Samara Mining (Pty) Ltd Proposed Diamond Prospecting Right In Offshore Concession Areas 4C And 5C Off The West Coast, South Africa

Desktop Marine Impact Assessment

Aquatic Ecosystem Services

April 2023

Executive Summary

Introduction

Samara Mining (Pty) Ltd (Samara) intends to undertake an exploration programme in Sea Concession Areas 4C and 5C (hereafter the Concession Areas) located approximately from 10 km to 195 km seaward of the West Coast shoreline of South Africa near Port Nolloth and Kleinsee. Samara is applying for a Prospecting Right for bulk sampling for diamonds which will be undertaken in a phased approach using both invasive and non-invasive methods. The project aims to gather sufficient data on the Concession Area to estimate potential diamond deposits in order to ascertain whether potential future mining is viable. The total Concession Area is approximately 781 362 hectares (Figure ES-1).

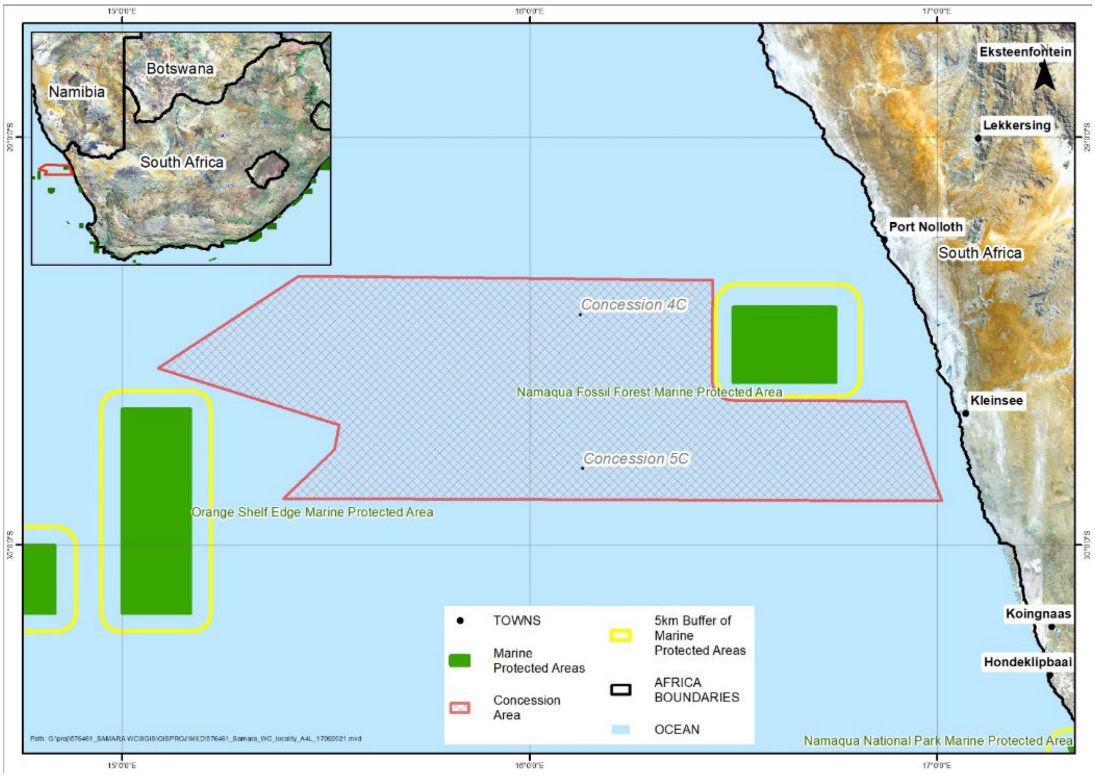

Figure ES-1: Location of Concession 4C and 5C (the Concession Area).

Project overview

The application is for a Prospecting Right for bulk sampling for diamonds which will be undertaken in a phased approach.

To prospect for diamonds, Samara Mining intends to use both invasive and non-invasive methods. The non-invasive method will be made up of desktop studies, geophysical surveys, 3D geological modelling and resource estimation. The invasive method will comprise of bulk sampling.

Desktop studies entail combining available historic data in order to get a clear understanding of the proposed diamond deposit character.

Geophysical surveys will be done to identify geological features where further exploration sampling will be undertaken. The equipment for the survey will be deployed from a vessel appropriate for the depth and survey method to be used.

Where geological features of interest (showing potential for diamond prospecting) have been identified, follow up surveys and sampling will be undertaken. Sampling will entail the extraction of sediment from the seabed using fit-for-purpose vessels, equipped with a crawler that will dredge materials from the seabed. The diamonds will be sorted from the dredged material in a mechanical treatment plant on board the vessel. Both fine and coarse tailings are then discarded off the vessel to either form a fine sediment plume or to settle on the bottom immediately below the vessel respectively.

Terms of Reference

The assessment of marine impacts has included a detailed search of available scientific and grey literature which was used to describe the baseline marine environment within the Concession Area. The following aspects were included:

- Review of basic oceanography in the area.
- Benthic seabed habitats.
- Benthic fauna.
- Ichthyofauna, avifauna and marine mammals.
- Conservation areas and areas of significance (excluding fossils).

This information has been contextualised within the region and used as the basis for assessing impacts resulting from the invasive mining exploration activities. No fieldwork or public consultation was undertaken in the preparation of this report.

Assumptions and limitations

- The study was conducted on a desktop basis only, no primary data collection was undertaken.
- The study has followed the categorisations provided by the marine spatial planning guidelines as published by the National Coastal and Marine Spatial Biodiversity Plan (NCMSBP) which was proclaimed in 2022.
- The applicable legislation presented in this report is based on searches on similar projects that have been authorised in the marine environment in South Africa, and does not represent a qualified legal opinion or review.

Methods

A detailed literature search was conducted to obtain peer-reviewed information sources on the marine environment in the Concession Area. Thereafter, online searches for grey material on the Concession Area were conducted. The most important sources of information for the assessment were obtained from the NCMSBP (DFFE et al. 2022). These contain GIS layers of biological information and known areas of biological importance in the region. These layers were intersected with the proposed mining exploration Concession Area to determine the extent of impacts that would take place on the affected environment.

Relevant legislation

The main pieces of national legislation that affect this specialist study are:

- Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002).
- National Environmental Management Act, 1998 (No. 107 of 1998).
- Environmental Impact Assessment (EIA) Regulations, 2014 (as amended)

- Marine Living Resources Act, 1998 (No. 18 of 1998)
- National Environmental Management: Integrated Coastal Management Act, 2008 (No. 24 of 2008)

Baseline description of the affected environment

Physical context

The Concession Area is found within the deep sub-photic zone (Figure ES-2), along the continental shelf.

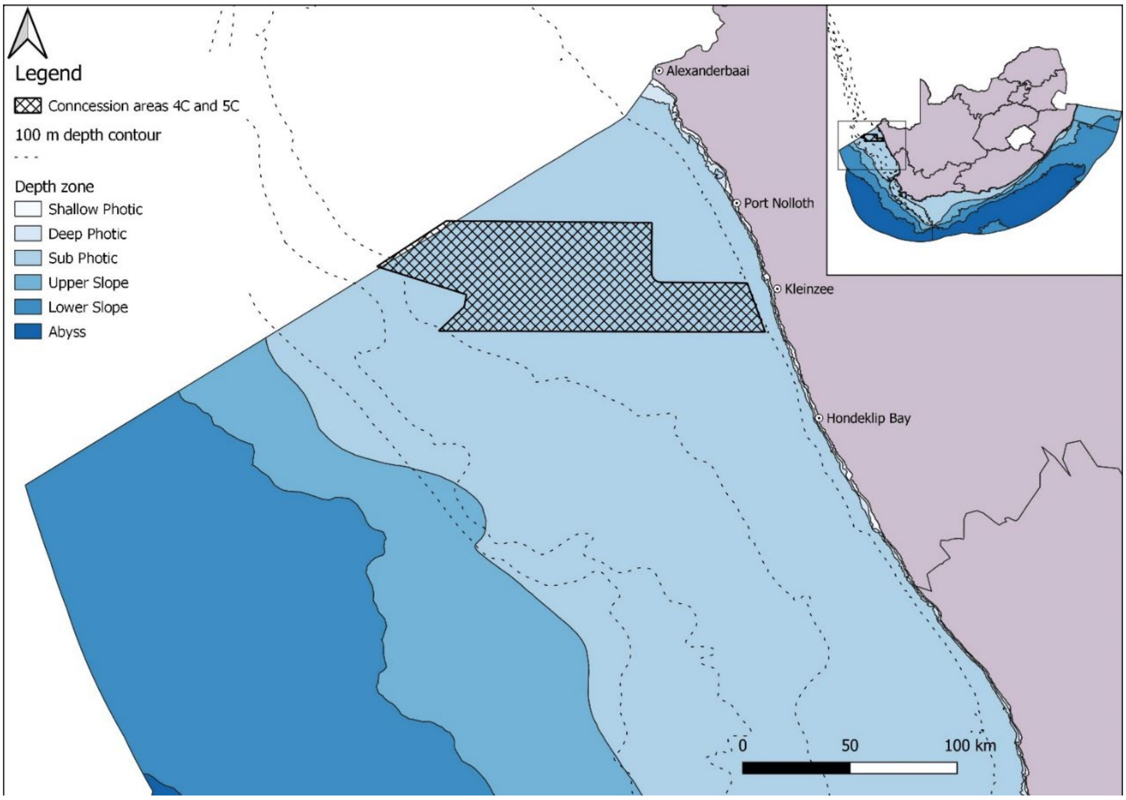

Figure ES-2: Oceanic depth zones and 100 m depth found in the vicinity of the Concession Area (Sink et al. 2019).

The region's nearshore dynamics are primarily wind driven, both on a large scale, with winds driving south-westerly swells that impact the coast, and locally, with winds contributing to northward-flowing inshore currents (Pulfrich 2018). The South Atlantic high-pressure system undergoes seasonal variations, being strongest during summer, in contrast, this high-pressure cell weakens and migrates north-westwards in winter (Shillington et al. 2006).

The strongest and most continuous winds occur during the summer months in a south-easterly direction (Shillington et al. 2006). These winds, through Ekman transport, push surface water offshore, resulting in strong upwelling of bottom waters which are nutrient rich (Lutjeharms and Meeuwis 1987).

During winter, winds are dominated by southerly to south-easterly winds (Pulfrich 2018). This switch from the summer condition reduces upwelling intensity, resulting in the movement of warmer oceanic water inshore, reducing stratification (Hutchings et al. 2009).

Biogeography

The Concession Area is located offshore, being mainly influenced by the Benguela Upwelling System (BUS). The BUS is one of the most productive upwelling driven eastern boundary currents globally (Carr 2002), where the dominant south-easterly wind described above displaces warm nutrient poor surface water offshore during the summer months, causing cold nutrient rich water from a deeper origin to replace it (Lutjeharms and Meeuwis 1987). The result is a cold northerly flowing eastern boundary current, rich in nutrients that supports phytoplankton growth in the presence of sunlight and therefore the base of the region's marine food web (Lutjeharms and Meeuwis 1987).

The Concession Area is situated in the cold temperate Namaqua Bioregion (Lombard et al. 2004) (Figure ES-3). The majority (85%) of the Concession Area lies between 150-200m depth, with 14% in 100-150m and less than 1% deeper than 200m.

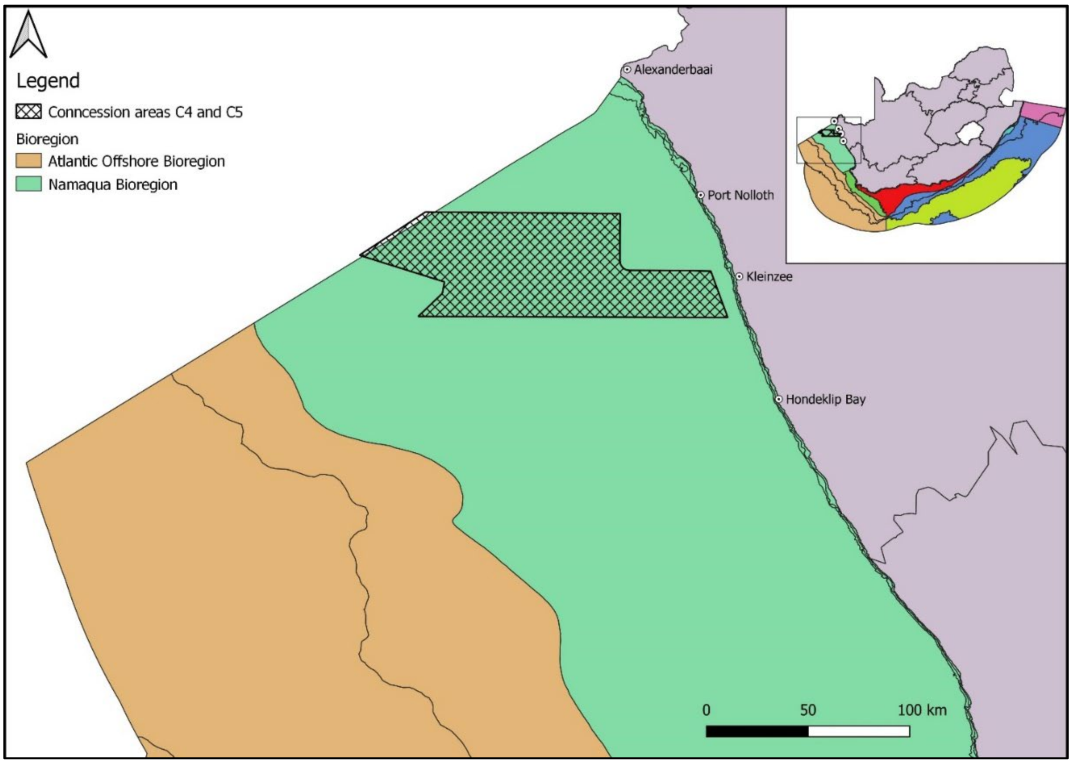

Figure ES-3: Marine bioregions found within the vicinity of the Concession Area (Data source Sink et al. 2019).

Based on Sink et al. (2019), the Concession Area is located within the Southern Benguela Ecoregion which extends from Cape Agulhas to Namibia. The Concession Area falls within two broad ecosystem types (Figure ES-4):

1. Deep rocky shelf, found towards the Concession Area's eastern (9 % of Concession Area),
2. Deep soft shelf, found throughout the Concession Area unless otherwise stated. (91 % of the Concession Area).

The entire deep rocky shelf broad ecosystem within the Concession Area consists of Namaqua Muddy Mid Shelf Mosaic (NMMSM) (9 % of Concession Area) (Figure ES-5).

Three ecosystems are found over the deep soft shelf habitat (Figure ES-5):

- the Namaqua Sandy Mid Shelf (NSMS) (2 % of Concession Area),
- the Namaqua Muddy Sands (NMS) (53 % of Concession Area) and
- the Southern Benguela Sandy Outer Shelf (SBSOS) (36 % of Concession Area).

Figure ES-6 shows the protection status of the areas inside the Concession Area.

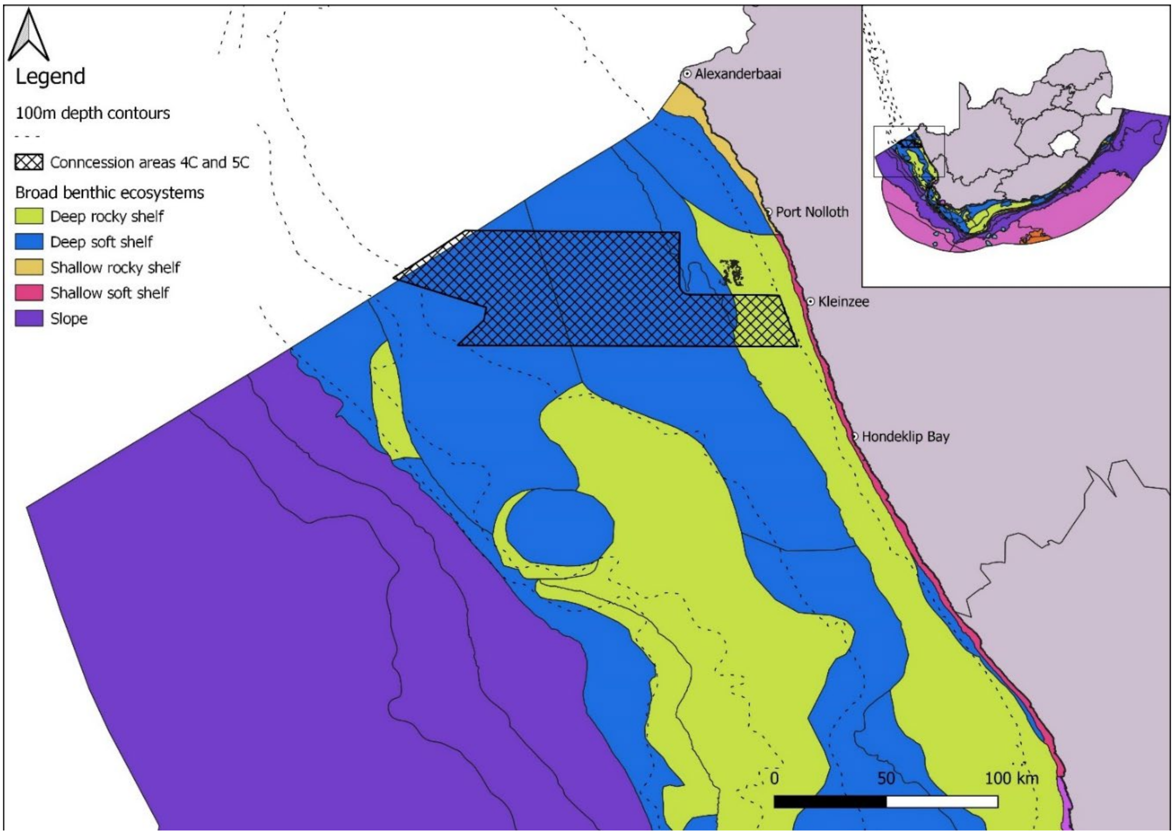

Figure ES-4: Broad benthic ecosystem types found within the vicinity of Concession Area. (Data source Sink et al. 2019).

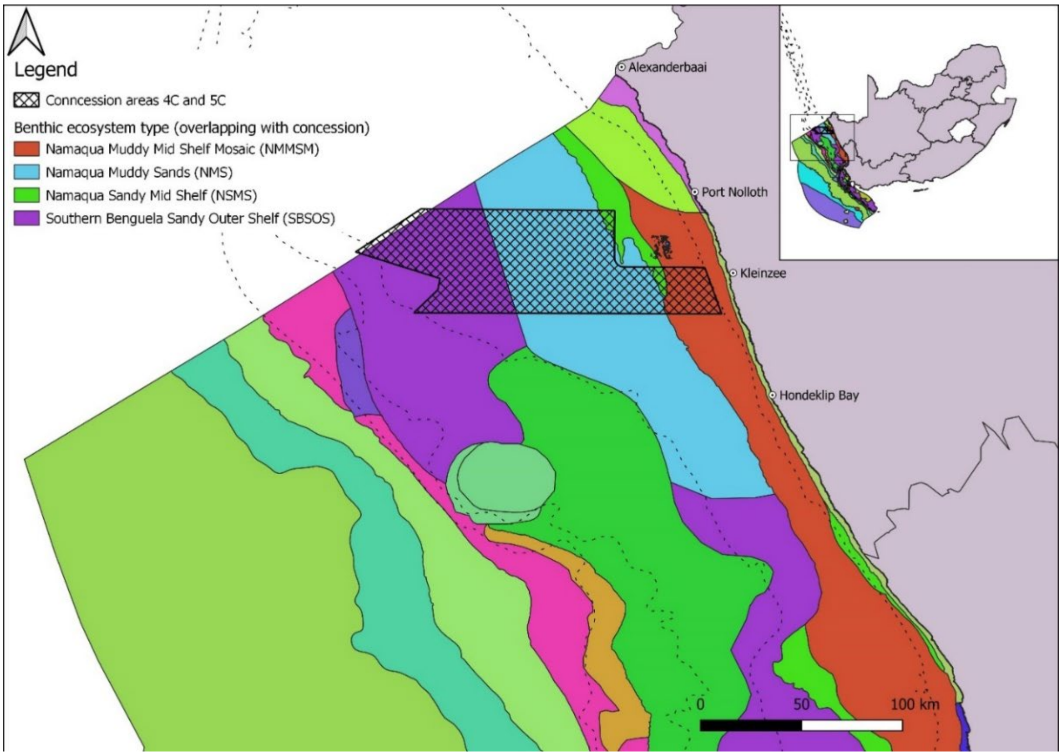

Figure ES-5: Benthic ecosystem types found within the Concession Area (Data source: Sink et al. 2019).

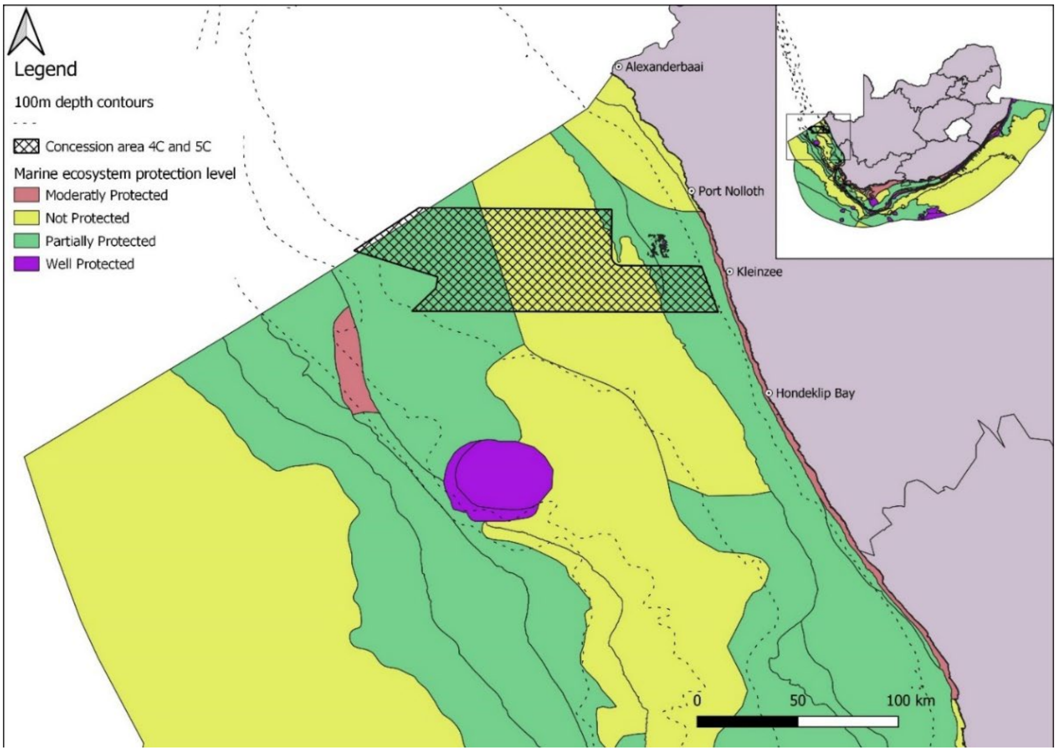

Figure ES-6: Protection level of marine benthic ecosystem types within the Concession Area (Data source: Sink et al. 2019).

