously unexploited area on the coast.
2002	South Africa	National Research Foundation	Launch the Marine and Coastal Node of the South African Environmental Observatory Network (SAEON) programme.
2002	South Africa	Department of Environmental Affairs & Tourism	Assessment of sardine migration habitats off the East coast of South Africa.
2002	South Africa	Department of Environmental Affairs & Tourism	Fisheries monitoring programme for an experimental hoop-net fishery for west coast rock lobster off Cape Hangklip, South Africa.
2002	South Africa	University of Rhode Island/ History of Marine Animal Populations	Desktop assessment of the likely impacts of climate change on the ecosystem functioning and fisheries of the Benguela ecosystem, South Africa.
2002	Seychelles		Assessment of the status of fisheries, fish stocks, and approaches to fisheries management in the Seychelles

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2001-2002, 2009-2010	South Africa	Department of Environmental Affairs & Tourism	Assessment of the quantity of west coast rock lobster caught by recreational fishers during the 2001/2002 and 2009/2010 fishing seasons.
2001-2003	South Africa	Department of Environmental Affairs & Tourism/ Rhodes University	Economic Sectoral Study of the South African Fishing Industry.
2001-2002	South Africa	AECI/SYNEXUS	Assessment of risks to marine life and human health resulting from disposal of contaminated groundwater from the Umbogintwini waste disposal site.
2001	South Africa	GEF/UNDP/IMO Globalballast Programme	Ballast water fauna and flora survey in the Port of Saldanha.
2001	South Africa	Nitrogen Products	Marine specialist on an EIA to assess impacts of effluent disposal on the marine environment from a fertilizer factory.
2001	South Africa	Maribus Industries	Application for a seawater lease and mariculture permit for a Gracilaria farm in St Helena Bay, South Africa
2001	United Arab Emirates	Dubai Municipality/ Martin Mid-East	Assessment of impacts of effluent discharges and shipbuilding activities on Dubai Creek, UAE.
2000-2002	South Africa	South African National Parks	Marine Coordinator Cape Peninsula National Park, responsible for the design and development of a marine component for the newly established Cape Peninsula National Park.
2000-2002	South Africa	Freshwater Consulting Group	Assessment and monitoring changes in the fish community of the Koekdou River following construction of a new dam on the system
2000-2001	Africa	GEF/UNDP UNESCO/IOC/ACOPS	National coordinator for South Africa on Phase 1 of the GEF MSP Sub-Saharan Africa Project (GF/6010-0016): Development and Protection of the Coastal and Marine Environment in Sub-Saharan Africa.
2000-2001	South Africa	SRK Consulting and PD Naidoo and Associates	Environmental Impact Assessment of potential impacts of the extension of the iron ore handling facility in Saldanha Bay on the marine environment and mariculture activities.
2000	South Africa	City of Cape Town/ Southern Water Ecological Research and Consulting	Environmental Impact Assessment for the upgrade of a rubble weir and other mouth management options for the Zandvlei estuary.
2000	South Africa	On Track Developments/ Chand Environmental	Environmental Impact Assessment for the redevelopment of the Sea Point Pavilion site, Cape Town
2000	South Africa	City of Cape Town/ Southern Water Ecological Research and Consulting	Freshwater fish specialist on the Zeekoeivlei and Rondevlei restoration project.
2000	Africa	SURVAS	National representative on the SURVAS Network tasked with assessing Vulnerability & Adaptation to Impacts of Accelerated Sea-Level Rise in Africa.
1999-2000	South Africa	United States Department of Energy/ Department of Environmental Affairs and Tourism, South Africa	Assessment of the effects of climate change on marine biodiversity in South Africa.

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1999-2000	South Africa	Foundation for Research Development	Assessment of impacts of exploitation of wonderworm <i>Marphysa sanguinea</i> on bouldershore habitats on the Cape Peninsula, South Africa.
1999-2000	South Africa	Department of Environmental Affairs & Tourism, South Africa	National Co-ordinator of the Subsistence Fisheries Programme designed to identify subsistence fishing communities in South Africa, to assess socio-economic profiles and resource harvesting techniques and to provide recommendations for the implementation of appropriate management systems for these fishers.
1999	South Africa	Ridge Management/ Eric van den Honert Environmental Consulting	Environmental Impact Assessment for for the Soetwater Mariculture Project (an abalone and seaweed aquaculture initiative) on the marine environment.
1999	South Africa	City of Cape Town/ Southern Water Ecological Research and Consulting	Environmental Impact Assessment for the construction of a foot bridge over the Zandvlei estuary.
1999	South Africa	City of Cape Town/ Southern Water Ecological Research and Consulting	Environmental Impact Assessment for flood mitigation measures (artificial wetland) on the Silvermine estuary.
1999	South Africa	City of Cape Town/ Freshwater Consulting Group	Fish specialist appointed to assess the ecological importance of Zoarvlei (a freshwater wetland) for marine, estuarine and freshwater fish species.
1999	South Africa	City of Cape Town/ Southern Water Ecological Research and Consulting	Environmental Impact Assessment for upgrading the Zandvlei Wate Water Treatment Works on the Eerste estuary.
1999	South Africa	Jakobsbaai Abalone Farm	Assessment of the application of anolytes to control red-tide dinoflagellates <i>Scripsiella trochoidea</i> in the mariculture industry.
1999	South Africa	Southern Water Ecological Research and Consulting	Guidelines for stocking Capricorn Lake (a shallow dendritic lake in the Capricorn Science and Business Park Lake) with fish
1998-1999	Mozambique	ARCO International Oil and Gas Company/ Austral	Environmental Impact Assessment for onshore and offshore seismic exploration and exploratory drilling for oil and gas in Sofala Bay (Beira) area in Mozambique.
1998-1999	South Africa/ Namibia/ Angola	GEF/UNDP/ Benguela Current Large Marine Ecosystem Programme (BCLME)	Production of an "Integrated Overview of Diamond Mining in the Benguela Current Region" as part of the synthesis and assessment of information on the Benguela Current Large Marine Ecosystem (BCLME) project.
1998	Namibia	Government of Namibia/ Desert Research Foundation of Namibia	Environmental Impact Assessment for a new Fishing Port at Möwe Bay, Skeleton Coast, Namibia.
1998	Namibia	Namdeb Diamond Company	Environmental Impact Assessment for the Elizabeth Bay Mine, Lüderitz, Namibia.
1998	South Africa	Marine Diamond Mines Association/ Sue Lane & Robin Carter & Associates	Generic Environmental Baseline Report on the status of the marine environment, fisheries and coastal utilisation in the South African west coast marine diamond 'a' concession areas, surf zone and admiralty strip.