Protected areas and marine spatial planning

In 2019, a network of 20 new Marine Protected Areas (MPAs) was gazetted in South Africa. The Namaqua Fossil Forest MPA is one of the recently proclaimed MPAs which is located adjacent to the Concession Areas 4C and 5C. The MPA is located 17km offshore of Port Nolloth within the 120 to 150m depth range and encompasses an area of approximately 875 km^2. The MPA was established due to the presence of a small rocky outcrop formed by fossilized yellowwood trees, including a species new to science (Bamford and Stevenson 2002; Stevenson and Bamford 2003). The Namaqua Fossil Forest MPA is surrounded by a 5km buffer, which extends by a further 8km on the southern boundary, which is designated as an Ecological Support Area, which provides further protection from direct impact on the ecosystem components it contains

In addition to the network of MPAs, a NCMSBP has recently been completed and proclaimed (Harris et al. 2022, DFFE et al. 2022). The NCMSBP builds on the network of formal conservation areas protected in the MPA network by identifying additional areas of importance for safeguarding representative areas of marine biodiversity. The output of the process is a Critical Biodiversity Area (CBA) Map which serves as a spatial plan to inform future marine spatial planning in support of sustainable development. The three categories include MPAs, CBAs and Ecological Support Areas (ESAs).

In terms of the current project, the Concession Area overlaps with both CBA and ESA areas. The CBA Maps identify 32% of the Concession area as CBA-N, 3% as ESA with <0.001% considered as CBA-R. The remaining 65% of the Concession Area is unclassified in terms of the CBA maps. Based on this, activities within 35% of the Concession Area are to be informed by the sea-use guidelines in order to achieve the management objectives for sustainable use and development (Figure ES-7).

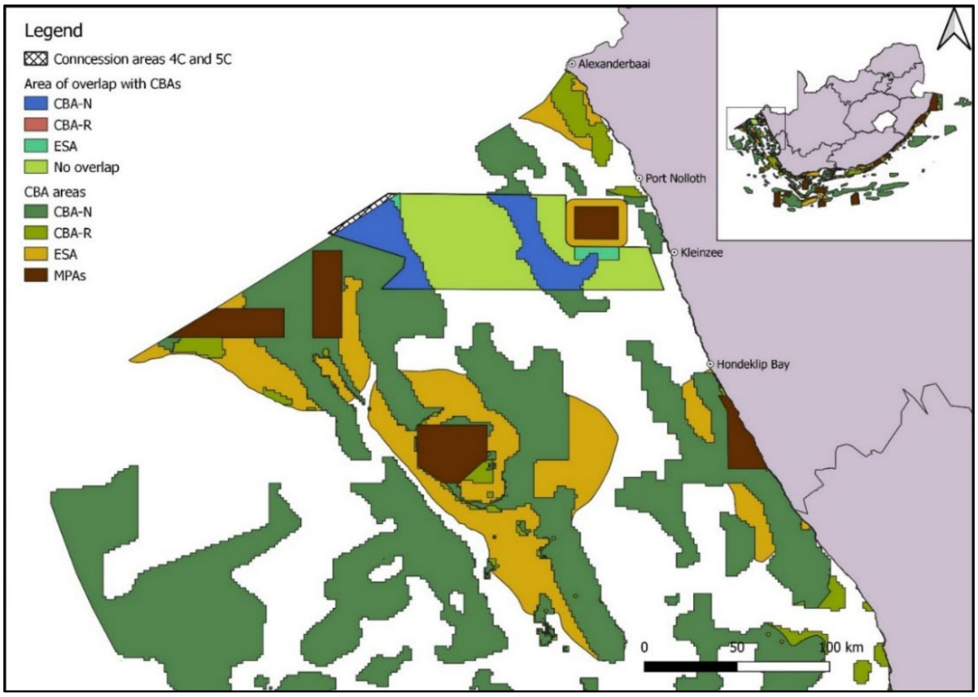

Figure ES-7: Critical biodiversity areas (CBA) identified by Harris et al. (2022) found within the vicinity of the Concession Areas as well as where the Concession Areas overlap with the CBA areas.

Impact Assessment

The potential impacts of the exploration and prospecting activities on the marine environment were evaluated based on available literature and previous basic assessments, EIAs and specialist reports associated with similar operations along the West Coast.

No operation phase impacts have been considered since the application only applies to the exploration phase. A separate EIA will be required should the project wish to proceed with mining.

The most significant impact of the project on the marine environment is the physical disturbance caused by the bulk sampling and the dumping of tailings over potentially sensitive habitat types found within the Concession Area, which currently overlaps with 32% CBA-N, 3% ESA and <0.001% CBA-R.

Consequently, the impact assessment has recommended that no invasive sampling should be undertaken in the CBAs and ESAs as outlined in the sea-use guidelines. Instead, the information gathered during the non-invasive sampling should be evaluated to determine whether there is sufficient evidence of mineral potential to justify further investigation and a possible re-classification of the CBA and ESA areas. Any re-evaluation would require a detailed spatial plan for invasive sampling within the CBAs or ESAs, which is currently unavailable. Additional primary data on the benthic habitats in these areas may also be required to inform the re-evaluation.

The assessment of impacts in the remainder of the Concession Area have shown that the exploration activities will result in limited negative impacts on a localised scale for short durations. Reasonable and feasible mitigation measures have been proposed which reduce the impacts further, in line with best practice. On this basis the proposed non-invasive exploration activities in the Concession Areas are acceptable, and invasive exploration activities are acceptable in the areas that are not delineated as CBAs or ESAs. The acceptability of invasive sampling in the CBA and ESA areas should be assessed based on the outcomes of the non-invasive sampling results and the provision of a detailed spatial sampling plan.

A summary of impacts and associated mitigation measures are provided in Table ES-1 below.

Table ES-1: Summary of impacts and mitigation / optimisation measures

Impact	Significance rating		Key mitigation / optimisation measures
	Before mitigation / optimisation	After mitigation/ optimisation	
EXPLORATION PHASE IMPACTS			
Noise pollution on invertebrates	Very low	n/a	• n/a
Noise pollution on fish	Very Low	Very Low	• Implement "soft starts" for the surveys for sound levels >210 dB re 1 µPa at 1 m over a period of 20 minutes to give sensitive species an opportunity to move away from the sampling area, particularly if large aggregations of fish are observed on the ship's sonar.
Noise pollution on marine mammals	Very Low	Very Low	• Undertake a visual scan of the area 15 minutes prior to the commencement of surveying activities and soft starts. Visual scans should be undertaken by a trained Marine Mammal Observer (MMO). • Implement "soft starts" for the surveys for sound levels >210 dB re 1 µPa at 1 m over a period of 20 minutes to give sensitive species an opportunity to move away from the sampling area. • Cease survey activities if abnormal behaviour in marine mammals is observed until the animal has moved away from the area. • Avoid surveys during known periods of cetacean migration into the area for feeding (beginning of June to the end of November) and ensure that cetaceans are able to move around sonar operations. • Implement Passive Acoustic Monitoring (PAM) on board survey ships, with a view to: o Detect the range and frequencies of marine mammal vocalisations expected to be present in the survey area. o Detect and identify vocalising marine mammals and establish bearing and range in a reasonable period of time. o Ensure real time relaying of the recordings to the PAM operator to allow for immediate mitigation activities to be implemented.
Potential vessel strikes on marine mammals	Low	Very Low	• Marine Mammal Observer to be onboard the survey vessel at all times. • Reduce vessel speed to <10 knots during the geophysical surveys. • Avoid known areas of high marine mammal activity. • Where possible avoid periods of high marine mammal activity within the Concession Area (June-November).

Impact	Significance rating		Key mitigation / optimisation measures
	Before mitigation / optimisation	**After mitigation/ optimisation**	
Bulk sampling on benthic fauna	Low	Very Low	• Exclude CBA and ESA areas from bulk sampling activities unless significant mineral resources can be demonstrated through non-invasive techniques. • Additional in situ assessment will be required for any invasive sampling within CBA areas. • Leave undisturbed areas between excavated pits to enhance recolonisation opportunities. • Monitor incoming benthic sediment for coral or fossil fragments, if observed halt sampling and mark the location.
Crushing of epifaunal community by crawler tracks	Very Low	n/a	• n/a
Increased turbidity in the water column due to fine sediment suspension	Very Low	n/a	• n/a (Assumes CBAs are excluded from sampling area)
Sedimentation impacts on benthic communities due to coarse tailings	Low	Insignificant	• No discharge of tailings to be undertaken within the CBA areas. • Non-invasive geophysical survey data should be used to identify hard substrate and these areas should be avoided when discharging coarse tailings.
Marine pollution from vessel operational discharges	Very Low	Insignificant	• Implement MARPOL regulations to manage ship effluent and discharges.

The individual impacts assessed above were considered within the NCMSBP sea-use guidelines, and the mitigation measures suggested will result in the outcomes of the project meeting the requirements of the plan. Given this outcome, and the fact that the Plan was developed taking into consideration the entire extent of the Namaqua Bioregion, cumulative impacts related to exploration activities in the benthic ecosystem types (Namaqua Muddy Sands, Southern Benguela Sandy Outer Shelf, Namaqua Muddy Mid Shelf Mosaic and Namaqua Sandy Mid Shelf) in the Concession Area will result in minimal cumulative impacts. Indeed, the intention of the NCMSBP is to ensure that foreseeable cumulative impacts are minimised and managed appropriately by designating protected and limited use areas.

In this instance, the No Go option, in which no disturbance of the seabed takes place is preferable to the exploration alternative. However, the impacts on the remaining Concession Area that falls outside the CBAs and ESAs are very limited (9.2Ha of area to be disturbed) and could result in significant economic benefits being derived from the area, which is in line with the published goals of the marine spatial planning initiative.

We feel that exploration in the Concession Areas that fall outside the areas delineated on the CBA Maps should be approved. Approval for non-invasive sampling in the CBA and ESA areas should be granted. Approval for invasive sampling in the CBAs and ESAs should be withheld at this stage pending further information on the mineral resources in this area based on the findings of the geophysical survey from which a detailed spatial sampling plan can be developed.

Table of Contents

List of Tables

List of Figures

Appendices

Acronyms and Abbreviations

AES	Aquatic Ecosystem Services
BA	Basic Assessment Process
BUS	Benguela Upwelling System
CBA	Critical Biodiversity Areas
CBA-N	Critical Biodiversity Areas – Natural State
CBA-R	Critical Biodiversity Areas - Restored
DFFE	Department of Forestry, Fisheries and the Environment
DMS	Dense Media Separation
EBSA	Ecologically and Biologically Significant Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESA	Ecological Support Areas
GIS	Geographic Information System
GPS	Global Positioning System
HABs	Harmful Algal Blooms
LPF	Large Pelagic Fishes
MMO	Marine Mammal Observer
MPA	Marine Protected Area
NCMSBP	National Coastal and Marine Spatial Biodiversity Plan
NEMA	National Environmental Management Act 107 of 1998
NMMSM	Namaqua Muddy Mid Shelf Mosaic
NMS	Namaqua Muddy Sands
NSMS	Namaqua Sandy Mid Shelf
PAM	Passive Acoustic Monitoring
ROVs	Remotely Operated Vehicles
SACW	South Atlantic Central Water
SBSOS	Southern Benguela Sandy Outer Shelf
S&EIR	Scoping and Environmental Impact Reporting
SPF	Small Pelagic Fishes
SRK	SRK Consulting (South Africa) (Pty) Ltd
ToR	Terms of Reference
TSS	Total Suspended Solids
VME	Vulnerable Marine Ecosystem
°C	Degrees Celsius
dB	Decibel
µM	Micro Mole
µPa	Micro Pascals
kts	Knots
Km	Kilometre
m	Metre

Glossary

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.
Concession Area	The area being investigated by this study. It is the combination of Concession Area 4C and 5C.
Construction Phase	The stage of project development comprising site preparation as well as all construction activities associated with the development.
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.
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.
Environmental Authorisation	Permission granted by the competent authority for the applicant to undertake listed activities in terms of the NEMA EIA Regulations, 2014 (GN R982, as amended by GN R326)
Environmental Impact Assessment	A process of evaluating the environmental and socio-economic consequences of a proposed course of action or project.
Environmental Impact Assessment Report	The report produced to relay the information gathered and assessments undertaken during the Environmental Impact Assessment.
Environmental Management Programme	A description of the means (the environmental specification) to achieve environmental objectives and targets during all stages of a specific proposed activity.
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.
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.
Operational Phase	The stage of the works following the Construction Phase, during which the development will function or be used as anticipated in the Environmental Authorisation.
Scoping	A procedure to consult with stakeholders to determine issues and concerns and for determining the extent of and approach to an EIA and EMP (one of the phases in an EIA and EMP). This process results in the development of a scope of work for the EIA, EMP and specialist studies.
Specialist study	A study into a particular aspect of the environment, undertaken by an expert in that discipline.
Stakeholders	All parties affected by and/or able to influence a project, often those in a position of authority and/or representing others.

1 Introduction

1.1 Background

Samara Mining (Pty) Ltd (Samara) intends to undertake an exploration programme in Sea Concession Areas 4C and 5C (the Concession Area) located approximately from 10 km to 195 km seaward of the West Coast shoreline of South Africa (Figure 1-1).

The application is for a Prospecting Right for bulk sampling for diamonds which will be undertaken in a phased approach.

To prospect for diamonds, Samara Mining intends to use both invasive and non-invasive methods. The non-invasive method will be made up of desktop studies, geophysical surveys, 3D geological modelling and resource estimation. The invasive method will comprise of bulk sampling.

Desktop studies entail combining available historic data in order to get a clear understanding of the proposed diamond deposit character.

Geophysical surveys will be done to identify geological features where further exploration sampling will be undertaken. The equipment for the survey will be deployed from a vessel appropriate for the depth and survey method to be used.

Where geological features of interest (showing potential for diamond prospecting) have been identified, follow up surveys and sampling will be undertaken. Sampling will entail the extraction of sediment from the seabed using fit-for-purpose vessels, equipped with a crawler that will dredge materials from the seabed. The diamonds will be sorted from the dredged material in a mechanical treatment plant on board the vessel. Both fine and coarse tailings are then discarded off the vessel to either form a fine sediment plume or to settle on the bottom immediately below the vessel respectively.

Aquatic Ecosystem Services (AES) was appointed by SRK Consulting (South Africa) (Pty) Ltd (SRK) to undertake a desktop marine specialist study of the project to inform the Environmental Impact Assessment (EIA) process. The specialist team involved in this assessment were Dr Alexander Winkler, Dr Russell Chalmers, and Naomi Richardson (refer to Appendix A for further information).

1.2 Terms of Reference

The assessment of marine impacts has included a detailed search of available scientific and grey literature which was used to describe the baseline marine environment within the Concession Area. The following aspects were included:

- Review of basic oceanography in the area.
- Benthic seabed habitats.
- Benthic fauna.
- Ichthyofauna, avifauna and marine mammals.
- Conservation areas and areas of significance (excluding fossils).

This information has been contextualised within the region and used as the basis for assessing impacts resulting from the invasive mining exploration activities. No fieldwork or public consultation was undertaken in the preparation of this report.

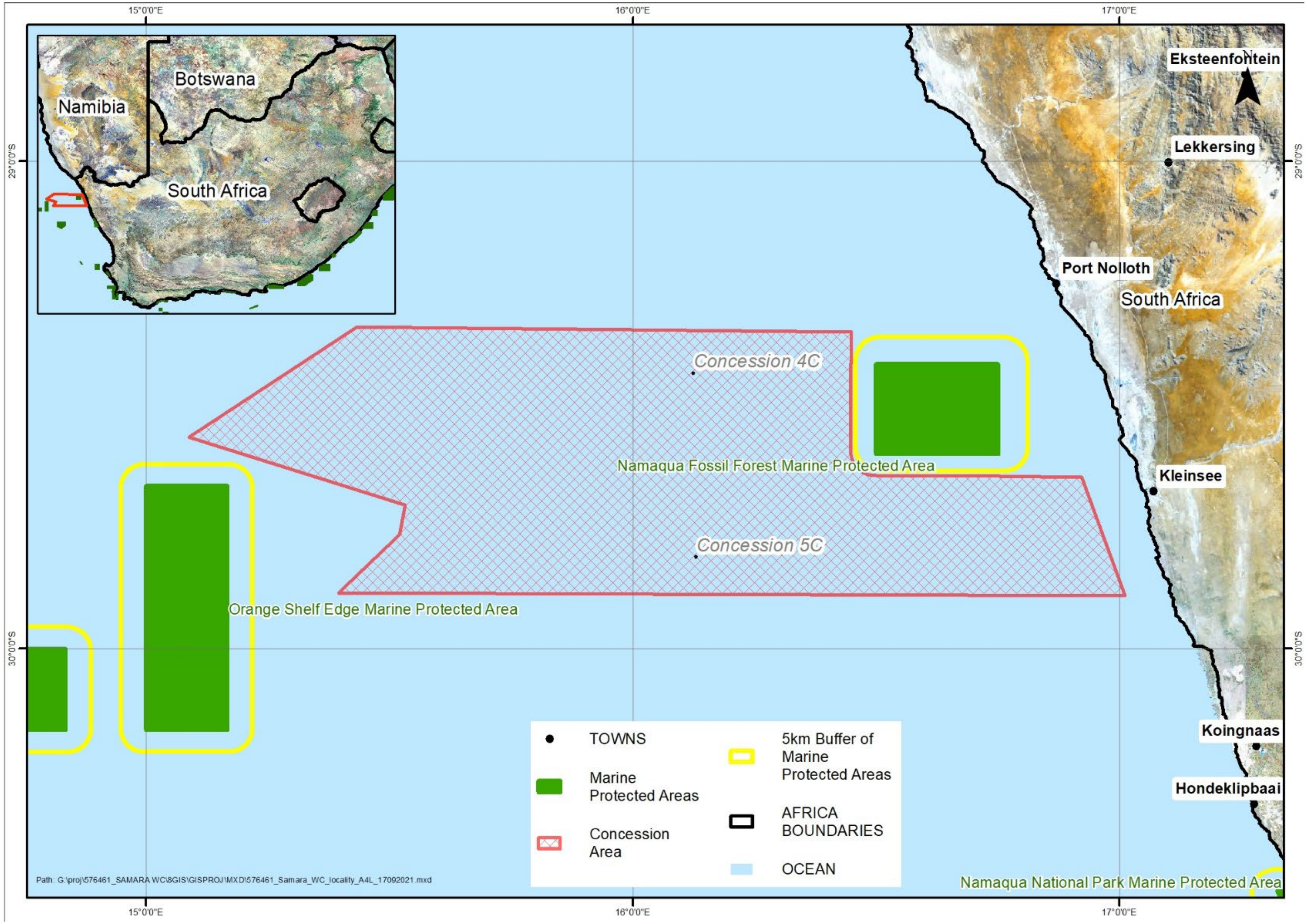

Figure 1-1: Location of Concession 4C and 5C (the Concession Area) (Source: SRK)

1.3 Content of Report

Appendix 6 of the EIA Regulations, 2014 (Government Notice (GN) R 982 of 2014, amended by GN R326 of 2017) prescribes the required content in a specialist report. These requirements and the sections of this specialist report in which they are addressed, are summarised in Table 1-1.

Table 1-1: Content of specialist report as per EIA Regulations, 2014

GNR 982, Appendix 6 Ref.:	Item	Report Section:
(1) (a) (i)	Details of the specialist who prepared the report;	1.1, App A
(1) (a) (ii)	Expertise of that specialist to compile a specialist report including a curriculum vitae;	App A
(1) (b)	A declaration that the specialist is independent in a form as may be specified by the competent authority;	App B
(1) (c)	An indication of the scope of, and the purpose for which, the report was prepared;	1.2
(1) (cA)	An indication of the quality and age of base data used for the specialist report;	2, 1.4
(1) (cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	5
(1) (d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	n/a
(1) (e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	2.2
(1) (f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	6
(1) (g)	An identification of any areas to be avoided, including buffers;	6, 7
(1) (h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	5
(1) (i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	1.4
(1) (j)	A description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	6
(1) (k)	Any mitigation measures for inclusion in the EMPr;	6
(1) (l)	Any conditions for inclusion in the environmental authorisation;	6,7
(1) (m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	6
(1) (n) (i)	A reasoned opinion whether the proposed activity, activities or portions thereof should be authorised;	7.2
(1) (n) (iA)	A reasoned opinion regarding the acceptability of the proposed activity or activities;	7.2
(1) (n) (ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	6
(1) (o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	See EIA Report
(1) (p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	See EIA Report
(1) (q)	Any other information requested by the competent authority.	n/a

GNR 982, Appendix 6 Ref.:	Item	Report Section:
(2)	Where the government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	

1.4 Assumptions and Limitations

The study is based on a number of assumptions and is subject to certain limitations, which should be borne in mind when considering information presented in this report. The validity of the findings of the study is not expected to be affected by these assumptions and limitations:

- The study was conducted on a desktop basis only, no primary data collection was undertaken.
- The study has followed the categorisations provided by the marine spatial planning guidelines as published by the National Coastal and Marine Spatial Biodiversity Plan (NCMSBP) (Department of Forestry, Fisheries, and the Environment (DFFE) et al. 2022).
- The applicable legislation presented in this report is based on searches on similar projects that have been authorised in the marine environment in South Africa and does not represent a qualified legal opinion or review.

Other assumptions made in the report are explicitly stated in the relevant sections.

2 Approach

2.1 Guidelines

The NCMSBP (DFFE et al. 2022) was developed by a group of knowledgeable specialist stakeholders who have assessed the importance of the study area from a conservation perspective relative to the rest of the South African coastline and in accordance with South Africa's commitments to sustainable development and the enhancement of the Blue Economy (Operation Phakisa). These guidelines identify areas of biological, cultural, and historical importance that must be safeguarded for future generations and provides guidelines on what types of activities may and may not be undertaken in particular areas.

Furthermore, they have weighed the needs of commercial activities in the marine environment and engaged with stakeholders from various industry groups to ensure that allowance for economic activities have been made where required to sustain the economies of coastal communities.

It has guided this impact assessment and the findings of the literature review.

2.2 Methodology

A detailed literature search was conducted to obtain peer-reviewed information sources on the marine environment in the Concession Area. Thereafter, online searches for grey material on the Concession Area were conducted. The most important sources of information for the assessment were obtained from the NCMSBP (DFFE et al. 2022). These contain Geographic Information System (GIS) layers of biological information and known areas of biological importance in the region. These layers were intersected with the proposed mining exploration Concession Area to determine the extent of impacts that would take place on the affected environment. Furthermore, the known distribution/habitat preferences of species groups were overlain across the Concession Area to provide some indication of possible habitats within the Concession Area and how important such habitats and associated faunal communities may be. This analysis has formed the basis for this impact assessment.

2.3 Impact Assessment

Potential impacts of the proposed project were identified based on the baseline data, project description, review of other studies for similar projects and professional experience.

The significance of the impacts was assessed using the prescribed SRK impact rating methodology (see Section 6.1).

Practical mitigation and optimisation measures that can be implemented effectively to reduce or enhance the significance of impacts were identified. The impact significance was rated again assuming the effective implementation of mitigation measures.