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1998	South Africa	Blaauberg Municipality/ World Wide Fund for Nature (WWF-SA)	Assessment of the intensity and impact of bait collecting activities on the ecology of the Diep River estuary, South Africa.
1998	South Africa	De Beers Namaqualand/Gibb Africa	Environmental Impact Assessment for the construction of a bridge across the Buffels estuary near Kleinsee.
1997-2012	Namibia	Namdeb Diamond Company	Baseline and Environmental Impact Assessment for beach diamond mining in the Bogenfels Mining Licence Area in the Sperrgebiet, Namibia. Sequential appointment for studies undertaken in 1997, 1998, and annually from 2004-2011.
1997-1998, 2000-2001, 2009-2011	South Africa	Department of Environmental Affairs & Tourism/ Department of Agriculture, Forestry & Fisheries	Implementation of an offshore, boat-based fisheries monitoring programme designed to supply and deploy aboard fishing vessels, competent, suitably trained and equipped scientific observers for the offshore trawl, inshore trawl, hake longline and west coast rock lobster fisheries.
1997-1998	South Africa	Foundation for Research Development/ University of Cape Town	Assessment of the enhanced utilisation and management of demersal fish resources off the east, south and west coasts of South Africa.
1997	United Arab Emirates	Adnoc-Borealis Petrochemicals/Martin Mid-East	Environmental Impact Assessment and Baseline Survey for a new petro-chemicals plant in Dubai, UAE.
1996	South Africa	Rein's Nature Reserve	Assessment of the status of exploited marine species in a small marine reserve near Mossel Bay, South Africa.
1994-1996	South Africa	Sea Fisheries Research Institute/ World-wide Fund for Nature (SA)	Assessment of the impact of commercial beach-seine netting on the fish and invertebrates in False Bay, South Africa.
1990	South Africa	Seafarm Products	Assessment of the impact of fish predation on the cultured mussel, <i>Mytilus galloprovincialis</i> , in the Seafarm Dam, South Africa.

PUBLICATION RECORD

Scientific papers

CLARK, B.M., TURPIE, J.K., CULLIS, J.D.S., DAWSON, J., DOBINSON, L., KUNNEKE M.M. & HORN, A. in press 2022.

The impacts of long-term flow reductions and an extreme drought on a large, permanently open estuary, and implications for setting the ecological reserve. *Water SA* 48(2) xxx-xxx.

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Clark, B.M. 2009. Introduction – The Berg River Baseline Monitoring Programme. *Transactions of the Royal Society of South Africa* 64(2): 95,

Clark, B.M. & S. Taljaard. 2009. Historic changes in inorganic nutrient loading and its effects on water quality biota of the Berg estuary, South Africa. *Transactions of the Royal Society of South Africa* 64(1) In press

Clark, B.M., Hutchings, K. & Lamberth, S.J. 2009. Long-term variations in composition and abundance of fish in the Berg estuary, South Africa. *Transactions of the Royal Society of South Africa* 64(2): 238–258.

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Clark, B.M., Hauck, M., Harris, J., Salo, K. and E. Russell. 2002. Identification of subsistence fishers, fishing areas, resource use and activities. *South Africa Journal of Marine Science* 24: 425-438.

Clark, B.M. 1996. Variation in surf zone fish community structure across a wave exposure gradient. *Est. cstl. Shelf Sci.* 44: 659-674.

Clark, B.M. 1996. Marine diamond mining activities off Namibia: do they really pose a threat to island biota? *S.A. Comm. Mar.* 5(3): 16.

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Clark, B.M., B.A. Bennett & S.J. Lamberth 1994. Assessment of the impact of commercial beach-seine netting on juvenile teleosts in the surf-zone of False bay, South Africa. *South Africa Journal of Marine Science* 14: 255-262.

Clark, B.M., B.A. Bennett & S.J. Lamberth 1996. Factors affecting spatial variability in seine net catches of fish in the surf-zone of False Bay, South Africa. *Mar. Ecol. Prog. Ser.* 131: 17-34.

Clark, B.M., B.A. Bennett & S.J. Lamberth 1996. Temporal variations in surf-zone fish assemblages from False Bay, South Africa. *Mar. Ecol. Prog. Ser.* 131: 35-47.

Branch, G.M. and Clark, B.M. 2006. Fish stocks and their management: The changing face of fisheries in South Africa. *Marine Policy* 30 (1): 3-17.

Hutchings, K., Clark, B.M., Atkinson, L.J. & C. G. Attwood. 2008. Evidence of recovery of the linefishery in the Berg River Estuary, Western Cape, South Africa, subsequent to closure of commercial gillnetting. *African Journal of Marine Science* 2008, 30 (3): 507–517.

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Environmental Science (Professional Natural Scientist)

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