3 Project Description

3.1 Introduction

Samara intends to undertake an exploration programme in Sea Concession Areas 4C and 5C (hereafter the Concession Areas) located approximately from 3 km to 195 km seaward of the West Coast shoreline of South Africa near Port Nolloth and Kleinsee. Samara is applying for a Prospecting Right for bulk sampling for diamonds which will be undertaken in a phased approach using both invasive and non-invasive methods. The project aims to gather sufficient data on the Concession Area to estimate potential diamond deposits in order to ascertain whether potential future mining is viable. The total Concession Area is approximately 987 039 hectares.

3.2 Phase 1 (Desktop Studies Month 1-23)

This phase will use non-invasive methods that will consist of desktop-literature studies, geophysical surveys within the Concession Areas, geophysical data processing and interpretation, compilation of a GIS database, geological modelling and delineation of potential diamond trap-sites which will form the knowledge base to plan and design the exploration sampling programme. The aim is to delineate areas within the Concession Area that show high mineralization potential, moderate potential, and no potential on a reconnaissance scale. This information will be used to plan and layout of geophysical survey lines in areas of moderate to high mineralisation potential. Survey line spacing will be determined by the selection of the appropriate geophysical survey equipment to provide adequate coverage as well as by the water depth of each potential area and is not known at this stage. The reconnaissance geophysical survey programme will be executed over a period of 2 months and geophysical survey equipment will include a decimetre accurate Global Positioning System (GPS), tide gauge, high resolution swath bathymetric system and high resolution seismic sub-bottom profiler. Post-processing of swath bathymetric data will produce a high resolution geographically accurate digital terrain model of the sea floor surface that will allow for interpretation of the sediment-rock contact, identifying different surface sediment coarseness areas and bedrock signature structures like fractures, joints, and faults. Post-processing of the seismic sub-bottom profiler data will digitise the deepest seismic bedrock reflector from the sea floor outcrop down to the deepest sediment cover as well as digitising internal reflectors within the sediment package that might indicate a consolidated layer that could have acted as a diamond trap site above bedrock or that may cause problems with penetration during drill sampling and mining.

There results will inform the design of the reconnaissance exploration drill programme with a focus on identifying diamond trap-site features. The parameters used to decide on the coordinates and spacing of exploration drill positions will depend on the ranking, size and orientation of the trap-sites and is unknown at this stage. Drill positions for a reconnaissance programme will typically be on a grid spacing of between 200 and 100 m. The total numbers of reconnaissance drill positions required is unknown and will depend on the total trap-sites identified from geophysical data, the ranking, and their footprint size.

3.3 Phase 2 (Invasive Drill Sampling Months 24-37)

Phase 2 begins with execution of the reconnaissance exploration drill programme within the Concession Area to determine the mineralisation of each diamond trap-site feature. This comprises invasive methods comprising reconnaissance exploration sample drilling which will be undertaken over a period of 4 months with the number of drill sites unknown at this stage as it is based on the findings of Phase 1.

At each drill site, the drill head must reach the bedrock footwall and the dredge pump will remove loose material from the bedrock surface. The choice of exploration drill equipment will be based on be proven technology for marine diamond exploration providing reliable results which will place confidence in ultimately defining and estimating a resource to be mined with proven mine technology suitable for water depths of the Concession Areas. The identified exploration drilling tool is the Wirth Drill, which will be lowered through a moon pool. The Wirth drill is capable of vertical drilling 10 to 12 m into the sea floor and can operate in water depths up to 160 m. The footprint of the drill is typically 3 to 5 m^2. A Dense Media Separation (DMS) plant will be used onboard the vessel to receive drilled material and process it via an in-line X-Ray concentrator.

The results of the reconnaissance drilling programme will firstly identify which of the potential trap-sites carry a positive grade and secondly which of the positive trap-sites have an overall grade and footprint size to justify either further infill geophysical survey lines and/or infill detail drilling to increase confidence in the estimate of the diamond resource. This information will contribute to the planning and design of the in-fill geophysical survey and in-fill drill exploration programmes. Further exploration work will entail infill seismic survey lines followed by an infill drill programme at 100 to 50 m spacing to increase confidence to ultimately achieve a resource estimation as well as determining the geotechnical character of the ore body that could impact mining and feasibility. The placing and number of infill seismic survey lines and infill drill sites are dependent on the results of the reconnaissance drill programme and therefore an unknown at this stage.

3.4 Phase 3 (Geophysical Surveys and Bulk Sampling, Months 38-60):

This phase will begin with the execution of non-invasive detail infill geophysical surveys for a 2-month period. This will be followed by geophysical data post-processing and interpretation of the infill survey lines. The seismic reflectors mapped out will be used to better define the bedrock topography, improve geological modelling, and improve knowledge of bedrock features that control diamond trap-site grade. This will improve the understanding of the mineralised features as identified through drilling. This high-resolution data will be used to augment the infill drill programme in adjusting drill positions to be better aligned based on improved data.

Once designed, the infill drill programme will be executed over a period of 2 months. Drilling will focus on increased detail within priority trap-site features. Results from this infill drilling programme will determine the level of confidence reached to either justify resource estimation and preliminary mine plan design or to undertake a second detail infill drill programme to improve confidence in resource estimation and preliminary mine plan design. The preliminary mine plan will be followed by a trench bulk sampling programme to simulate mining, finalising the mine plan, and gathering geotechnical and production data for the feasibility study. Methods and equipment for bulk sampling will be based on similar approaches previously used in the area and those which will be used in the mining phase. The trench sampling programme will be executed over 2 months (4 months total for planning, design, and execution) using a seabed crawler. The location of trenches is currently unknown as it will be based on the outcomes of Phase 2. The trench sampling programme will be implemented over 4 months with an estimated 20 trenches excavated to a maximum of 4 m depth. Trenches will be approximately 20 m in width and 240 m in length which will result in excavation over an area of 9.6 ha within the Concession Area (0.00097% of Concession Area). Approximately 9 600 m^3 of overburden and 2 400m^3 of ore will be removed. The final component of Phase 3 will assess rehabilitation after drilling and trenching, however, in light of the very small area impacted and that swell with sediment movement acts as a natural recovery of the sea floor, no rehabilitation is anticipated. This phase will determine the feasibility and decision on proceeding with the mining project in the Concession Area.

In terms of activities which will affect the marine environment the project aims to undertake 4 months of geophysical surveys, 4 months of exploration drilling and 2 months of bulk sampling within the Concession Area.

3.5 Alternatives

Samara proposes to analyse existing data available for the Concession Area using recognised desktop analyses techniques and geophysical surveys to determine the areas where bulk sampling will be undertaken. It is neither feasible nor possible to meaningfully to identify exploration development footprint alternatives. The proposed project site is preferred due to the history of rich diamond deposits in the area. The invasive prospecting phase will be dependent on the results of the preceding phase. Where practicable, the bulk sampling sites will be selected to avoid sensitive environments such as marine biodiversity of conservation importance and heritage features.

The option of not implementing the activity will result in a loss of valuable information regarding the mineral status (diamonds) on the affected areas. In addition to this, should economic reserves be present, and the applicant does not have the opportunity to prospect, the opportunity to exploit the reserves will be forgone.

4 Applicable Legislation and Policy

This section lists applicable international and national legislation as it applies to the marine environment. It excludes all health, safety, labour and liability legislation, as well as shipping and shipping related legislation. The overview does not constitute a legal review or legal opinion.

4.1 Relevant legislation associated with this specialist report

4.1.1 National Legislation

The main pieces of national legislation that affect this specialist study are:

- Mineral and Petroleum Resources Development Act (Act No.28 of 2002).
- National Environmental Management Act (Act No. 107 of 1998).
- EIA Regulations, 2014 (as amended).
- Marine Living Resources Act (Act No. 18 of 1998).
- National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008).

Other national legislation includes:

- National Environmental Management: Waste Act (Act No. 59 of 2008).
- National Heritage Resources Act (Act No. 25 of 1999).
- Companies Act (Act No. 71 of 2008).
- Climate Change – Carbon Tax Act (Act No.15 of 2019).
- Climate Change – National Climate Change Response White Paper.
- National Environmental Management: Protected Areas Act (Act No. 57 of 2003).
- Maritime Zones Act (Act No. 15 of 1994).
- Constitution of South Africa.
- Carriage of Goods by Sea Act (Act No. 1 of 1986).
- Dumping at Sea Control Act (Act No. 73 of 1980).
- Hazardous Substances Act and Regulations (Act No. 85 of 1983).
- Marine Pollution (Control and Civil Liability) (Act No. 6 of 1981).
- Marine Pollution (Prevention of Pollution from Ships) Act (Act No. 2 of 1986).
- Sea-Shore Act (Act No. 21 of 1935).
- Sea Birds and Seals Protection Act (Act No. 46 of 1973).
- Wreck and Salvage Act (Act No. 94 of 1995).
- Marine Pollution (Intervention) Act (Act No. 65 of 1987).
- Maritime Zones Act (Act No. 15 of 1994).

4.1.2 International Maritime Conventions

- International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL).
- Amendment of the International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL) (Bulletin 567-2/08).
- International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC Convention).
- United Nations Convention on Law of the Sea, 1982 (UNCLOS).
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (the London Convention) and the 1996 Protocol (the Protocol).
- International Convention relating to Intervention on the High Seas in case of Oil Pollution Casualties (1969) and Protocol on the Intervention on the High Seas in Cases of Marine Pollution by substances other than oil (1973).
- Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (1989).
- Convention on Biological Diversity (1992).
- Convention on Migratory Species (1999).

5 Baseline description of affected environment

5.1 Geophysical dynamics

5.1.1 Bathymetry

The continental shelf of the West Coast of South Africa is wide and deep, in contrast to the East Coast which is narrow and steep (Pulfrich 2018). The nearshore is generally narrow and rocky, and slopes steeply until approximately 80m of depth. Thereafter the slope between the middle and outer shelf is gentle to the shelf break at a depth of approximately 300m depth (Pulfrich 2018).

The Concession Area is found within the deep sub-photic zone (Figure 5-1), along the continental shelf. The continental shelf within this area includes the Orange Bank (Shelf or Cone), a shallow zone (150 - 200 m) that reaches a maximum width of 180 km offshore of the Orange River mouth and the Childs Bank (Pulfrich 2018).

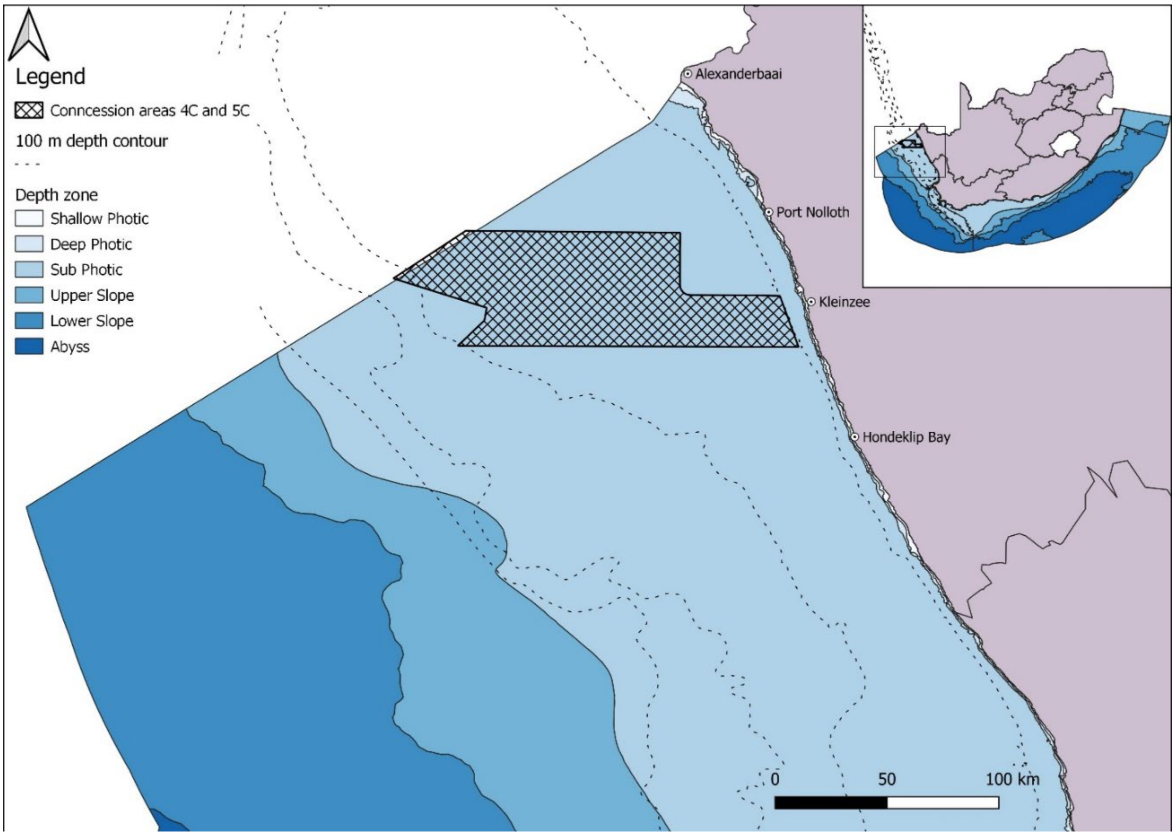

Figure 5-1: Oceanic depth zones and 100 m depth found in the vicinity of the Concession Area (Data source: Sink et al. 2019).

5.1.2 Seabed Geology and Sediment Types

The geological and sediment formations within the area of the Orange river mouth are thought to be related to a series of interglacial changes in sea level (Birch et al. 1976, Hoyt et al. 1969, Bluck et al. 2007). As sea levels dropped due to historic glacial formation in the Northern Hemisphere, coastal erosion processes formed terraces, gullies, potholes, and sea cliffs (Hoyt et al. 1969). With each subsequent sea level retreat, these erosion-formed features were filled with coarse beach sediments due to wave action. Importantly, the lack of sediments both to the north and south away from the Orange river mouth, suggests that the sediments are derived from fluvial deposition (Hoyt et al. 1969). While coarse sediments are generally deposited north of the Orange river mouth, muddy sediments are found west, north and south of the Orange river mouth, probably dispersed by slow-moving ocean scale currents (Bluck et al. 2007). This dispersal system is thought to have been operating since the Eocene (56 – 33 Ma) (Bluck et al. 2007),

The geology and seabed geomorphology of the coastal and inner continental shelf areas differ significantly. The inner shelf is composed of bedrock, while the middle and outer shelf areas consist of sediments (Birch et al. 1976, Hoyt et al. 1969). However, due to erosion, sediment cover is thin, especially on the continental shelf. The sediments become finer as one moves further offshore, changing from sand on the inner and outer shelves to muddy sand and sandy mud in deeper water (Birch et al. 1976, Hoyt et al. 1969). This general pattern has been modified by biological deposition, where large areas of shelf sediments contain high levels of calcium carbonate (Birch et al. 1976). A 500-km-long mud belt, up to 40 km wide and with an average thickness of 15 m, is located over the inner edge of the middle shelf between the Orange River and St Helena Bay (Bluck et al. 2007). Offshore, sediment is dominated by muddy sands, sandy muds, mud, and some sand. The continental slope, seaward of the shelf break, has a smooth seafloor and is underlain by calcareous ooze (Birch et al. 1976).

5.2 Biophysical dynamics

5.2.1 Wind driven circulation

The Benguela region's nearshore dynamics are primarily wind driven, both on a large scale, with winds driving south-westerly swells that impact the coast, and locally, with winds contributing to northward-flowing inshore currents, which in turn distribute sediments both in the marine environment and back on shore (Pulfrich 2018). Seasonal changes in wind direction and intensity affect both upwelling dynamics, long shore current flow and therefore sedimentation rates (Bluck et al. 2007, Shillington et al. 2006).

Wind intensity and direction in the Benguela region are primarily influenced by the South Atlantic high-pressure cell and associated mid-latitude cyclones to the south of southern Africa, and seasonal atmospheric cut-off low pressures (Shillington et al. 2006). The South Atlantic high-pressure cell undergoes seasonal variations, being strongest during summer and weakening and migrating north-westwards in winter (Shillington et al. 2006). Mid-latitude cyclones dominate during the winter months while cut-off lows develop during seasonal transitions in spring and autumn.

The differences between summer and winter wind patterns in the region change due to the migration of the southern hemisphere high-pressure system and the associated mid-latitude cyclones (Shillington et al. 2006). The strongest and most continuous winds occur during the summer months in a south-easterly direction (Shillington et al. 2006). Southerlies are the dominant winds, with an average speed of 20-30 kts, with gusts reaching over 100 km/h (60 kts) (Pulfrich 2018). South-easterlies are almost as common, averaging 20-30 kts (Pulfrich 2018). These winds, through Ekman transport, push surface water offshore, resulting in strong upwelling of bottom waters which are nutrient rich (Lutjeharms and Meeuwis 1987).

During winter, winds are dominated by southerly to south-easterly winds, the arrival of winter mid-latitude cyclone systems from the south, results in south-westerly to north-westerly winds (Pulfrich 2018). This switch from the summer condition reduces upwelling intensity, resulting in the movement of warmer oceanic water inshore, reducing stratification (Hutchings et al. 2009). Winter is generally characterized by more energetic swell conditions because the prevailing winds are from the same direction as the prevailing oceanic swells (Pulfrich 2018). Despite this, winter conditions tend to also be calmer, with periods of little to no wind occurring more frequently (Lutjeharms and Meeuwis 1987).

5.2.2 Oceanography

The Concession Area is located offshore, being mainly influenced by the Benguela Upwelling System (BUS). The BUS is one of the most productive upwelling driven eastern boundary currents globally (Carr 2001), where the dominant south-easterly wind described above displaces warm nutrient poor surface water offshore during the summer months, causing cold nutrient rich water from a deeper origin to replace it (Lutjeharms and Meeuwis 1987). The result is a cold northerly flowing eastern boundary current, rich in nutrients that supports phytoplankton growth in the presence of sunlight and therefore the base of the region's marine food web (Lutjeharms and Meeuwis 1987).

Seawater temperatures on the continental shelf where the Concession Area is found can vary from 6°C to 16°C, depending on depth (Dingle and Nelson 1993). Thermal fronts that separate the upwelled water from the ocean's interior are well-defined (Lutjeharms and Meeuwis 1987). These thermal fronts can generate upwelling filaments, which are surface streamers of cold water which cause localised expansion of the upwelling to relatively large distances offshore (Hagen et al. 2001). These fronts generally last from a few days to a few weeks, and their filamentous mixing area can extend up to ~600 km offshore (Hagen et al. 2001). The average water temperature during the summer upwelling season is ~ 11˚C but can increase during downwelling events when strong westerly winds dominate (Lutjeharms and Meeuwis 1987). During Benguela Ninos when westerly winds dominate, upwelling cells breakdown and warm oceanic water moves inshore causing increases in surface water temperature (Imbol Koungue et al. 2019).

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations, particularly on the seabed, with a saturation value of approximately 80%, but lower oxygen concentrations (<40% saturation) are frequently observed (Bailey et al. 1985; Chapman & Shannon 1985).

The peak nutrient concentrations can be modified by phytoplankton uptake, which varies according to phytoplankton biomass and production rate (Carr 2001). As a result, the range of nutrient concentrations are variable, but concentrations are generally high in comparison to areas that experience less upwelling.

High nutrient concentrations can lead to periodic Harmful Algal Blooms (HABs), which are due to very high concentrations of dinoflagellate and ciliate blooms (Stephen and Hockey 2007). These can result in large scale die-offs of various faunal species because certain dinoflagellate species are toxic (Pitcher and Calder 2000). These blooms may also cause anoxic (low oxygen) conditions when they sink and decompose on the benthos, causing high biological oxygen demand, resulting in low oxygen conditions that may also result in faunal mass dies offs (Pitcher and Calder 2000). Naturally occurring low oxygen levels in continental shelf waters can move up onto the inner shelf and into nearshore waters as a result of upwelling processes, also resulting in fish and invertebrate die offs (Pulfrich 2018).

5.3 Biological aspects of the region

The Concession Area is situated in the cold temperate Namaqua Bioregion (Lombard et al. 2004) (Figure 5-2). The marine ecology of the southern Benguela region is primarily shaped by the coastal, wind-induced upwelling that characterises the Northern Cape coastline described in the previous paragraphs. The Benguela system is known for its cold surface water, high biological productivity, and highly variable physical, chemical, and biological conditions (Hutchings et al. 2009). Despite this, the West Coast is characterised by low marine species richness and low endemicity (Awad et al. 2002).

Marine communities in the southern African West Coast region are generally abundant and specific only to substrate type or depth zone (Awad et al. 2002). These communities often comprise of varying numbers of species that often display considerable spatio-temporal variability (Awad et al. 2002).

Within the broader Namaqua Bioregion, habitats comprise of both consolidated and unconsolidated sediments, hard reefs, and the pelagic water column (Pulfrich 2018). The main faunal species found in these habitats are therefore described below so that the effects of the potential exploratory activity can be assessed correctly. The majority (85%) of the Concession Area lies between 150-200m, with 14% in 100-150m and less than 1% deeper than 200m.

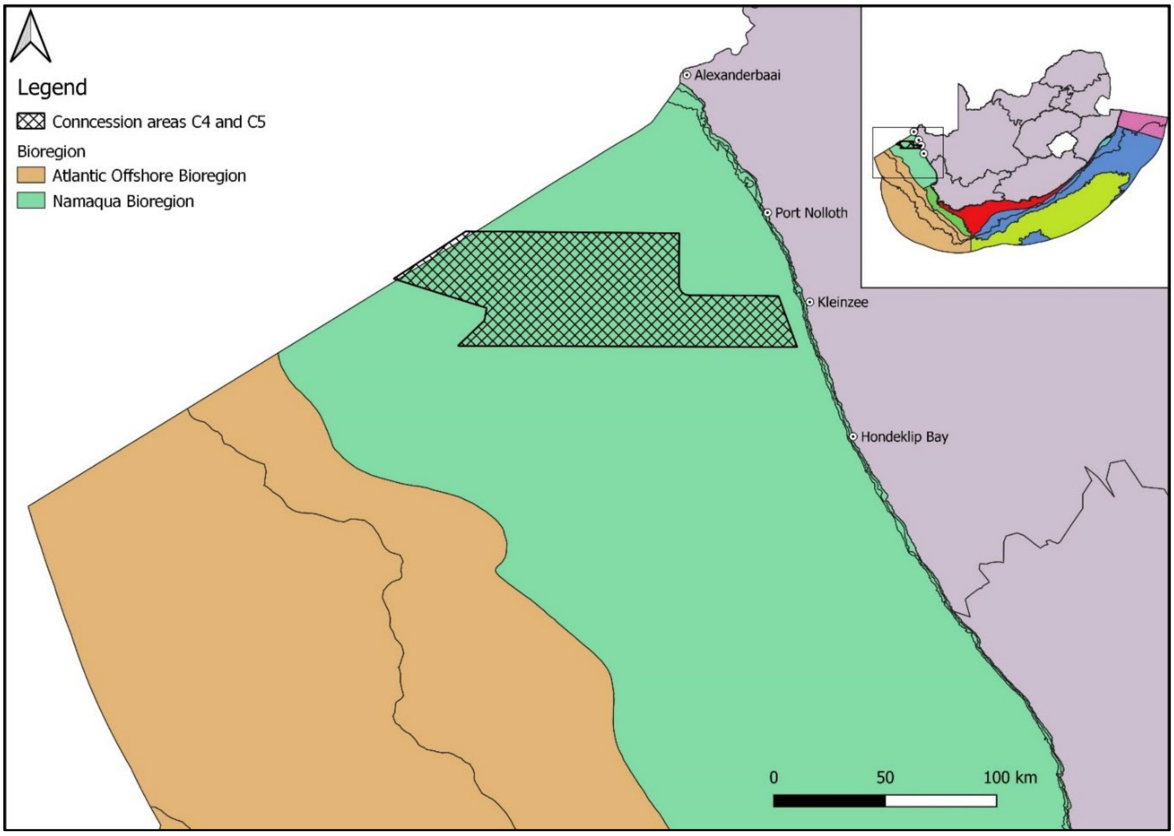

Figure 5-2: Marine bioregions found within the vicinity of the Concession Area (Data source Sink et al. 2019).

5.3.1 Biogeography

Based on Sink et al. (2019), the Concession Area is located within the Southern Benguela Ecoregion which extends from Cape Agulhas to Namibia, and falls within two broad ecosystem types (Figure 5-3):

1. Deep rocky shelf, found towards the Concession Area ‘s east (9 % of Concession Area),
2. Deep soft shelf, found throughout the Concession Area unless otherwise stated. (91 % of the Concession Area).

The entire deep rocky shelf broad ecosystem within the Concession Area consists of Namaqua Muddy Mid Shelf Mosaic (NMMSM) (9 % of Concession Area) (Figure 5-4).

Three ecosystems are found over the deep soft shelf habitat (Figure 5-4):

- the Namaqua Sandy Mid Shelf (NSMS) (2 % of Concession Area),
- the Namaqua Muddy Sands (NMS) (53 % of Concession Area) and
- the Southern Benguela Sandy Outer Shelf (SBSOS) (36 % of Concession Area).

All four of these ecosystem types are considered to be of Least Concern with regards to ecosystem collapse risk potential by the IUCN (www.iucnredlist.org; accessed 15/04/2023). Of these ecosystems the NMMSM, NSMS and SBSOS are all partially protected due to overlap with either the Namaqua Fossil Forest Marine Protected Area (MPA) or the Orange Shelf Edge MPA. Due to the NMS ecosystem not overlapping with any protected areas, this ecosystem is the only area of the Concession Area that does not receive any spatial protection from MPAs (Figure 5-5).

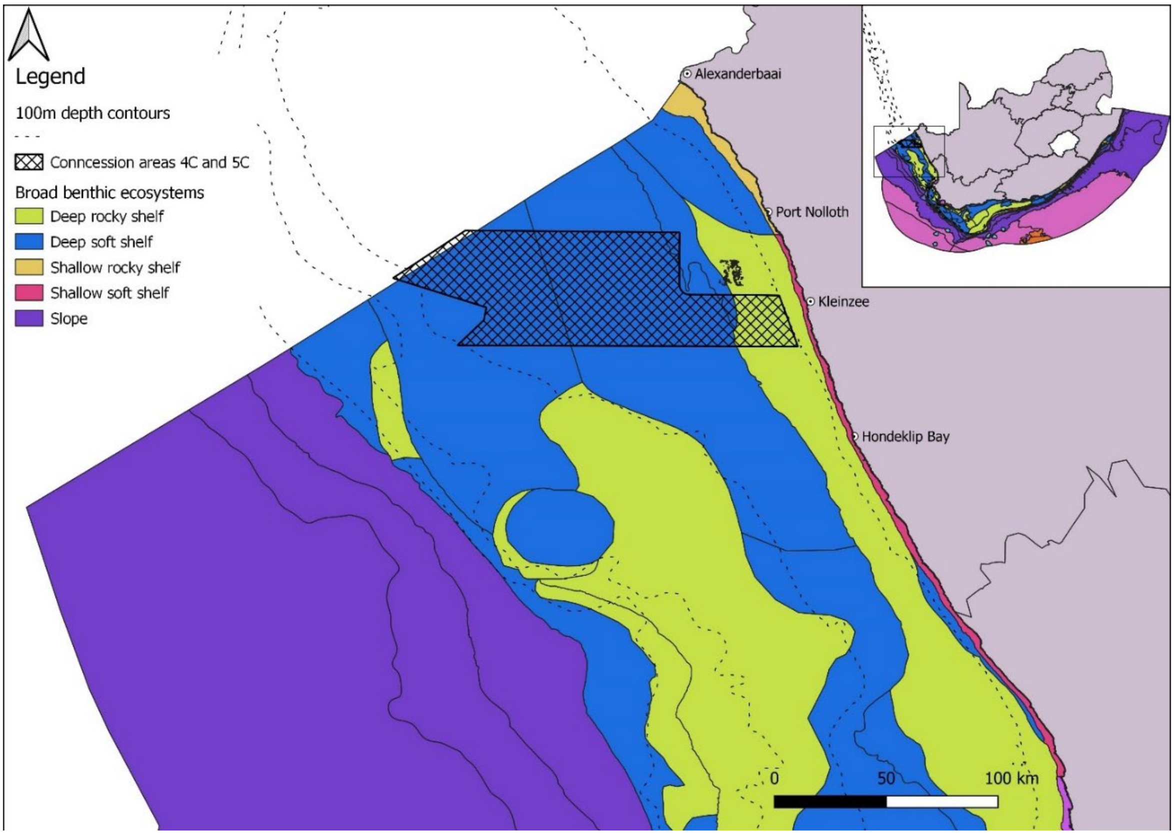

Figure 5-3: Broad benthic ecosystem types found within the vicinity of Concession Area.

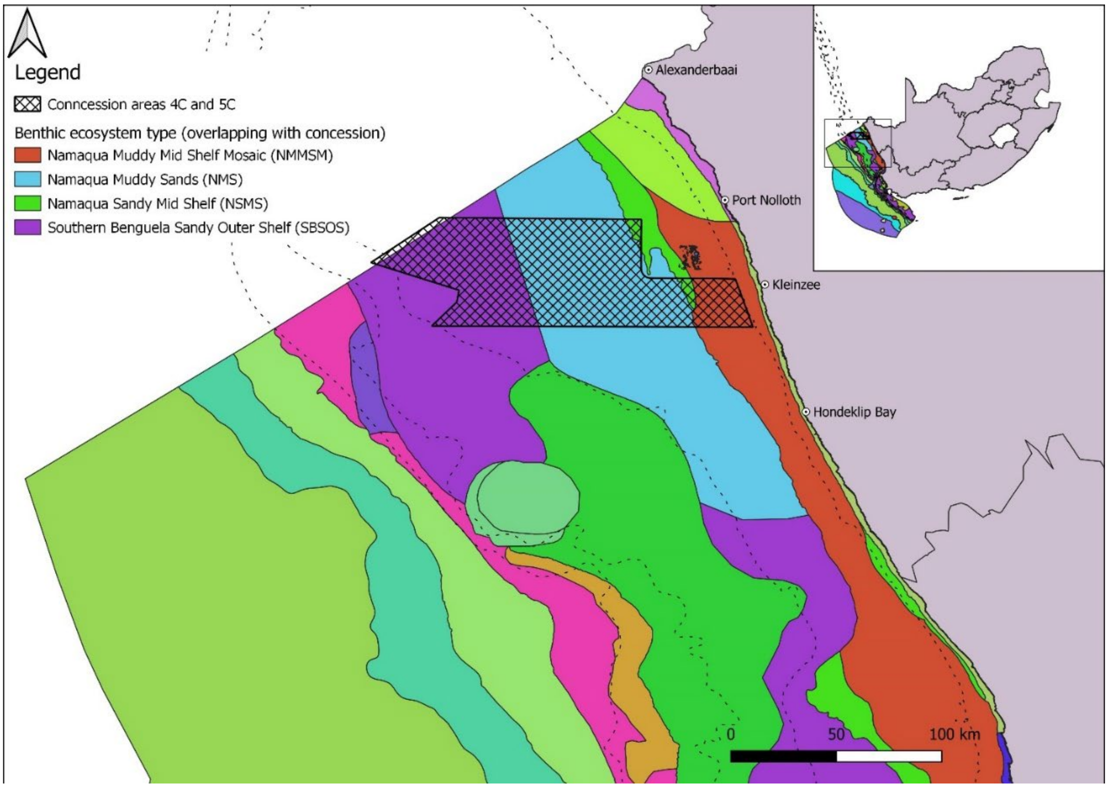

Figure 5-4: Benthic ecosystem types found within the Concession Area.

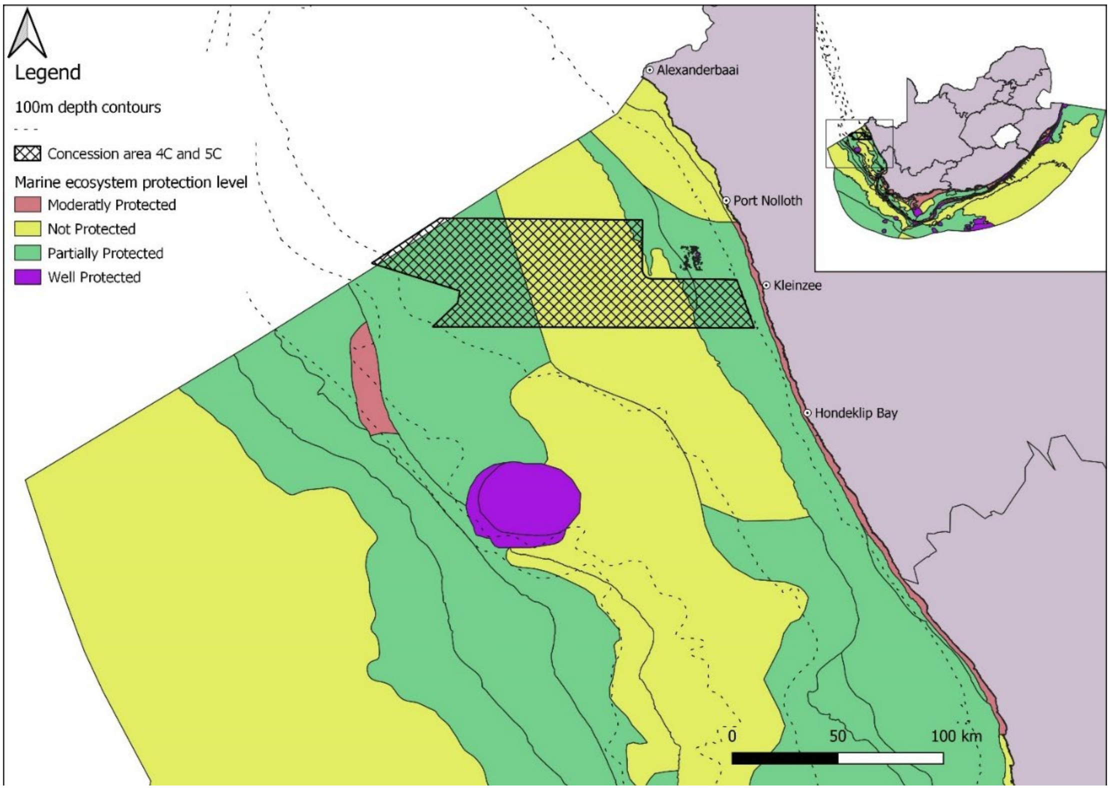

Figure 5-5: Protection level of marine benthic ecosystem types within the Concession Area

5.4 Ecology

The biological productivity that results from the wind driven upwelling is the main characteristic of the ecology of the area. The unique combination of seasonal increases in surface water nutrient levels combined with biological communities that have adapted to take advantage of this phenomenon leads to a particular pelagic and benthic faunal community in the Concession Area comprising low diversity and low endemicity This faunal assemblage represents both sedentary (resident) and transient (migratory) fauna that either utilise the area seasonally or are confined to the area during their life history. The Benguela system displays cold surface water, significant biological productivity, and notable fluctuations in physical, chemical, and biological conditions (Awad et al. 2002).

5.4.1 Benthic invertebrate community

The benthic invertebrate faunal community is made up of epifauna and infauna, which are further divided into small meiofauna (<1mm) or larger macrofauna (>1mm). The Concession Area holds two distinct mid-shelf communities with differing sediment types. The Namaqua muddy sands (52.8 % of concession) community comprises primarily of mud prawns, namely *Kraussillichirus* (formerly *Callianassa*) sp. and *Calocaris barnardi*, which have a wide distribution throughout South Africa (Pulfrich 2018). In contrast, the sandy sediment community is characterized by various cosmopolitan polychaetes, including deposit feeding species, in addition to crustaceans and molluscs, which collectively represent the majority of individuals, biomass, and species found within the area (Awad et al. 2002). Species distribution within these communities is, however, erratic, influenced by both sediment type and other benthic species residing in the unconsolidated sediments (Awad et al. 2002). According to the marine component of the 2018 National Biodiversity Assessment (Sink et al. 2019), parts of the outer continental shelf on the West Coast are deemed 'vulnerable' but do not fall within the Concession Area (Figure 5-6). Species richness tends to increase from the inner shelf to the mid-shelf and is influenced by sediment type (Awad et al. 2002). The mid-shelf sandy sediments exhibit the highest total abundance and species diversity, while biomass is greatest in the inshore and decreases across the mid-shelf (Sink et al. 2019).

Figure 5-6: Conservation status of the marine benthic ecosystem within the vicinity of Concession Area

Importantly, deep water benthic community structure is primarily influenced by a plethora of environmental factors. Depth and sediment type are considered to be the primary factors influencing benthic community structure off the west coast (Steffani 2007a; 2007b). Studies have however also identified water movement, oxygen concentration, sediment organic carbon and temperature as strong influences on benthic community structure (Pulfrich 2018). Periodic low oxygen events have been identified as a major benthic community structuring feature (Monteiro & van der Plas 2006; Pulfrich et al. 2006). Community structure in these areas is characterised either by species that are able to tolerate low oxygen conditions or by fast growing organisms that are able to rapidly recruit into areas that have been affected by low oxygen levels (Pulfrich et al. 2006).

Soft-bottom substrates are generally home to demersal epifaunal and bottom-dwelling invertebrate species. According to Lange's (2012) findings, between the depths of 100 m and 250 m, the presence of *Sympagurus dimorphus* and *Parapaguris pilosimanus* hermit crabs, *Funchalia woodwardi* prawns, and *Brisaster capensis* sea urchins form a single epifaunal community (Pulfrich 2018). Atkinson (2009) also discovered numerous species of urchins and burrowing anemones beyond a depth of 300 m off the West Coast which falls out of the Concession Area (Pulfrich 2018).

5.4.2 Animal forest communities

The Concession Area is exclusively located within the sub-photic benthic zone, where due to the depth (> 100 m), sunlight fails to penetrate the water column leading to a lack of photosynthetic macrophyte algae common in shallower water depths (see Figure 5-1). In the absence of this bottom flora, sessile corals and sponges proliferate, forming "animal forests" that are not reliant on the sun's energy but feed on suspended particles and organisms that are filtered from the water column (Samaai et al. 2020). These animal forests are described by Samaai et al. (2020) to typically be composed of "assemblages of anthozoans or sponges forming the matrix for a diverse community of other benthic invertebrate taxa".

Sponges

Off the west coast of South Africa, within the Southern Benguela ecoregion, 194 different species of benthic sponges have been identified, with most of these organisms being found between 100 – 500 m of depth and dominated by a single taxon, *Suberites dandelenae*, where approximately 18 tonnes/km^2 have been collected during benthic trawl surveys (Samaai et al. 2020). These sponge grounds have been described by Samaai et al. (2020) to "*constitute an ecologically important habitat of great complexity for fishes and both motile and sessile invertebrates, and they may play an important role in the ecology and diversity of the west coast region*". Due to these ecosystem services that these sponge grounds provide, Samaai et al. (2017) suggested that: "*their presence could indicate a potential Vulnerable Marine Ecosystem (VME) or an Ecologically and Biologically Significant Area (EBSA) in the sense of their fragility and slow recovery*". These sponges were included in the final delineation of the Namaqua Fossil Forest MPA designation in 2022 to ensure their protection.

Cold-water corals (Scleractinia)

Cold-water stoney corals are usually found in deep water with little to no light and therefore lack symbiotic algae which is common in shallow water Scleractinian stoney corals (Samaai et al. 2020). Furthermore, cold-water corals are slow growing, vulnerable, and extremely delicate (Freiwald et al.

2004), and play an important role as habitat engineers enhancing benthic habitat complexity and conglomeration (Freiwald et al. 2004). Due to these factors, it has been suggested they should be protected from bottom trawling and deep-sea mining damage in key areas. The majority of cold-water corals sampled from the west coast have been from a depth > 300 m (Samaai et al. 2020). The Concession Area occurs in waters shallower than 300m, with less than 1% being greater than 200m in depth. Therefore, it is unlikely that these will be encountered and damaged during the exploration surveys.

Cnidarians (anemones)

Sea anemones are the common name for cnidarians belong to the orders Actiniaria and Corallimorpharia. Of the 49 identified species of sea anemones found off the coast of South Africa, 20 have been identified along the west coast (Laird 2013). While anemones are found throughout the benthic habitat, Uriz (1988) reported that west coast soft sediments were characterized by a sizeable biomass of a sea anemones occurring at the 400–500 m depth range and therefore excludes the Concession Area.

Bryozoans

Bryozoans or “moss animals” are colonial epiphytic sessile organisms that are predominantly marine, occupying benthic habitats of the intertidal zone, continental shelf, deep ocean canyons and abyssal plains (Samaai et al. 2020). They are known to attach to a diverse array of substrates from anthropogenic structures to large rocks, shells, algae, and even other bryozoans (Samaai et al. 2020). Despite the ubiquitous occurrence of bryozoans off the South African coastline, few studies have been carried on South African bryozoan communities (Samaai et al. 2020). Bryozoans of significant size frequently offer a dwelling place for varied associated groups, notably other bryozoans, molluscs, annelids, arthropods, cnidarians, sponges, echinoderms and macroalgae (Wood et al. 2012). Furthermore, bryozoa that form habitats also provide environmental benefits, such as stabilizing sediment, decreasing water flow within and around the thickets, creating three-dimensional attachment surfaces, and providing a source of sustenance (Anderson et al. 2019). One of the most beneficial characteristics of bryozoan communities is that they are significant habitat engineers, providing three-dimensional structures, forming thin or thick circular or irregular patches or erect and bushy tufts that resemble algae or hydroids, while others can form three-dimensional calcified coral-like structures. While little is known about South African bryozoan communities, beds of bryozoans are known to occur on the continental shelf within the 200 – 500 m depth range along both the west and east coasts of South Africa (Samaai et al. 2020), beyond the main depth zone of the Concession Area.

Ascidians

Ascidians, more commonly known as sea squirts, are the largest and most diverse group of Tunicata. There are approximately 3 000 species found within this group and they are found in all marine habitats. In South Africa 145 species of Ascidians have been described (Parker-Nance and Atkinson 2018) of which ~ 81 species (56%) are thought to be endemic to South Africa (Awad et al. 2002), with ~ 30% found in deeper sub-photic waters (Monniot et al. 2001). Along the South African west coast Parker-Nance and Atkinson (2018) list eight deep water species found on the continental shelf, shelf edge and slope while Uriz (1988) reported high densities of *Molgula scutate* being abundant between 400 and 500 m, which is beyond the depth range of the Concession Area.

5.4.3 Benthic fish community

Benthic fish or demersal fish are those fishes that are known to occupy the seabed. In excess of 110 species of fishes have been known to occur on the west coast continental shelf (Roel 1987). Of these, approximately 50 are commonly encountered during trawl surveys (Kirkman et al. 2013). Variation in fish communities occur with changes in depth and habitat, where the cape hake *Merluccius capensis*, jacopever *Helicolenus dactylopterus*, Izak catshark *Holohalaelurus regani*, soupfin shark *Galeorhinus galeus* and whitespotted houndshark *Mustelus palumbes* dominate depths < 400 m (Pulfrich 2018). Below these depths (>400 m) deepwater hake *Merluccius paradoxus*, monkfish *Lophius vomerinus*, kingklip *Genypterus capensis*, bronze whiptail *Lucigadus ori,* hairy conger *Bassanago albescens* and various squalid shark species dominate (Pulfrich 2018).

While an annotated checklist of non-cartilaginous fish is not explicitly available for the west coast of South Africa, Compagno et al. (1991) compiled such a list for cartilaginous species (elasmobranchs) which are likely to occur with the Concession Area (Table 5-1). Due to elasmobranchs exhibiting a variety of life history characteristics such as late maturity and low fecundity they are particularly susceptible to exploitation and habitat degradation (Jorgensen et al. 2022). Understanding the benthic shark community within the Concession Area is therefore important and thus more detail has been provided on this species group. Of the 40 species of elasmobranchs that were documented by Compagno et al. (1991), one is classified as Data Deficient, 28 are Least Concern, two are Near Threatened, five are Vulnerable, three are Endangered and one is Critically Endangered based on the IUCN redlist ratings (IUCN 2023) (Table 5-1).

Table 5-1: Elasmobranch species that are likely to occur within Concession areas 4C and 5C, accompanied by their depth range and current IUCN redlist status, adapted from Compagno et al. (1991). Entries in bold are likely to occur within the Concession Area

Common Name	Scientific Name	Depth (m)	IUCN redlist
Short-tail lanternshark	*Etmopterus brachyurus*	450-900	DD
Brown lanternshark	*Etmopterus compagnoi*	450-925	LC
Southern lanternshark	*Etmopterus granulosus*	>700	LC
Smooth lanternshark	*Etmopterus pusillus*	400-500	LC
Shortnose spurdog	***Squalus megalops***	**75-460**	**LC**
Sixgill sawshark	***Pliotrema warreni***	**60-500**	**LC**
Goblin shark	*Mitsukurina owstoni*	270-960	LC
Smalleye catshark	*Apristurus microps*	700-1,000	LC
Saldanha catshark	*Apristurus saldanha*	450-765	LC
Izak catshark	***Holohalaelurus regani***	**100-500**	**LC**
Whitespotted houndshark	*Mustelus palumbes*	>350	LC
Great torpedo ray	***Torpedo nobiliana***	**120-450**	**LC**
Softnose skate	*Bathyraja smithii*	400-1,020	LC
Smoothnose pygmy skate	*Cruriraja durbanensis*	>1,000	LC
Triangular legskate	***Cruriraja parcomaculata***	**150-620**	**LC**
South African dwarf skate	*Neoraja stehmanni*	290-1,025	LC
Bigmouth skate	*Amblyraja robertsi*	>1,000	LC
Slime skate	***Dipturus pullopunctatus***	**15-460**	**LC**
Rough-belly skate	***Dipturus springeri***	**85-500**	**LC**
Roughskin skate	*Malacoraja spinacidermis*	1,000-1,350	LC
Munchkin skate	*Rajella caudaspinosa*	300-520	LC
Bigthorn skate	***Rajella confundens***	**100-800**	**LC**
Ghost skate	*Rajella dissimilis*	420-1,005	LC
Leopard skate	*Rajella leopardus*	300-1,000	LC
Smoothback skate	*Rajella ravidula*	500-1,000	LC
St Joseph	***Callorhinchus capensis***	**30-380**	**LC**
Cape chimaera	*Chimaera notafricana*	680-1,000	LC
Brown chimaera	*Chimaera carophila*	420-850	LC
Spearnose chimaera	*Rhinochimaera atlantica*	650-960	LC
Yellowspotted catshark	*Scyliorhinus capensis*	150-500	NT
Thornback skate	***Raja clavata***	**25-500**	**NT**
Spiny dogfish	*Squalus acanthias*	100-400	VU
Tiger catshark	*Halaelurus natalensis*	50-100	VU
Lesser guitarfish	*Rhinobatos annulatus*	<100	VU
Thorny skate	***Amblyraja radiata***	**50-600**	**VU**
Yellowspot skate	***Leucoraja wallacei***	**70-500**	**VU**
Shortspine spurdog	*Squalus mitsukurii*	150-600	EN
Houndshark	*Mustelus mustelus*	<100	EN
Spearnose skate	***Rostroraja alba***	**75-260**	**EN**
Soupfin shark/Vaalhaai	***Galeorhinus galeus***	**<10-300**	**CR**

5.4.4 Pelagic faunal communities

Organisms that utilise the marine open water column are termed pelagic, and while they may also utilise the benthos, they are predominantly found within the water column. These communities are typically divided into plankton which forms the base of the food web followed by fish, marine mammals (seals, dolphins, and whales), seabirds and marine turtles.

Plankton

Plankton is particularly abundant over the continental shelf of the West Coast, being associated with the intense upwelling driven system. Plankton range from single-celled bacteria to jellyfish, and include bacterio-plankton, phytoplankton, zooplankton, and fish larvae. Given that the Benguela eastern boundary current is one of the most productive upwelling driven systems in the world (Carr 2001), phytoplankton driven primary production is in excess of 2 g C/m^2 /day (Figure 5-7). This phytoplanktonic driven primary production forms the base of the region's food web (Carr 2001).

Both Copepods and euphausiids make up the majority of the meso- and macro-zooplanktonic community found within the region (Hutchins et al. 2009). Typically, these species can be found in the upper mixed layer of the water column, which is rich in phytoplankton (Hutchins et al. 2009). Planktonic abundance responds to seasonal changes in upwelling intensity, and seasonal minima exist during non-upwelling periods when primary production is lower (Carr 2001). Zooplankton abundance also decrease during winter when predation by recruiting anchovy is high (James 1987). Furthermore, immediately following intense upwellings, zooplankton concentrations decrease in response to low levels of phytoplankton which still need to colonise the new nutrient rich water. As the upwelled water ages phytoplankton colonises and zooplankton levels rise in response to increases in available phytoplankton (Hutchins et al. 2009).

The Orange River Cone region, located immediately to the north of the Namaqua upwelling cell, offshore of the Orange river mouth, experiences significant turbulence and deep mixing in the water column, resulting in reduced phytoplankton biomass (Hutchins et al. 2009). As a result, this area is considered an environmental obstacle to the transport of fish larvae from the southern to the northern Benguela upwelling ecosystems (Pulfrich 2018). Important pelagic fish species, such as anchovy, redeye round herring, horse mackerel, and shallow-water hake, have been documented spawning on either side of the Orange River Cone region (Pulfrich 2018). Consequently, phytoplankton, zooplankton, and ichthyoplankton abundances in the eastern parts of the Concession Area are anticipated to be relatively high in contrast to the offshore westerly component (Pulfrich 2018). In the offshore areas of the Concession Area, the abundance of plankton is anticipated to be low (Pulfrich 2018).

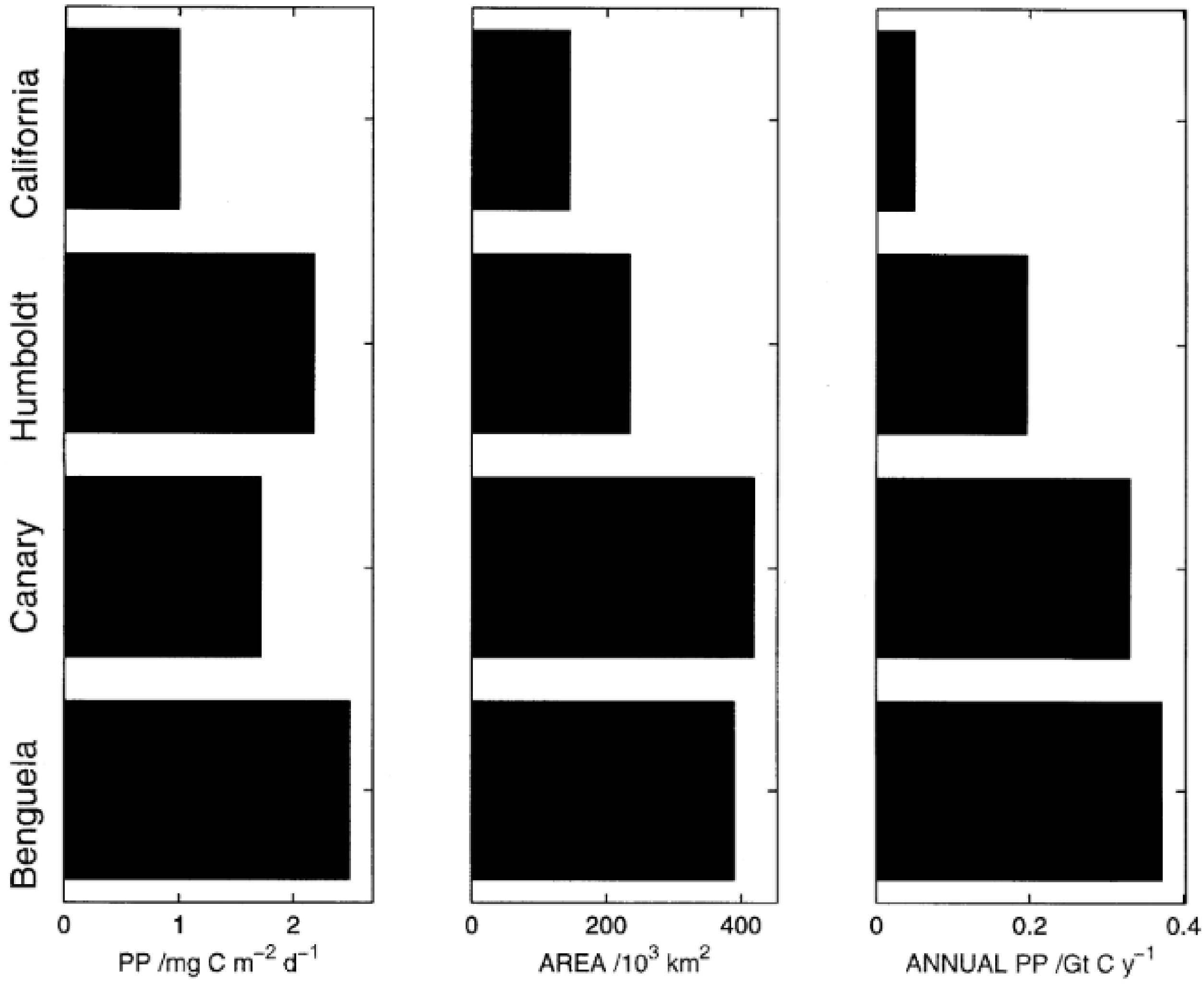

Figure 5-7: Regional comparison of primary production, area of activity and annual production (From Carr 2001)

Cephalopods

Loligo vulgaris, Todarodes angolensis, Todaropsis eblanae, Lycoteuthis diadema, Sepia australis and *Octopus* spp. represent the main cephalopod resources in the southern Benguela (Lipinski 1992); *Sepia australis* is one of most common species associated with the substrate at depths ranging from 60-190 m (Augustyn et al. 1995). *Loligo vulgaris* is distributed down to 350 m along the west coast, but limited by water temperatures below 8˚C and oxygen levels below 3.5 ml.l^{-1} (Augustyn 1991). All *Octopus spp.* (*O. vulgaris and O. magnificus*) found along the west coast are benthic, with *O. magnificus* being found at depths between 100 – 300 m (Oosthuizen 2003). All the above-mentioned species maybe found in the Concession Area, but none are of conservation concern.

Pelagic fish

Pelagic fish in this region are categorised as either Small Pelagic Fishes (SPF) or Large Pelagic Fishes (LPF), with the former group being made up of small, large shoal forming, zooplankton feeding clupeids (sardine, anchovy, and round herring), scombrids (mackerel) and carangids (horse mackerel). The LPF are primarily composed of large predatory fish such as the tunas, billfish, and pelagic sharks. There are, however, fish species that straddle between the benthos and the pelagic ecosystem (termed benthopelagic fish), which often partake in diel vertical migrations. These include important fishery species such as the Cape snoek (*Thyrsites atun*) (McQueen 2002) and hake (*Merluccius spp.*) (Pillar and Barange 1995).

There are five main species of SPF that dominate the pelagic waters of the Benguela current, namely Clupeidae: sardines (*Sardinops sagax*), anchovies (*Engraulis encrasicolus*) and redeye round herring (*Etrumeus whiteheadi*); Scombridae: chub mackerel (*Scomber japonicus*) and Carangidae: Cape horse mackerel (*Trachurus capensis*). These species often form mixed shoals of different species but of similar size which is thought to be a consequence of similar feeding amongst species when at similar sizes. While all these species are known to partake in diel vertical migrations, this is more prominent in smaller size classed sardines (< 25 g wet weight) and anchovies, with peak feeding occurring close to the surface at night (James 1987, Louw et al. 1998). These migrations are thought to be in response to diel vertical migratory behaviour exhibited by this groups main zooplanktonic prey items. The main source of zooplankton consumed by sardines consists of small copepods (calanoid and cyclopoid), along with eggs and nauplii of anchovy and crustaceans. Anchovies however, primarily feed on larger zooplankton, particularly calanoid copepods and euphausiids. They primarily capture these larger prey items through selective feeding based on size, as described by James (1987). While both smaller sized chub mackerel and horse mackerel feed on similar planktonic prey items to the clupeids, as they grow bigger than the three clupeid species, they shift their diet onto larger pelagic invertebrates and fish.

As with the SPF species which follow their preferred zooplanktonic prey throughout the water column, LPF primarily feed off SPF (Smale 1992) in turn following them through the water column to feed. Five species of true tuna (Genus *Thunnus*) (longfin *Thunnus alalunga*, yellowfin *T. albacares*, bigeye *T. obesus*, southern bluefin *T. maccoyii*, northern bluefin *T. thunnus*) have been documented off the west coast, with higher abundances of longfin tuna (Talbot and Penrith 1968, as cited by Smale 1992). Two species of bonito have also been documented, namely skipjack (*Katsuwonus pelamis*) and Atlantic bonito (*Sarda sarda*). Two species of Marlin; Atlantic blue marlin (*Makaira nigricans*) and white marlin (*Tetrapturus albidus*) as well as broadbill swordfish (*Xiphias gladius*) are also known to occur within the region, with the marlins feeding primarily on tunas and *X. gladius* on cephalopods. The distribution of these species is dependent on food availability in the mixed boundary layer between the Benguela and warm central Atlantic waters. Concentrations of large pelagic species are also known to occur associated with underwater features such as canyons and seamounts as well as meteorologically induced oceanic fronts. The predominate species of pelagic shark species found in the area are blue shark (*Prionace glauca*), makos (*Isurus oxyrinchus*), threshers (*Alopias* spp.), bronze whalers (*Carcharhinus brachyurus),* soupfins (*Galeorhinus galeus*) and mackerel sharks (*Lamna nasus*) (Nepgen 1970, as cited by Smale 1992).

The two benthopelagic fish species found in the Concession Area are Cape snoek and hake.Both forage on the sea floor during the day and migrate into shallower pelagic waters at night (diel vertical migration) (McQueen 2002, Pillar et al. 1991)following pelagic prey species such as sardines (< 25 g wet weight) and anchovies which also conduct vertical diel migration foraging in pelagic surface waters at night (James 1987). These two important fisheries species are therefore highly associated with both the benthic and the pelagic environment. While snoek's diel vertical migrations have been discussed above, they also migrate into inshore regions from the deep (< 500 m) between spawning bouts to feed on pelagic fish found inshore before returning to depth to spawn (Griffiths 2002). The consequence of this is that negative effects on the offshore snoek will be manifested in the inshore region where they are fished.

Marine Turtles

Five species of marine turtle are known to occur within the BUS, of which one is Critically Endangered (hawksbill turtle; *Eretmochelys imbricata*), one is Endangered (green turtle; *Chelonia mydas*) and three are Vulnerable (olive ridley; *Lepidochelys olivacea*, loggerhead turtle; *Caretta caretta* and leatherback; *Dermochelys coriacea*) (IUCN 2023). All five turtle species are of conservation concern, a consequence of their life history where they are long-lived and have low reproductive capacity due to high juvenile mortality rates (Spotila 2004 as cited by Honig et al. 2008). The combination of these factors leaves them particularly susceptible to overexploitation and fishing pressure (Honing et al. 2008). While land-based threats such as egg and adult harvesting as well as nesting habitat alteration are a notable cause of their decline, incidental catch made by pelagic longline vessels has been identified as a significant contributor to their demise (Honig et al. 2008). Furthermore, by signing an International Memorandum of Understanding specifically focused on the conservation of marine turtles, South Africa, as a signatory of the Convention on Migratory Species, has demonstrated its commitment to protecting these species on a global scale (CMS 1999).

Seabirds

As with many of the BUS's marine predators, numerous seabird species forage on the abundance of small pelagic fishes. The BUS is utilised by 82 different seabird species, of which 66 are migrants, seven are endemic and 16 breed on terrestrial habitats found within the region (Makhado et al. 2021, Table 5-2). Eighteen of these species are considered common within the Benguela region. Pelagic foraging within the area primarily occurs off the shelf break (200 – 500 m depth), with maximum foraging occurring during the summer months (Pulfrich 2018). While most breeding seabirds forage within a range depending on their flight capabilities from the shore (Makhado et al. 2021), Cape gannets have been observed to venture between 70 – 130 km from their colonies (Cohen et al. 2014). Similarly, African penguins which are listed as critically endangered usually forage within 3km of the coast but can swim in excess of 50 km from their colonies, with individuals being spotted at far as 100 km offshore (Crawford and Whittington 2005)

Table 5-2: Marine bird species that have been recorded within the Benguela region, accompanied by their conservation status and population trend. Bolded entries denote species that are resident to the region and highly likely to be encountered. Asterix denote species that breed in the region. (Adapted from Makhado et al. 2021)

Scientific Name	Common name	IUCN redlist	Population status
Aptenodytes patagonicus	King Penguin	Least Concern	Increasing
Ardenna carneipes	Flesh-footed Shearwater	Near Threatened	Decreasing
Ardenna gravis	Great Shearwater	Least Concern	Stable
Ardenna grisea	Sooty Shearwater	Near Threatened	Decreasing
Bulweria bulwerii	Bulwer's Petrel	Least Concern	Stable
Calonectris borealis	Cory's Shearwater	Least Concern	Unknown
Calonectris diomedea	**Scopoli's Shearwater**	**Least Concern**	**Decreasing**
Catharacta antarctica	**Brown (Subantarctic) Skua**	**Least Concern**	**Decreasing**
Catharacta maccormicki	South Polar Skua	Least Concern	Stable
Daption capense	**Cape (Pintado) Petrel**	**Least Concern**	**Stable**
Diomedea amsterdamensis	Amsterdam Albatross	Endangered	Increasing
Diomedea dabbenena	Tristan Albatross	Critically Endangered	Decreasing
Diomedea epomophora	Southern Royal Albatross	Vulnerable	Stable
Diomedea exulans	Wandering Albatross	Vulnerable	Decreasing
Diomedea sanfordi	Northern Royal Albatross	Endangered	Decreasing
Eudyptes chrysocome	Southern Rockhopper Penguin	Vulnerable	Decreasing
Eudyptes chrysolophus	Macaroni Penguin	Vulnerable	Decreasing
Eudyptes moseleyi	Northern Rockhopper Penguin	Endangered	Decreasing
Fregetta grallaria	White-bellied Storm-Petrel	Least Concern	Decreasing
Fregetta tropica	**Black-bellied Storm-Petrel**	**Least Concern**	**Decreasing**
Gelochelidon nilotica	Common Gull-billed Tern	Least Concern	Decreasing
Hydobates leucorous (Oceanodroma leucorhoa)	**Leach's Storm-Petrel**	**Vulnerable**	**Decreasing**
Hydrobates pelagicus	**European Storm-Petrel**	**Least Concern**	**Unknown**
Hydroprogne caspia*	**Caspian Tern**	**Least Concern**	**Increasing**
Larus cirrocephalus*	**Grey-headed Gull**	**Least Concern**	**Stable**
Larus dominicanus*	**vetula Kelp Gull**	**Least Concern**	**Increasing**
Larus hartlaubii*	**Hartlaub's Gull**	**Least Concern**	**Increasing**
Larus pipixcan	Franklin's Gull	Least Concern	Increasing
Larus ridibundus	Common Black-headed Gull	Least Concern	Unknown
Lugensa brevirostris	Kerguelen Petrel	Least Concern	Decreasing
Macronectes giganteus	**Southern Giant-Petrel**	**Least Concern**	**Increasing**
Macronectes halli	Northern Giant-Petrel	Least Concern	Increasing
Microcarbo coronatus*	**Crowned Cormorant**	**Near Threatened**	**Stable**
Morus capensis*	**Cape Gannet**	**Endangered**	**Decreasing**
Morus serrator	Australian Gannet	Least Concern	Increasing
Oceanites oceanicus	**Wilson's Storm-Petrel**	**Least Concern**	**Stable**
Onychoprion (Sterna)	fuscatus Sooty Tern	Least Concern	Unknown
Pachyptila belcheri	**Slender-billed Prion**	**Least Concern**	**Stable**
Pachyptila desolata	**Antarctic Prion**	**Least Concern**	**Decreasing**
Pachyptila salvini	**Salvin's Prion**	**Least Concern**	**Stable**
Pelagodroma marina	White-faced Storm-Petrel	Least Concern	Decreasing
Pelecanus onocrotalus*	**Great White Pelican**	**Least Concern**	**Unknown**
Phaethon aethereus	Red-billed Tropicbird	Least Concern	Decreasing
Phaethon lepturus	White-tailed Tropicbird	Least Concern	Decreasing
Phaethon rubricauda	Red-tailed Tropicbird	Least Concern	Stable

Table 5-2 (cont): Marine bird species that have been recorded within the Benguela region, accompanied by their conservation status and population trend. Bolded entries denote species that are resident to the region and highly likely to be encountered. Asterix denote species that breed in the region. (Adapted from Makhado et al. 2021)

Phalacrocorax capensis*	**Cape Cormorant**	**Endangered**	**Decreasing**
Phalacrocorax lucidus*	**White-breasted Cormorant**	**Least Concern**	**Unknown**
Phalacrocorax neglectus*	**Bank Cormorant**	**Endangered**	**Decreasing**
Phalaropus fulicarius	Red (Grey) Phalarope	Least Concern	Unknown
Phalaropus lobatus	Red-necked Phalarope	Least Concern	Decreasing
Phoebetria fusca	Sooty Albatross	Endangered	Decreasing
Phoebetria palpebrata	Light-mantled Albatross	Near Threatened	Decreasing
Procellaria aequinoctialis	**White-chinned Petrel**	**Vulnerable**	**Decreasing**
Procellaria cinerea	Grey Petrel	Near Threatened	Decreasing
Procellaria conspicillata	Spectacled Petrel	Vulnerable	Increasing
Pterodroma incerta	Atlantic Petrel	Endangered	Decreasing
Pterodroma macroptera	**Great-winged Petrel**	**Least Concern**	**Decreasing**
Pterodroma mollis	**Soft-plumaged Petrel**	**Least Concern**	**Stable**
Puffinus assimilis	Little Shearwater	Least Concern	Decreasing
Puffinus puffinus	Manx Shearwater	Least Concern	Unknown
Spheniscus demersus*	**African Penguin**	**Endangered**	**Decreasing**
Stercorarius longicaudus	Long-tailed Jaeger	Least Concern	Stable
Stercorarius parasiticus	Arctic (Parasitic) Jaeger	Least Concern	Stable
Stercorarius pomarinus	Pomarine Jaeger	Least Concern	Stable
Sterna albifrons	Little Tern	Least Concern	Decreasing
Sterna dougallii	**Roseate Tern**	**Least Concern**	**Unknown**
Sterna hirundo	Common Tern	Least Concern	Unknown
Sterna paradisaea	Arctic Tern	Least Concern	Decreasing
Sterna vittata	Antarctic Tern	Least Concern	Unknown
Sternula balaenarum	**Damara Tern**	**Vulnerable**	**Decreasing**
Sula leucogaster	Brown Booby	Least Concern	Decreasing
Sula sula	Red-footed Booby	Least Concern	Decreasing
Thalassarche carteri	Indian Yellow-nosed Albatross	Endangered	Decreasing
Thalassarche cauta	**Shy Albatross**	**Near Threatened**	**Unknown**
Thalassarche chlororhynchos	**Atlantic Yellow-nosed Albatross**	**Endangered**	**Decreasing**
Thalassarche chrysostoma	Grey-headed Albatross	Endangered	Decreasing
Thalassarche melanophrys	**Black-browed Albatross**	**Least Concern**	**Increasing**
Thalassarche salvini	Salvin's Albatross	Vulnerable	Unknown
Thalasseus b. bergii	Greater Crested (Swift) Tern	Least Concern	Stable
Thalasseus maximus	Royal Tern	Least Concern	Stable
Thalasseus sandvicensis	Sandwich Tern	Least Concern	Stable
Xema (Larus) sabini	**Sabine's Gull**	**Least Concern**	**Stable**

Marine Mammals

Thirty-nine species of obligate marine mammals are known to occur within the Benguela Current marine region, comprised of thirty-four cetacean species and five species of seal (Table 5-3). The offshore regions of the west coast of southern Africa have been inadequately researched, and the majority of the data available on deeper waters (>200 m) are derived from historical whaling records before 1970. Presently, there is a dearth of knowledge concerning the distribution, population sizes and trends of most cetacean species inhabiting this region. The scarcity of information is especially pronounced for smaller cetaceans found in deeper waters, and therefore, the precautionary principle should be applied when anticipating potential interactions with cetaceans in this area. Due to the highly variable oceanographic nature of the Concession Area, particularly the offshore area (> 100 km offshore) which is influenced less by the upwelling cells, the area can at times exhibit species compositions more similar to temperate and tropical Atlantic waters.

The most common of the marine mammals found in the Benguela is undoubtably the Cape fur seal (*Arctocephalus pusillus pusillus*) which is the only eared seal species resident to the region (Kirkman et al. 2013). As with most marine predators in the region, the Cape fur seal primarily feeds off small pelagic fish such as sardines and anchovies. They are, however, quite opportunistic being known to feed on cephalopods (especially octopus), hake and even sea birds (Mecenero et al. 2005, 2006a, 2006b). Several colonies of Cape fur seals are present in the study area, including at Kleinzee (including Robeiland), Bucchu Twins near Alexander Bay, and Strandfontein Point (located south of Hondeklipbaai). Kleinzee colony boasts the largest seal population and produces the highest number of seal pups on the South African coast, according to Wickens (1995).

One other eared seal species (subantarctic fur seal) is found within the Benguela area but is considered a rare subantarctic visitor. Three other seals (eared seals) are also rarely found within the southern Benguela region (southern elephant seal, crab eater seal and the leopard seal) (Table 5-3). None of these seal species are of significant conservation concern.

Due to the unique oceanographic features found within this region, a fairly diverse array of cetaceans has been documented. These are often split into dolphins and porpoises, toothed whales, and baleen whales. Fourteen species of dolphins are known to occur in the area, which includes two small (< 1.5 m length) Benguela endemic inshore species (dusky and heaviside's dolphins), which almost exclusively utilise inshore areas (Findlay 1989). Only three other species (common bottle nose, common (short beaked) dolphin and long finned pilot whales) are likely to be encountered in both offshore and inshore environments. All of these species that may be commonly encountered are not of any conservation concern (IUCN 2023).

Of the ten species of larger, toothed whales that are likely to occur within the Concession Area, none are likely to be frequently encountered (Findlay 1989), and only one is listed as Vulnerable by the IUCN red list (sperm whale) (IUCN 2023). The other nine species are considered to be rarely or occasionally encountered throughout their distribution including within the Benguela region.

The majority of the Baleen whales found in the region primarily feed in the cooler sub-Antarctic and Antarctic waters in the summer, with some species moving north into warmer sheltered coastal waters of South Africa to calf (southern right whales and humpback whales). Of the ten baleen whales known to occur within the region, three species are likely to be encountered (southern right whales, humpback whales and Antarctic minke whales) (Findlay 1989). Of these, only Antarctic minke whales are considered to be of conservation concern while southern right whales and humpback whales have very seasonal winter distributions in the area, which they either traverse to find suitable calving areas or for occasional foraging during the summer (IUCN 2023).

Table 5-3: Marine mammal species that are likely to occur within the Concession Area, with corresponding seasonality to the area, IUCN redlist status (as of 2023) and the likelihood of encounter either inshore or offshore of the Concession Areas. Information derived from Findlay (1989) and the IUCN redlist.

Common name	Group	Scientific name	Seasonality	IUCN Redlist Status	Likelyhood of Encounter
Cape fur seal	Eared seal	Arctocephalus pusillus pusillus	All year	Least Concern	Daily (inshore)
Subantarctic fur seal	Eared seal	Arctocephalus tropicalis	Not Known	Least Concern	Rare
Southern elephant seal	Earless seal	Mirounga leonina	Not Known	Least Concern	Rare
Crab eater seal	Earless seal	Lobodon carcinophagus	Not Known	Least Concern	Rare
Leopard seal	Earless seal	Hydrurga leptonyx	Not Known	Least Concern	Rare
Dusky dolphin	Dolphin	Lagenorhynchus obscurus	All year	Least Concern	Daily (inshore)
Heaviside's dolphin	Dolphin	Cephalorhynchus heavisidii	All year	Near Threatened	Daily (inshore)
Common bottlenose dolphin	Dolphin	Tursiops truncatus	All year	Least Concern	Monthly (inshore and offshore)
Common (short beaked) dolphin	Dolphin	Delphinus delphis	All year	Least Concern	Monthly (inshore and offshore)
Southern right dolphin	Dolphin	Lissodelphis peronii	All year	Least Concern	Occationally (offshore)
Striped dolphin	Dolphin	Stenella coeruleoalba	Not Known	Least Concern	Rare
Pantropical spotted dolphin	Dolphin	Stenella attenuata	All year	Least Concern	Rare
Long-finned pilot whale	Dolphin	Globicephala melas	All year	Least Concern	Monthly (offshore)
Short-finned pilot whale	Dolphin	Globicephala macrorhynchus	Not Known	Least Concern	Rare
Rough-toothed dolphin	Dolphin	Steno bredanensis	Not Known	Least Concern	Rare
Killer whale	Dolphin	Orcinus orca	All year	Data Deficient	Occationally (inshore and offshore)
False killer whale	Dolphin	Pseudorca crassidens	All year	Near Threatened	Monthly (offshore)
Pygmy killer whale	Dolphin	Feresa attenuata	Not Known	Least Concern	Occationally (offshore)
Risso's dolphin	Dolphin	Grampus griseus	Not Known	Least Concern	Occationally (offshore)
Pygmy sperm whale	Toothed Whale	Kogia breviceps	All year	Least Concern	Occationally (offshore)
Dwarf sperm whale	Toothed Whale	Kogia sima	Not Known	Least Concern	Rare
Sperm whale	Toothed Whale	Physeter macrocephalus	All year	Vulnerable	Occationally (offshore)
Cuvier's beaked whale	Toothed Whale	Ziphius cavirostris	All year	Least Concern	Occationally (offshore)
Arnoux's beaked whale	Toothed Whale	Berardius arnouxii	All year	Least Concern	Occationally (offshore)
Southern bottlenose whale	Toothed Whale	Hyperoodon planifrons	All year	Least Concern	Occationally (offshore)
Strap-toothed whale	Toothed Whale	Mesoplodon layardii	All year	Least Concern	Occationally (offshore)
True's beaked whale	Toothed Whale	Mesoplodon mirus	All year	Least Concern	Occationally (offshore)
Gray's beaked whale	Toothed Whale	Mesoplodon grayi	All year	Least Concern	Occationally (offshore)
Blainville's beaked whale	Toothed Whale	Mesoplodon densirostris	All year	Least Concern	Occationally (offshore)
Antarctic minke whale	Baleen Whale	Balaenoptera bonaerensis	Winter	Near Threatened	Monthly (offshore)
Common minke whale	Baleen Whale	Balaenoptera acutorostrata	All year	Least Concern	Occationally (offshore)
Fin whale	Baleen Whale	Balaenoptera physalus	Winter	Vulnerable	Occationally (offshore)
Blue whale	Baleen Whale	Balaenoptera musculus	Not Known	Endangered	Occationally (offshore)
Sei whale	Baleen Whale	Balaenoptera borealis	Autumn	Endangered	Occationally (offshore)
Inshore Bryde's whale	Baleen Whale	Balaenoptera edeni edeni	All year	Least Concern	Occationally (inshore)
offshore Bryde's whale	Baleen Whale	Balaenoptera edeni brydei	All year	Not Assessed	Occationally (offshore)
Pygmy right whale	Baleen Whale	Caperea marginata	All year	Least Concern	Occationally (inshore)
Humpback whale	Baleen Whale	Megaptera novaeangliae	All year (higher in summer)	Least Concern	Daily (inshore)
Southern right whale	Baleen Whale	Eubalaena australis	All year (higher in Winter)	Least Concern	Daily(inshore)

5.5 Marine Protected Areas and Marine spatial planning

In 2019, a network of 20 new Marine Protected Areas (MPAs) was gazetted in South Africa which increased the protection of the coastal waters within South Africa's Exclusive Economic Zone (EEZ) to approximately 5.4%. The Namaqua Fossil Forest MPA is one of the recently proclaimed MPAs which is located adjacent to the Concession Areas 4C and 5C 17 km offshore of Port Nolloth within the 120 to 150m depth range and encompasses an area of approximately 875 km^2. The MPA was established due to the presence of a small rocky outcrop formed by fossilized yellowwood trees, including a species new to science (Bamford and Stevenson 2002; Stevenson and Bamford 2003). The outcrop formed by slabs of fossils trees has become colonised by sensitive cold water scleractinian corals (Sink et al. 2019). The MPA also incorporates unprotected mud habitat and a habitat forming sponge (Samaai et al. 2017). The primary ecosystem types of the MPA comprises:

- 4% Namaqua mid shelf fossils.
- 52% Namaqua muddy mid shelf mosaic.
- 29% Namaqua sandy mid shelf. and
- 16% Namaqua muddy sands.

The Namaqua Fossil Forest MPA is surrounded by a 5km buffer, which extends by a further 8km on the southern boundary and is designated as an Ecological Support Area (see below) which provides further protection from direct impact on the ecosystem components it contains.

The Orange Shelf Edge MPA occurs approximately 7km to the west of the Concession Area at its closest point. The MPA contains Critically Endangered hard grounds and areas of sandy seabed in the southern Benguela that have never been trawled before (Sink et al 2019). Two other MPAs occur further afield from the Concession Area. The Childs Bank MPA is located approximately 85km to the south and the Namaqua MPA is inshore and to the east approximately 75km at its nearest point to the Concession Area. The latter two MPAs are sufficiently distanced from the Concession Area and are unlikely to experience any adverse effects from prospecting activities.

In addition to the network of MPAs, a NCMSBP has recently been completed and proclaimed (Harris et al. 2022, DFFE et al. 2022). The NCMSBP builds on the network of formal conservation areas protected in the MPA network by identifying additional areas of importance for safeguarding representative areas of marine biodiversity. The output of the process is a Critical Biodiversity Area (CBA) map which serves as a spatial plan to inform future marine spatial planning in support of sustainable development. The CBA maps are developed based on technical guidelines developed by the South African National Biodiversity Institute and include three categories of priority areas which collectively aim to ensure the long-term sustainability of ecosystems and species through protection of representative areas of ecosystem types and features. The three categories include MPAs, CBAs and Ecological Support Areas (ESAs). All three categories should be considered collectively when considering future activities, and each category has its own management objectives. Marine Protected Areas are governed in terms of their gazetted management plans. The management objective for areas designated as CBAs is to maintain, or restore them to a near natural state, while for ESAs the objective is to prevent further deterioration in the ecological condition (Harris et al. 2022). In order to achieve the objectives of the CBAs and ESAs the NCMSBP developed a set of sea-use guidelines which set out which activities are compatible with each category given the management objectives.

A systematic spatial prioritisation exercise was undertaken using 437 biodiversity features including ecosystem types, distributions of key species, unique features, ecological infrastructure, and existing priority areas (DFFE et al. 2022). Design elements included 539 features incorporating alignment with existing planning initiatives, culturally important areas, ecological condition, and climate change adaption features. Targets were set for each feature to ensure representative areas were selected for inclusion into critical biodiversity areas and ongoing future conservation. As part of the spatial prioritisation process a cost layer was developed which incorporated data from 19 different sectors including mining and petroleum activities, several fisheries, aquaculture, and marine transport. The aim of the cost layer is to ensure areas of biodiversity importance which conflict least with activities are preferentially selected. The outputs from the process include CBAmaps which highlight areas of importance for future marine spatial planning. The activities of the industries such as marine mining which utilise the marine ecosystem are taken into account in the design and preparation of the CBA maps. Thus, the NCMSBP has already considered multiple users and cumulative impacts on marine areas through lengthy stakeholder engagement and consultation with various experts, as well as affected communities and businesses.

The output of CBA maps from the NCMSBP identified a further 28.2% of the country’s Exclusive Economic Zone (EEZ) which was required to meet the biodiversity targets and ensure long-term sustainability (Harris et al. 2022, DFFE et al. 2022). Critical Biodiversity Areas accounted for 21.6% of the area identified and 6.6% was designated as ESAs. The CBAs were further split based on their ecological condition with 18% considered to be in a natural state (CBA-N) and 3.6 % as CBAs requiring restoration (CBA-R).

Conservation importance of habitats in the Concession Area

In terms of the current project, the Concession Area overlaps with both CBA and ESA areas. The CBA maps identify 32% of the Concession area as CBA-N, 3% as ESA with <0.001% considered as CBA-R (Figure 5-8). The remaining 65% of the Concession Area is unclassified in terms of the CBA maps. Based on this, activities within 35% of the Concession Area are to be informed by the sea-use guidelines in order to achieve the management objectives for sustainable use and development.

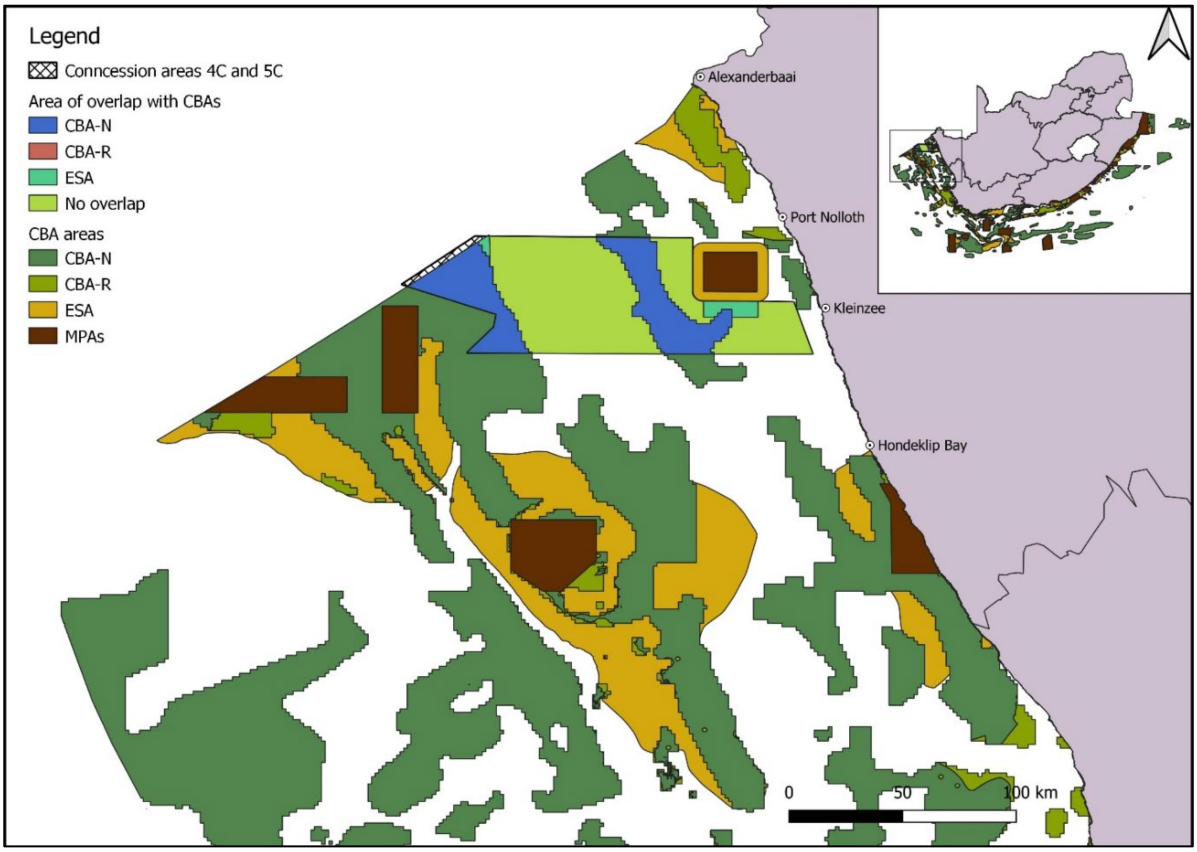

Figure 5-8: Critical biodiversity areas (CBA) identified by Harris et al. (2022) found within the vicinity of the Concession Areas as well as where the Concession Areas overlap with the CBA areas.

The four main habitat types that occur in the Concession Area include Namaqua Muddy Mid Shelf Mosaic; Namaqua Muddy Sands, Namaqua Sandy Mid Shelf and Southern Benguela Sandy Outer Shelf. These habitats comprise between 2% and 31% of the Namaqua Ecoregion totalling 53% of the ecoregion's benthic habitat (Table 5-4).

Namaqua Muddy Sands are the dominant habitat in the Concession Area accounting for 53% of the overall area and 34% of the area available outside of the CBAs (Table 5-4). The amount of this habitat within the Concession Area is 33% of what is present within the ecoregion, 22% of which occurs outside of the CBAs. Currently only 1% of this habitat type is protected within the existing MPA network, with a further 31% in CBAs and 2% in ESAs.

Southern Benguela Sandy Outer Shelf is the next most abundant habitat type within the Concession Area accounting for 36% of the surface area and representing 8% of the habitat available within the ecoregion. The percentage of this habitat falling outside of CBAs within the Concession Area is 21% which equates to 5% of the available habitat type in the ecoregion. Currently 2% of this habitat is protected within MPAs with a further 40% and 11% included in CBAs and ESAs respectively.

Namaqua Muddy Mid Shelf Mosaic and Namaqua Sandy Mid Shelf comprise 9% and 2% of the available habitat within the Concession Area respectively, which represents 6% and 5% of the habitat type within the Ecoregion. The percentage of habitat within the Concession Area which is outside of CBAs is 8% and 1% respectively, which represents 5% and 4% of the available habitat. Currently 5% of both habitats is represented within the MPA network with 30-31% included in CBAs and 8-9% within ESAs.

To summarise, three of the habitats within the Concession Area represent between 5-8% of the available habitat, which drops to 4-5% when the CBAs are taken into consideration. Namaqua Muddy Sands are the only habitat within the Concession Area which make up a substantial portion of the ecoregion's habitat accounting for 33%, but this drops to 22% when the CBAs within the Concession Area are taken into account.

Table 5-4: Relative proportion of the four main habitat types that occur in the Concession Area within the Ecoregion, within the Concession Area, within the Concession Area but excluding CBAs, proportion of each habitat type protected in an MPA, CBA and ESA (Data source: Sink et al. 2019).

Ecoregion Habitats within the Concession Area	Ecoregion		Concession Area			Concession Area excluding CBAs			MPAs		CBAs		ESAs	
	ha	% of Ecoregion Habitat	ha	% of Concession area	Concession as % of Ecoregion	ha	% Concession Area	% of Ecoregion	ha	% of Ecoregion	ha	% of Ecoregion	ha	% of Ecoregion
Namaqua Muddy Mid Shelf Mosaic	1 176 251	10%	66 474	9%	6%	62 633	8%	5%	63 061	5%	359 177	31%	109 977	9%
Namaqua Muddy Sands	1 216 895	10%	406 535	53%	33%	264 874	34%	22%	7 835	1%	373 017	31%	28 120	2%
Namaqua Sandy Mid Shelf	285 316	2%	15 435	2%	5%	10 256	1%	4%	14 575	5%	84 611	30%	21 691	8%
Southern Benguela Sandy Outer Shelf	3 605 707	31%	280 461	36%	8%	162 948	21%	5%	72 554	2%	1 442 155	40%	414 429	11%

Activity guidelines

Within both CBA-N and ESA areas, various sea-use activities are either applicable, have restricted compatibility or are considered not compatible due to reasons stated in Table 5-5 (Harris et al. 2022). Regarding, prospecting, and mining, only non-destructive prospecting is considered to have restricted compatibility within the CBA-N and ESA. While destructive prospecting such as bulk sampling is not considered to be compatible with CBA-N, restricted compatibility with the ESA area is possible (Table 5-6).

Allowance is made in the footnote to Table 5-6 for concessions that are found to have significant mineral resources following prospecting activities for the reclassification of CBA-N and CBA-R areas. Under such circumstances the affected parcels within the CBA-N and CBA-R would need to be reclassified and offsets to mitigate the loss would need to be identified that meet the targets required to replace those lost through the reclassification in the same area.

Table 5-5: Overview of the Biodiversity Zones in the national marine spatial plan, broad spatial regulations, and explanation (from Harris et al. 2022).

Type of zone	Sub-category	Spatial regulations	Justification
Strict Biodiversity Conservation Zone	Marine Protected Areas	Marine Protected Areas (MPAs) declared under the National Environmental Management: Protected Areas Act (NEMPA) and managed as per their gazetted NEMPA MPA regulations. Activities that are not permitted in the regulations will not be allowed to take place in these areas.	In the Strict Biodiversity Conservation Zone, key biodiversity features will be maintained in a natural or near-natural state, or as near to this state as possible, through strict place-based conservation measures with associated regulation of human activities. These will include current designated MPAs regulated in terms of NEMPA, Biodiversity Conservation Areas, and Biodiversity Restoration Areas that require strict conservation management measures regulated in terms of the Marine Area Plan. Biodiversity Conservation Areas and Biodiversity Restoration Areas are controlled by the regulations as per the legally binding Marine Area Plans that are informed by the requirements to protect the features that underpin their original selection as CBAs. Additional areas for MPAs would be informed by the National Protected Areas Expansion Strategy (particularly the protection targets), MPA focus areas, Protected Area implementation feasibility, and alignment with other sectors. The MPA gazetting process requires additional consultation and public participation steps (beyond the MSP process) to meet the requirements of NEMPA.
	Biodiversity Conservation Areas	These are the areas identified as CBAs that will be managed by the Marine Area Plan and its regulations, informed by the rationale for their selection as CBAs. Activities that are not permitted in the regulations and/or marine area plan will not be allowed to take place in these areas.	
	Biodiversity Restoration Areas	These are areas identified as CBA Restore. These are areas of high biodiversity importance that are not in a natural or near-natural condition that will be managed by place-based regulations, informed by the reasons for their selection.	
Biodiversity Impact Management Zone		These are areas identified as Ecological Support Areas in the CBA Map. These areas will be managed by place-based regulations, informed by the reasons for their selection.	In the Biodiversity Impact Management Zone, 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.

Table 5-6: "Sea-use guidelines Version 1.2 (Released 12-04-2022). List of all sea-use activities, grouped by their broad sea use and Marine Spatial Planning (MSP) Zones, and categorised according to their compatibility with the management objective of Critical Biodiversity Areas (CBA-N = CBA Natural; CBA-R = CBA Restore) and Ecological Support Areas (ESA). Activity compatibility is given as Y = yes, compatible, R = restricted compatibility, or N = not compatible. Marine protected areas (MPAs) are managed according to their gazetted regulations." (Directly from Harris et al. 2022).

Broad sea use	Associated MSP Zones	Associated sea-use activities	MPA	CBA N	CBA-R	ESA
Conservation	Biodiversity Zones	Expansion of place-based conservation measures (e.g., MPA expansion)	se activities as per gazetted MPA regulations	Y	Y	Y
Recreation and tourism	Marine Tourism Zone	Beach recreation, non-motorised water sports		Y	Y	Y
		Ecotourism (e.g., shark cage diving, whale watching)		Y	Y	Y
		SCUBA diving		Y	Y	Y
		Motorised water sports (e.g., jet skis)		R	R	Y
		Recreational fishing (e.g., shore-based, boat-based and spearfishing)		N	R	Y
		Shark control: exclusion nets		Y	Y	Y
		Shark control: drumlines and gillnets		N	R	Y
Heritage	Heritage Conservation Zone	Protection of sites of heritage importance, including historical shipwrecks		Y	Y	Y
		Protection of sites of seascape value		Y	Y	Y
Fisheries	Commercial and Small-Scale Fishing Zones	Abalone harvesting		R	R	Y
		Linefishing		N	R	R
		Demersal shark longlining		N	R	Y
		Demersal hake longlining		N	R	R
		Midwater trawling		N	R	Y
		Pelagic longlining		R	R	Y
		Small pelagics fishing		N	R	Y
		South coast rock lobster harvesting		R	R	Y
		Squid harvesting		R	R	Y
		Tuna pole fishing		R	R	Y
		West coast rock lobster harvesting		R	R	Y
		Crustacean trawling		N	N	R
		Demersal hake trawling (inshore and offshore)		N	R	R
		Hake handlining		R	R	Y
		Seaweed harvesting		R	R	Y
		Commercial white mussel harvesting		R	R	Y
		Beach seining		R	R	Y
		Gillnetting		R	R	Y
		Kelp harvesting		R	R	Y
		Oyster harvesting		R	R	Y
		Small-scale fishing		R	R	Y
	Fisheries Resource Protection Zone	Resource protection		Y	Y	Y
Aquaculture	Aquaculture Zone	Sea-based aquaculture		N	R	R

Table 5-6 cont.: "Sea-use guidelines Version 1.2 (Released 12-04-2022). List of all sea-use activities, grouped by their broad sea use and Marine Spatial Planning (MSP) Zones, and categorised according to their compatibility with the management objective of Critical Biodiversity Areas (CBA-N = CBA Natural; CBA-R = CBA Restore) and Ecological Support Areas (ESA). Activity compatibility is given as Y = yes, compatible, R = restricted compatibility, or N = not compatible. Marine protected areas (MPAs) are managed according to their gazetted regulations." (Directly from Harris et al. 2022).

			Sea-u		
Mining	Mining Zone	Mining: prospecting (non-destructive)	R	R	R
		Mining: prospecting (destructive, e.g., bulk sampling)	N	N	R
		Mining: mining construction and operations[1]	N	N	R
Petroleum	Petroleum Zone	Petroleum: exploration (non-invasive)	R	R	R
		Petroleum: exploration (invasive, e.g., exploration wells)	R	R	R
		Petroleum: production[1,2]	N	N	R
		Petroleum: oil and gas pipelines	N	N	R
Renewable Energy	Renewable Energy Zone	Renewable energy installations	N	R	R
Defence	Military Zone	Military training and practice areas	R	R	Y
		Missile testing grounds	R	R	Y
Transport	Maritime Transport Zone	Designated shipping lanes (including port approach zones)	R	R	Y
		Anchorage areas	R	R	Y
		Bunkering	N	N	R
		Ports and harbours (new)	N	N	R
		Dumping of dredged material	N	N	R
Infrastructure	Underwater Infrastructure Zone	Pipelines (excluding oil and gas)	N	R	Y
		Undersea cables (new installations)	N	R	Y
	Land-based Infrastructure Zone	Coastal development (new installations, including piers, breakwaters, and seawalls)[3]	N	N	R
Abstraction and Disposal	Disposal Zone	Waste-water (new installations)	N	R	Y
	Sea-water abstraction and disposal	Sea-water abstraction and disposal (e.g., desalination)	R	R	Y
		Sea-water abstraction and disposal (e.g., aquaculture disposal)	N	R	Y

[1] The activity should not be permitted to occur in CBAs because it is not compatible with the respective management objective. However, if significant mineral or petroleum resources are identified during prospecting/exploration, then the selection of the site as a CBA could be re-evaluated as part of compromises negotiations in current or future MSP processes. This would require alternative CBAs and/or biodiversity offsets to be identified. However, if it is not possible to identify alternative CBAs to meet targets for the same biodiversity features that are found at the site, it is recommended that the activity remains prohibited.

[2] The recommended prohibition of the activity in CBAs (because it is not compatible with the management objective) refers to the location of the biodiversity disturbance rather than the location of the petroleum resource. If petroleum production is possible using lateral drilling or other techniques that do not result in any impacts on biodiversity within the CBAs, then production may be treated as an activity with restricted compatibility (i.e., recommended to be a consent activity).

[3] New coastal development should not be permitted in CBA Restore sites unless it is part of rehabilitation and restoration activities to improve ecological condition.

6 Impact Assessment

6.1 Impact Assessment Methodology

Impacts are rated according to SRK's prescribed impact assessment methodology presented below.

The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring, including possible irreversibility of impacts and/or loss of irreplaceable resources, and the **probability** that the impact will occur.

The criteria used to determine impact consequence are presented in Table 6-1.

Table 6-1: Criteria used to determine the consequence of the impact

Rating	Definition of Rating	Score
A. *Extent* *– the area (distance) over which the impact will be experienced*		
Local	Confined to project or study area or part thereof (e.g., the development site and immediate surrounds)	1
Regional	The region (e.g., Municipality or Quaternary catchment)	2
(Inter) national	Nationally or beyond	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 and/or irreplaceable resources[1] are lost	3
C. Duration *– the timeframe over which the impact will be experienced and its reversibility*		
Short-term	Up to 2 years (i.e., reversible impact)	1
Medium-term	2 to 15 years (i.e., reversible impact)	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** (Table 6-2)

Table 6-2: Method used to determine the consequence score

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

Once the consequence is derived, the probability of the impact occurring is considered, using the probability classifications presented in the Table 6-3.

Table 6-3: Probability classification

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

[1] Defined as important cultural or biological resource which occur nowhere else, and for which there are no substitutes.

The overall **significance** of impacts is determined by considering consequence and probability using the rating system prescribed in Table 6-4.

Table 6-4: Impact significance ratings

		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

Finally, the impacts are 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 Table 6-5.

Table 6-5: Impact status and confidence classification

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a ‘benefit’)
	– ve (negative – a ‘cost’)
Confidence of assessment	
The degree of confidence in predictions based on available information, SRK’s judgment and/or specialist knowledge.	Low
	Medium
	High

The impact significance rating should be considered by authorities in their decision-making process based on the implications of ratings ascribed below, using a negative impact as an example:

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

Practicable mitigation and optimisation measures are recommended, and impacts are rated in the prescribed way both without and with the assumed effective implementation of mitigation and optimisation measures. Mitigation and optimisation measures are either:

- **Essential**: measures that must be implemented and are non-negotiable; or
- **Best Practice:** recommended to comply with best practice, with adoption dependent on the proponent’s risk profile and commitment to adhere to best practice, and which must be shown to have been considered and sound reasons provided by the applicant if not implemented.

6.2 Potential Impacts of Exploration activities on the Marine Environment

The potential impacts of the exploration and prospecting activities on the marine environment were evaluated based on available literature and previous basic assessments, EIAs and specialist reports associated with similar operations along the West Coast.

No operation phase impacts have been considered since the application only applies to the exploration phase. A separate EIA will be required should the project wish to proceed with mining.

6.2.1 Impact 1: Noise pollution

The proposed diamond prospecting project will generate noise in the marine environment in two main forms:

1. Noise from geophysical survey equipment.
2. Operational noise from ship and subsea crawler activity.

The geophysical survey will initially take place over a two-month period during the reconnaissance survey and for a second two-month period during the infill geophysical survey. During this period of time two main forms of survey equipment will be used which will generate noise impacts within the Concession Area, namely:

1. Swath beam bathymetric surveys.
2. Seismic sub-bottom profiler surveys.

Swath beam bathymetric surveys make use of multi-beam sonar technology to collect multiple depth readings perpendicular to the path of the vessel's movement. This allows for high resolution depth data to be obtained beneath and adjacent to the vessel path as a swath of depth readings. Water depth plays an important role in the width of the sonar swath and needs to be taken into account when designing the bathymetric mapping surveys. Survey grids are generally designed based on the water depth so that swaths from parallel paths overlap creating a dataset with 100% cover of the target area. These surveys produce a high-resolution digital terrain model of the sea floor and can be used to identify key physical features in the seascape. Bathymetric mapping sonars use frequencies ranging from 12 kHz for deep-water systems to 70-100 kHz or higher for shallow-water mapping systems (Hildebrand 2009; Harding & Cousins 2022). Multibeam sonars have high source sound levels ranging from 220 to 235 dB re 1 µPa (Koper and Plön 2012) but have highly directional beams which are focussed downwards (Hildebrand 2009). Furthermore, the sonars have high frequencies which attenuate rapidly thereby reducing the field of exposure and creating a localised impact on marine fauna (Hildebrand 2009).

Sub-bottom profilers are used to generate data on the composition of the seafloor sediment layers and potential objects within the sediments. Sub-bottom profilers produce a mid-frequency (3 to 7 kHz) and have a high sound source level (213-230 dB re 1 µPa @ 1 m) in order to penetrate deep into the sediment layers (Hildebrand 2009; Le Gall 2016; Harding & Cousins 2022). The sound emission is targeted in a downward direction and assessment of the potential for physiological impact on marine mammals has been shown to be inconsequential (within 45m for a 10-minute exposure duration) (Le Gall 2016).

In addition to the noise created by the geophysical sonic equipment, the operation of the vessel and seabed crawler for dredging will also generate noise which may affect marine fauna. Small vessels have sound source levels of 130-160 dB re 1 µPa with large ships between 130 and 200 dB re 1 µPa or higher (Koper and Plön 2012; Harding & Cousins 2022). Ambient shipping noise has also been reported in the range of 97 to 131 dB re 1 µPa (Reine et al. 2012a, b; Suedel et al. 2019) while noise generated by dredging varies from 100 to 190 dB re 1 µPa at 1 m (Dickerson et al. 2001; Thomsen et al. 2009; Koper and Plön 2012; Suedel et al. 2019). It has been reported that dredging noise can be heard up to 20-25km away (Greene and Moore 1995 in Koper and Plön 2012).

There is growing body of evidence suggesting that anthropogenic noise can affect marine fauna (Figure 6-1) (Duarte et al. 2021). Noise pollution generated by the survey vessel's operations, as well as the use of sonic surveying equipment have been suggested to impact a variety of marine fauna (Duarte et al. 2021). Direct effects on specifically sensitive fauna include death, physical injury, stress, and behavioural change (Duarte et al. 2021). Indirect effects include changes in predator prey relationships, changes in energy budgets due to behavioural change (van der Knaap et al. 2021). It must, however, be noted that research into both the direct and indirect effects of noise pollution on marine fauna is still in its infancy with the majority of the work done being on marine mammal megafauna (Duarte et al. 2021).

Various factors influence the severity of noise pollution impacts, from the intensity and wavelength of the noise to the distance between the noise source and the affected organism. The affected organism's mobility can also be a factor in understanding how the stressor will influence an organism.

The impacts of noise pollution derived from the ship's operations and use of the seabed crawler, as well as from geophysical survey derived noise in Concession Area has been evaluated separately on organisms that are known to be sensitive to sound: being invertebrates, fish, and marine mammals.

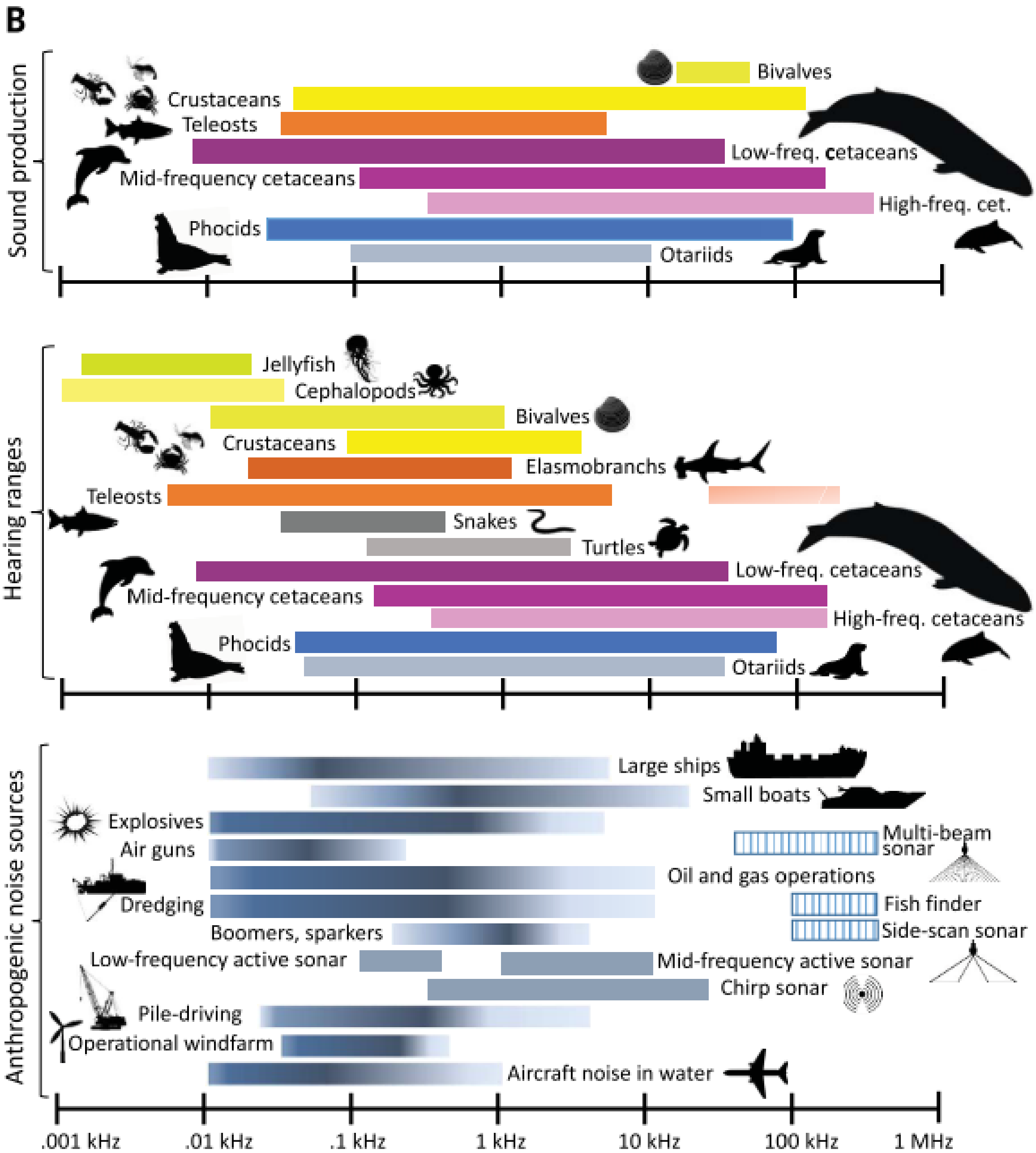

Figure 6-1: Approximate sound production and hearing ranges of marine taxa and frequency ranges of selected anthropogenic sound sources. These ranges represent the acoustic energy over the dominant frequency range of the sound source, and colour shading roughly corresponds to the dominant energy band of each source. Dashed lines represent sonars to depict the multifrequency nature of these sounds. (Directly from Duarte et al. 2021).

Invertebrates

Most invertebrates do not have dedicated hearing organs, but sensory organs such as hairs or papilla that are capable of sensing changes in water pressure. Given that sound travels through water as pressure waves, it is likely that the primitive tactile sensory organs that invertebrates possess are able to detect sound. While there is very little published information on the effects of sound on invertebrates, recent research has shown that low frequency sound can affect the burrowing behaviour of a benthic amphipod (*Corophium volutator*), while little effect was found on a benthic polycheate (*Arenicola marina*) or bivalve (*Limecola balthica*) (Wang et al. 2022). Furthermore, Olivier et al. (2023) found little sustained effect of low frequency noise on the survival rates of bivalve larvae. Given these findings, the impact of noise from operations during prospecting within the Concession Area will be limited in extent and of short duration and will therefore likely have limited impact on invertebrates. Noise impacts will definitely occur but will be of very low significance to invertebrates. As a result, no mitigation is required.

The impact is assessed to be of very **low** significance and does not require mitigation (Table 6-6).

Table 6-6: Significance of noise pollution impacts on invertebrates

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Medium 2	Short-term 1	**Very low** **4**	Definite	**VERY LOW**	– ve	Low

Fish

Sound production in fish is well developed and often plays an important role in certain fish species' reproduction, particularly those that known to be soniferous (Amorim et al. 2013). While almost no research has been conducted on the effects of sound on Southern African marine fishes, there is a growing body of research on other fish species that function in a similar nature to Southern African marine fishes (de Jong et al. 2020). While most fish have the ability to detect anthropogenic sound (see Figure 6-1, Duarte et al. 2021) deliberation amongst research suggests soniferous fish maybe more intensely affected due to sublethal effects in communication between individuals at key life history phases (de Jong et al. 2020). It is also thought that the effects of sound on fish may be increased during spawning bouts, if fish gather in dense localised spawning aggregations (Portner and Farrel 2008). Physical damage such as barotrauma or death can result from exposure to intense sounds (Slabbekoorn et al. 2010). Physical damage is most likely to occur when species are in close proximity to the sound source (ship). This impact can be mitigated by implementing "soft starts". This involves releasing low level sounds at the start of the survey so that species are able to move away from the ship before it emits more intense sounds.

One of the more recent notable indirect effects of anthropogenic sound on fish was conducted by van der Knaap et al. (2021) Where they found that high intensity seismic surveys disrupted cod diel foraging behaviour and therefore could have energetic implications on the population. Given that snoek and hake both undertake diel vertical foraging movements (McQueen 2002, Pillar et al. 1991), anthropogenic sound from the geophysical surveying may disrupt their behaviours, having consequences on their energetics if specific mitigation measures are not implemented. The likelihood of this impact is unknown and would require more in-depth research into snoek and hake behaviour. However, in light of the history of the broader area, which has been subject to exploration activities using acoustic sampling methods in the past without any reported significant impact on hake or snoek populations this is unlikely to be a major concern. Furthermore, sampling typically will take place over a relatively short period of time (several weeks); and exploration will take place over a relatively small portion of snoek and hake grounds (they occur throughout the West Coast); and it is likely that the fish will move from the affected area (which is likely to be a 20km radius around the ship (Green Jnr and Moore 1995 in Koper and Plön 2012)) temporarily during prospecting activities. Given these considerations, this impact is unlikely to have significant implications for snoek and hake populations.

The following best practice guidelines are suggested as mitigation measures to lower risks associated with this impact:

- Implement "soft starts" for the surveys for sound levels >210 dB re 1 μPa at 1 m over a period of 20 minutes to give sensitive species an opportunity to move away from the sampling area, particularly if large aggregations of fish are observed on the ship's sonar.

The impact is assessed to be of **very low** significance before mitigation and **very low** (but with a lower overall score) once mitigated. (Table 6-7).

Table 6-7: Significance of noise pollution impacts on fish

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Medium 2	Short-term 1	**Very low** **4**	Definite	**VERY LOW**	– ve	High
Best practice mitigation measures: • "Soft start" should be carried out for source sound levels > 210 dB re 1 µPa at 1 m over a period of 20 minutes to give fish time to move out of the area								
With mitigation	Local 1	Low 1	Short-term 1	**Very low** **3**	Definite	**VERY LOW**	– ve	High

Marine Mammals

Cetacean are known to use sound extensively, from using sound to find prey, avoid obstructions to communication between individuals. Due to this obligate use of sound by marine mammals, Findlay (1996) conducted a study to assess the potential impact of vessel-based diamond mining on the marine mammal community off the southern African West Coast. The study found that any impact is likely to be insignificant because the area of influence of the elevated noise level was estimated to be restricted to approximately 20 km around the mining vessel. While the noise from sampling operations may cause localized behavioural changes in some marine mammals, these changes are unlikely to have a significant impact on the broader ecosystem, as demonstrated by Perry (1998). Given these findings, the impact of noise on marine mammals is likely to be low. Nonetheless, a study compiled by the International Council for the Exploration of the Sea in 2005, and later guidelines developed by the Joint Nature Conservation Committee in 2017, adapted for South African conditions by Pulfrich (2018), have provided the following guidelines to ensure that risks to marine mammals and cetaceans particularly are minimised.

- Undertake a visual scan of the area 15 minutes prior to the commencement of surveying activities and soft starts. Visual scans should be undertaken by a trained Marine Mammal Observer (MMO).
- Implement "soft starts" for the surveys for sound levels >210 dB re 1 µPa at 1 m over a period of 20 minutes to give sensitive species an opportunity to move away from the sampling area.
- Cease survey activities if abnormal behaviour in marine mammals is observed until the animal has moved away from the area.
- Avoid surveys during known periods of cetacean migration into the area for feeding (beginning of June to the end of November) and ensure that cetaceans are able to move around sonar operations.
- Implement Passive Acoustic Monitoring (PAM) on board survey ships, with a view to
    - Detect the range and frequencies of marine mammal vocalisations expected to be present in the survey area.
    - Detect and identify vocalising marine mammals and establish bearing and range in a reasonable period of time.
    - Ensure real time relaying of the recordings to the PAM operator to allow for immediate mitigation activities to be implemented.

The impact is assessed to be of **very low** significance before mitigation and remains **very low** (but with a lower overall score) once mitigated (Table 6-8).

Table 6-8: Significance of noise pollution impacts on marine mammals

	Extent	***Intensity***	***Duration***	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Without mitigation	Local 1	Medium 2	Short-term 1	**Very low** **4**	Definite	**VERY LOW**	– ve	High
Best Practice mitigation measures: • Pre-survey visual scans should be undertaken 15 minutes prior to the start of the survey. • "Soft start" should be carried out for source sound levels > 210 dB re 1 µPa at 1 m over a period of 20 minutes to give fish time to move out of the area. • Terminate geophysical surveys if any marine mammals are observed behaving abnormally. • Avoid geophysical surveys during peak cetacean migrations through the area (June – November). • A marine mammal observer should be on board the ship to make sure compliance to mitigation measures is conducted.								
With mitigation	Local 1	Low 1	Short-term 1	**Very low** **3**	Definite	**VERY LOW**	– ve	High

6.2.2 Impact 2: Potential vessel strikes on marine mammals.

The increasing use of the world's oceans by commercial and recreational vessels is the main source of concerns regarding the impact of collisions on marine animals globally and in South Africa (Schoeman et al. 2020). The extent of the issue was highlighted by the formation of the International Whaling Commission Conservation Committee who established the Ship Strike Working Group in 2005. Most of the available research on the topic is on Northern right whales, fin whales, blue whales, humpback whales, sperm whales and manatees (Schoeman et al. 2020). Given the areas importance to whales and cetaceans, mitigation to avoid vessel strike are considered necessary.

While there are a variety of mitigation measures available to reduce vessel strikes, (see Schoeman et al. 2020 for an in-depth review), the most prominent measure is speed reduction, where vessel strikes can be reduced by up to 50 % if speed is reduced to below 10 knots when ships are operating in areas where marine mammals are active (Conn and Silber 2013). Schoeman et al. (2020) suggest that both speed reduction and re-routing of vessels around prominent marine mammal hot spots are likely to be the two biggest mitigation actors that will reduce marine mammal vessel strikes.

Geophysical surveys will be undertaken in the Concession area for a period of 4 months over the project duration (60 months). During this period the survey vessel will travel across a series of grids to obtain the bathymetric and stratigraphic data. The vessel is yet to be decided but survey work is generally conducted below 10-12 knots. The low survey speed and short duration of geophysical period reduce the risk of this impact occurring. The impact of vessel strikes will be localised to the Concession Area and will be limited in duration to the periods of the geophysical (4 months) and bulk sampling programme (2 months). Due to the severity of the impact which may cause serious injury or death the intensity has been rated as high. (Table 6-9).

The mitigation measure suggested are simple to Implement in order to reduce the risks to marine mammals to an acceptable level.

Table 6-9: Significance of potential vessel strikes on marine mammals

<table>
<tr><th></th><th>Extent</th><th>Intensity</th><th>Duration</th><th>Consequence</th><th>Probability</th><th>Significance</th><th>Status</th><th>Confidence</th></tr>
<tr><td>Without mitigation</td><td>Local
1</td><td>High
3</td><td>Short-term
1</td><td>Low
5</td><td>Improbable</td><td>VERY LOW</td><td>– ve</td><td>High</td></tr>
<tr><td colspan="9">Essential mitigation measures:
Marine Mammal Observer to be onboard the survey vessel at all times.
Reduce vessel speed to <10 knots during the geophysical surveys.
Avoid known areas of high marine mammal activity.
Where possible avoid periods of high marine mammal activity within the Concession Area (June-November).</td></tr>
<tr><td>With mitigation</td><td>Local
1</td><td>Low
1</td><td>Short-term
1</td><td>Very low
3</td><td>Improbable</td><td>INSIGNIFI-CANT</td><td>– ve</td><td>High</td></tr>
</table>

6.2.3 Impact 3: Bulk sampling on benthic fauna

Bulk sampling is likely to be the most severe and direct ecological impact on the marine environment. During bulk sampling, 20 trenches that are 20 m wide, 2 m deep (average) and 240 m in length will be excavated, removing approximately 192000 m^3 of benthic over burden in total and 48000 m^3 of ore in total, essentially removing 240000 m^3 of benthic sediment. The excavation of the trenches will directly affect a surface area of 96000 m^2 (9.6 ha) of benthic surface habitat. This equates to approximately 0.001% of the Concession Area which will be subject to invasive prospecting operations through trenching. Given that benthic fauna primarily exists in the upper 20-30 cm of sediment, sampling would inevitably eradicate the benthic infaunal and epifaunal biota located within the excavation footprints due to 4 m deep excavations (maximum depth). Differing communities of benthic fauna will be affected depending on in which of the four benthic ecosystem types trenching occurs (see section 3.5.1 in the baseline assessment). The Concession Area comprises 53% muddy sands, 36% sandy outer shelf habitats, 9% muddy mid shelf mosaic and 2% sandy mid shelf habitats.

However, parts of the Concession Area have been identified as Critical Biodiversity Areas (CBAs) through the National Marine and Coastal Spatial Biodiversity Plan (NMCSBP) (Harris et al. 2022). Overall, 245 672 ha have been identified as CBAs representing 32% of the Concession Area footprint with a further 21 640 ha, representing 2.8% of the Concession Area, identified as Ecological Support Areas (ESAs) (Figure 5-8). The sea-use guidelines developed with the NMCSBP CBA maps indicate that bulk sampling activities are not compatible with CBAs while restricted activities may occur in ESAs. Non-invasive sampling may occur in the CBAs and the sea-use guidelines make provisions for re-evaluation of CBAs should significant mineral resources be identified through non-invasive methods. This would require discussion and negotiation with the relevant authorities and the following would need to be undertaken:

- More detailed in situ studies to obtain more precise information on the biological characteristics of the areas of interest and determine whether invasive sampling should be permitted.
- A recategorization of the area would be required, to declassify it as a CBA, and suitable alternative areas in the same region, with the same or better conservation value would need to be identified and classified as a CBA to replace the areas lost.
- Invasive sampling in ESAs should be supported by convincing evidence of mineral potential prior to sampling and may require additional in situ studies that demonstrate that the areas to

be disturbed are not of significant conservation value. This evidence should be submitted as part of an updated prospecting work programme to the Department of Mineral Resources and Energy and to the Provincial Department of Environmental Affairs (Northern Cape Department: Agriculture, Environmental Affairs, Rural Development and Land Reform) prior to the commencement of invasive sampling activities.

As this is beyond the scope of this desktop assessment the impact has been assessed on a reduced footprint assuming that destructive bulk sampling will not be permitted within the CBAs and ESAs. The footprint available for bulk sampling outside of CBAs is reduced by 34.8% to 500 710 ha. The remaining benthic habitat type within the Concession Area that is not classified as a CBA or ESA (65.2%), consists of:

- 13% Namaqua Muddy Mid Shelf Mosaic.
- 53% Namaqua Muddy Sands.
- 2% Namaqua Sandy Mid Shelf.
- 33% Southern Benguela Sandy Outer Shelf.

At present the areas to be sampled are unknown, so the calculations indicating % habitat loss in Table 6-10 show the maximum and worst-case scenario for habitat loss (i.e., assuming 9.6ha of sampling within each habitat type). Under this worst-case scenario the % loss of habitat within the remainder of the Concession Area (reduced footprint) is 0.1% or lower across habitat types (Table 6-10). This implies an extremely low spatial impact of physical disturbance to the benthic habitats within the Concession Area.

In considering the impacts to the benthic environment it should be recognised that sensitive habitats within the west coast mining area have been formally protected through the declaration of several MPAs. The two MPAs adjacent to the Concession Area provide protection for cold water corals, fossilised trees and sponge gardens within the Namaqua Fossil Forest MPA, and the Orange Shelf Edge MPA protects previously undisturbed habitats of critically endangered hard grounds and areas of sandy seabed in the southern Benguela (Sink et al. 2019).

Table 6-10: Estimate of percentage loss of individual habitats assuming all sampling occurs only in one habitat (worst case scenario).

Habitat type	Concession Area		Critical Biodiversity Areas category								Remainder not within CBAs		Max % Benthic Loss based on 9.6 ha trenching
			All CBAs		CBA-N		CBA-R		ESA				
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	
Namaqua Muddy Mid Shelf Mosaic	66 474	8.6%	3 567	5.4%	2	0.0%		0.0%	3 564	5.4%	62 633	94%	0.02%
Namaqua Muddy Sands	406 535	52.9%	141 310	34.8%	131 829	32.4%	1	0.0%	9 479	2.3%	264 874	65%	0.00%
Namaqua Sandy Mid Shelf	15 435	2.0%	5 013	32.5%		0.0%		0.0%	5 013	32.5%	10 256	66%	0.10%
Southern Benguela Sandy Outer Shelf	280 461	36.5%	117 423	41.9%	113 839	40.6%		0.0%	3 584	1.3%	162 948	58%	0.01%
TOTAL Concession Area (ha)	**768 904**		**267 312**	**34.8%**	**245 671**	**32.0%**	**1**	**0.0%**	**21 640**		**500 710**	**65%**	**0.00%**

While the recovery disturbed benthic ecosystems does occur, the rate and success of the recovery depends on a variety of factors (Currie 2021). Generally speaking, shallower areas in moderate energy environments generally recover sooner than those in deeper low energy environments. Importantly an interplay between hydrodynamics and sediment particle size plays a large role in determining ecosystem recovery rates. For example, Boyd et al. (2005) found that areas dredged at a depth of 22 m and in a moderately energetic environment displayed notable dissimilarities from non-dredged reference sites after a six-year recuperation period. Based on this observation, the researchers concluded that it would probably take numerous years, possibly decades, to restore benthic assemblages in low-energy environments (Currie 2021). Importantly the destructive sampling procedure in this project will be undertaken in waters between 100 m and 200m in depth in in low energy habitats that are not adapted to frequent disturbances such as those in higher energy shallow environments. The infilling of the excavated trenches is therefore likely to take many years if not decades (Currie 2021). The removal of overburden will also likely change the benthic surface sediment characteristics, resulting in a community shift to pioneer species (species that are adapted to attaching or burrowing into the new sediment types (Currie 2021)).

In order to minimise bulk sampling impacts on benthic infauna in these areas, as far as reasonably possible while still allowing for sufficient confidence in the outcomes of the sampling for mine planning purposes, the proponent should avoid excavating pits directly adjacent to each other. Allowance should be made to leave undisturbed areas intact between excavation pits. While the effect of the distance between excavated tracks has not been thoroughly investigated, this mitigation action may reduce the recolonisation time of the affected areas.

Continuous monitoring of incoming sediments on deck should be implemented to check for evidence of biologically sensitive environments. If fragments of corals or fossil fragments are observed coming into the sieving area, operations should be stopped, and the location should be marked on the ships GPS. This area should be reported on the sampling log as an area of biological importance and should be investigated by a suitable specialist before further bulk sampling can take place at this location.

Impacts on CBAs and ESAs have not been assessed since they both require further negotiation with relevant authorities and in situ studies prior to being eligible for invasive sampling. The impact of bulk sampling on benthic fauna is localised, high intensity and short-term duration, resulting in a **low** impact significance, which can be mitigated to a **very low** significance (Table 6-11).

Table 6-11: Significance of bulk sampling impacts on benthic fauna

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	High 3	Short-term 1	**Low** **5**	Definite	**LOW**	– ve	High
Essential mitigation measures: • Exclude CBAs and ESAs from bulk sampling activities unless significant mineral resources can be demonstrated through non-invasive techniques. • Additional in situ assessment will be required for any invasive sampling within CBAs. • Leave undisturbed areas between excavated pits to enhance recolonisation opportunities. • Monitor incoming benthic sediment for coral or fossil fragments, if observed halt sampling and mark the location.								
With mitigation	Local 1	Medium 2	Short-term 1	**Very low** **4**	Definite	**VERY LOW**	– ve	High

6.2.4 Impact 4: Crushing of epifaunal community by crawler tracks

Other than the direct impacts on the benthic community caused by the excavation of bulk sampling trenches, the tracks which the crawler uses to navigate on the seafloor can also be a potential source of benthic disturbance. The crawler deployment will be very close to the area of interest and no unnecessary crawling along the seabed will be done. The trawler track mostly coincide with area of excavation. Unlike the excavation of trenches which removes large volumes of sediment, the crushing footprint of the crawlers tracks only affects the benthic surface epifaunal and infaunal communities. The crushing will likely only affect soft bodied organisms as harder bodied crustaceans and molluscs may be more resilient to direct downward pressure. The impacts of such a disturbance would therefore be of low intensity, at a localised level and recovery would most probably be rapid with organisms recruiting quickly from adjacent undisturbed habitats. Given the localised scale, low intensity, and quick recovery times likely to be associated with this disturbance, and difficulty associated with finding feasible mitigation measures, no mitigation is required. It must however be noted that this rating assumes that the CBA and ESA zones are excluded from any sampling in accordance with the mitigations raised in the previous impact,

The impact is assessed to be of **very low** significance before mitigation and does not require mitigating (Table 6-12).

Table 6-12: Significance of crushing epifaunal community by crawler tracks

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Short-term 1	**Very low** **3**	Definite	**VERY LOW**	– ve	High

6.2.5 Impact 5: Increased turbidity in the water column due to the suspension of fine sediments during bulk sampling

During the bulk sampling operation, seabed sediments will be excavated and pumped into classifiers aboard the ship which sort the sediments into different size and weight classes. Gravels, in which diamonds are likely to occur, will be used to grade the ore. The finer tailings are washed off the gravels of interest immediately and discarded overboard resulting in sediment plume immediately downstream of the ship. The distribution and resettlement of the fine sediment plume is affected by a combination of factors such as local oceanography, sediment characteristics and the way in which they are released into the water column. The resultant fine sediment plume can change the immediate area's water quality and chemical composition. It will affect light attenuation into the water column, which is needed by photosynthetic phytoplankton and affects the foraging efficiencies of local pelagic species. Contaminant resuspension is a low risk in this case since the Concession Area is far offshore and therefore away from terrestrial anthropogenic contamination sources.

Previous research conducted by Carter (2008) who conducted water sampling for De Beers Marine in the MPT 25/2011 area confirmed that the suspended sediments in plumes settle quite quickly. Additionally, the results showed that the contaminant levels in the plumes are well below the water quality guideline levels. Based on these findings it is suggested that the effect of the sediment plume will be at a local scale, over a short time period and be of low intensity. It must, however, be noted that the dumping of dredge spoils is not compatible with the CBA guidelines for CBA-N and CBA-R areas (32% of the concession).

The impact Is assessed to be of **very low** significance before mitigation and does not require mitigating (Table 6-13), assuming that the CBA areas are excluded from the bulk sampling area.

Table 6-13: Significance of increased turbidity in the water column due to suspension of fine sediments during bulk sampling.

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Short-term 1	**Very low** **3**	Definite	**VERY LOW**	– ve	Medium

6.2.6 Impact 6: Sedimentation impacts on benthic communities due to coarse tailings

Along with fine sediment dumping, coarse tailings such as oversized gravel and rocks are also discarded overboard to settle back on the benthos beneath the vessel. The sinking of this material will therefore cover and smother sessile and sensitive benthic fauna, either immediately crushing organisms or smothering live organisms that may be deprived of oxygen or be unable to filter particles from the water column. The effects of re-deposited tailings on benthic fauna are dependent on the mobility of the fauna being affected, where sessile epifaunal communities will be affected the most, while mobile epifaunal organisms are able to migrate vertically through the deposited substrate back to the surface.

The effect on mobile benthic fish and cephalopods is thought to be limited as they are able to escape localised redeposition of coarse sediments because they are capable of rapid movement. In contrast, immobile sedentary faunal groups are unable to move and will therefore be affected, particularly those that attach to hard substrate types such as sponges and cold-water coral species (Mortensen et al. 2001). The Concession Area comprises 62% muddy shelf and 38% sandy shelf substratum which is further divided into primary ecosystem types which comprises 9% Namaqua Muddy Mid Shelf Mosaic, 53% Namaqua Muddy Sands, 2% Namaqua Sandy Mid Shelf and 36% Southern Benguela Sandy Outer Shelf. The distribution of hard substrates is therefore likely limited in extent (approximately 9% in total for mosaic habitat) to the inshore section of the Concession Area where the shelf mosaic habitats occur (Figure 5-4). Deposition of coarse tailings over harder substrates that are dominated by epiphytic sponges and cold-water corals is of greater concern but known areas of rock outcrop containing sensitive cold-water corals and sponges have been formally protected in the Namaqua Fossil Forest MPA, which is also bounded by a 5km buffer. These areas make a significant contribution to the protection of known sensitive areas within the broader region within and adjacent to the Concession Area.

The effects of coarse tailings deposits over soft mud and sands sediments are likely to be negligible at a local scale with rapid recolonisation of mobile faunal groups up though the deposits. Due to the limited and isolated distribution of hard substrates within the Concession Area the impact on fauna within this habitat is likely limited based on the scale of the proposed bulk sampling activities (Table 6-13). It must, however, be noted that the dumping of tailings is not compatible with the CBA guidelines for CBA-N and CBA-R areas (32% of the concession).

This impact is rated as **low** significance before mitigating and can be mitigated to **insignificant** (Table 6-14).

Table 6-14: Sedimentation impacts on benthic communities due to coarse tailings

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	High 3	Short-term 1	**Low** **5**	Probable	**LOW**	– ve	Medium
Essential mitigation measures: • No discharge of tailings to be undertaken within the CBAs. • Non-invasive geophysical survey data should be used to identify hard substrate and these areas should be avoided when discharging coarse tailings.								
With mitigation	Local 1	Low 1	Short-term 1	**Very low** **3**	Improbable	**INSIGNIFI-CANT**	– ve	Medium

6.2.7 Impact 7: Marine pollution originating from operational discharges during vessel operations.

During all vessel operations at sea, vessel discharges into the marine environment occur on a daily basis, from deck and machinery washing, grey water discharges, detergents, cooling water and food wastes. There are industry standards that regulate and govern how waste is discharged off vessels (International Convention for the Prevention of Pollution from Ships: MARPOL). This agreement regulates the discharge of oil pollution, noxious chemicals, packaging, sewage, garbage, and air pollution. It is therefore assumed that the operating vessel is compliant with MARPOL meaning that marine pollution originating from the vessel will be negligible or at a scale that will negligibly affect the local environment.

The impact is assessed to be of **very low** significance before mitigation and **insignificant** once mitigated (assuming standard MARPOL operating rules are adhered to) (Table 6-15).

Table 6-15: Significance of pollution originating from operational discharges during vessel operations

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Medium 2	Short-term 1	**Very low** **4**	Definite	**VERY LOW**	– ve	High
Essential mitigation measures: • Implement MARPOL regulations to manage ship effluent and discharges								
With mitigation	Local 1	Low 1	Short-term 1	**Very low** **3**	Improbable	**INSIGNIFI-CANT**	– ve	High

6.3 Cumulative Impacts

The published goals of the NCMSBP initiative were to:

- Unlock the ocean economy through providing an enabling environment for marine investments and developments to occur. Specifically, it aimed to "i*dentify compatible uses and reduce conflicts between incompatible uses."*
- Engage with the ocean through increasing awareness of the ocean and how it relates to South African identity.
- Ensure healthy marine ecosystems through protection, conservation, and restoration activities. This was to be achieved through the integration of biologically and ecologically important areas into decision making.
- Contribute to good ocean governance through the inclusion of role players in the planning and decision-making processes.

The NCMSBP was developed in order to identify areas of importance for safeguarding representative areas of marine biodiversity. The output of the process is a Critical Biodiversity Area (CBA) map which serves as a spatial plan to inform future marine spatial planning in support of sustainable development. The plan was developed taking into consideration all aspects of sustainable development, which include conservation and sustainable natural resource use and extractive activities. The activities of the industries such as marine mining which utilise the marine ecosystem are taken into account in the design and preparation of the CBA maps. The areas that have been determined to be suitable for exploitation in mining have been selected as such while considering the conservation needs of each habitat type. Thus, the NCMSBP has already considered multiple users and their cumulative impacts on marine areas.

The sea use guidelines were specifically developed for use in Environmental Impact Assessments such as these, to guide practitioners in identifying the most suitable areas and activities to be undertaken in South Africa's territorial waters. The individual impacts assessed above were considered within the NCMSBP sea use guidelines, and the mitigation measures suggested will result in the outcomes of the project meeting the requirements of the plan. Given this outcome, and the fact that the NCMSBP was developed taking into consideration the entire extent of the Namaqua Bioregion, cumulative impacts related to exploration activities in the benthic ecosystem types (Namaqua Muddy Sands, Southern Benguela Sandy Outer Shelf, Namaqua Muddy Mid Shelf Mosaic and Namaqua Sandy Mid Shelf) in the Concession Area will result in minimal cumulative impacts. Indeed, the intention of the NCMSBP is to ensure that foreseeable cumulative impacts are minimised and managed appropriately by designating protected and limited use areas.

7 Findings and Conclusions

7.1 Findings

The most significant impact concern relating to the proposed prospecting application is that of bulk sampling and the dumping of tailings over potentially sensitive habitat types found within the Concession Area. While the existing Concession Area layout to excludes potentially sensitive areas around the two Marine Protected Areas found in the immediate vicinity by including 5 km buffer zones, there are other areas that have been identified in the NCMSBP as Critical Biodiversity Areas (CBAs) which are not compatible with the current proposed exploration proposal. The CBA maps identify 32% of the Concession area as Critical Biodiversity Area in a natural state (CBA-N), 3% as an Ecological Support Area (ESA) and <0.001% considered as Critical Biodiversity Areas that require recovery (CBA-R). The remaining 65% of the Concession Area is unclassified in terms of the CBA maps. Based on this recent marine spatial planning, a significant portion of the proposed Concession Area is not compatible with the proposed bulk sampling methods.

The remaining potential impacts on the marine environment include the presence of the ship and the associated surveying activities are not seen to be major cause for concern if specific mitigation measures are implemented which have been outlined in this report.

A summary of impacts and mitigation / optimisation measures is provided in Table 7-1.

Table 7-1: Summary of impacts and mitigation / optimisation measures

Impact	Significance rating		Key mitigation / optimisation measures
	Before mitigation / optimisation	After mitigation / optimisation	
EXPLORATION PHASE IMPACTS			
Noise pollution on invertebrates	Very low	n/a	• n/a
Noise pollution on fish	Very Low	Very Low	• Implement "soft starts" for the surveys for sound levels >210 dB re 1 µPa at 1 m over a period of 20 minutes to give sensitive species an opportunity to move away from the sampling area, particularly if large aggregations of fish are observed on the ship's sonar.
Noise pollution on marine mammals	Very Low	Very Low	• Undertake a visual scan of the area 15 minutes prior to the commencement of surveying activities and soft starts. Visual scans should be undertaken by a trained Marine Mammal Observer. • Implement "soft starts" for the surveys for sound levels >210 dB re 1 µPa at 1 m over a period of 20 minutes to give sensitive species an opportunity to move away from the sampling area. • Cease survey activities if abnormal behaviour in marine mammals is observed until the animal has moved away from the area. • Avoid surveys during known periods of cetacean migration into the area for feeding (beginning of June to the end of November) and ensure that cetaceans are able to move around sonar operations. • Implement Passive Acoustic Monitoring (PAM) on board survey ships, with a view to: o Detect the range and frequencies of marine mammal vocalisations expected to be present in the survey area. o Detect and identify vocalising marine mammals and establish bearing and range in a reasonable period of time. o Ensure real time relaying of the recordings to the PAM operator to allow for immediate mitigation activities to be implemented.
Potential vessel strikes on marine mammals	Low	Very Low	• Marine Mammal Observer to be onboard the survey vessel at all times. • Reduce vessel speed to <10 knots during the geophysical surveys. • Avoid known areas of high marine mammal activity. • Where possible avoid periods of high marine mammal activity within the Concession Area (June-November).

Impact	Significance rating		Key mitigation / optimisation measures
	Before mitigation / optimisation	**After mitigation / optimisation**	
Bulk sampling on benthic fauna	Low	Very Low	• Exclude CBAs and ESAs from bulk sampling activities unless significant mineral resources can be demonstrated through non-invasive techniques. • Additional in situ assessment will be required for any invasive sampling within CBAs. • Leave undisturbed areas between excavated pits to enhance recolonisation opportunities. • Monitor incoming benthic sediment for coral or fossil fragments, if observed halt sampling and mark the location.
Crushing of epifaunal community by crawler tracks	Very Low	n/a	• n/a
Increased turbidity in the water column due to fine sediment suspension	Very Low	n/a	• n/a (Assumes CBAs are excluded from sampling area).
Sedimentation impacts on benthic communities due to coarse tailings	Low	Insignificant	• No discharge of tailings to be undertaken within the CBAs. • Non-invasive geophysical survey data should be used to identify hard substrate and these areas should be avoided when discharging coarse tailings.
Marine pollution from vessel operational discharges	Very Low	Insignificant	• Implement MARPOL regulations to manage ship effluent and discharges

7.2 Conclusion and Authorisation Opinion

The Concession Area overlaps with both CBA and ESA areas as delineated in the CBA maps from the NCMSBP. The CBA maps identify 32% of the Concession area as CBA-N, 3% as ESA with <0.001% considered as CBA-R. The sea-use guidelines for CBA-N and CBA-R allow for restricted non-destructive prospecting, but no bulk sampling or mining operations. Restricted non-destructive prospecting, bulk sampling and mining may be undertaken in ESAs if the anticipated resource is significant. Similarly, it is possible to de-classify the CBAs if evidence of significant mining resources exists, but alternative equivalent areas need to be identified in the same region to adequately replace the area lost.

No invasive sampling should be undertaken in the CBAs and ESAs as outlined in the sea-use guidelines. At present there is no detailed spatial plan of the bulk sampling activities these will be decided upon once Phase 1 (geophysical survey) of the project is completed. A re-evaluation of the CBAs and ESAs could be undertaken at a later stage should the non-invasive sampling reveal significant mineral resources could exist in these areas. Any re-evaluation would require a detailed spatial plan for invasive sampling within the CBAs or ESAs, which is currently unavailable. Additional primary data on the benthic habitats in these areas may also be required to inform the re-evaluation.

The extent of impacts in the remainder of the Concession Area have shown that the exploration activities will result in limited negative impacts on a localised scale for short durations. Reasonable and feasible mitigation measures have been proposed which reduce the impacts further, in line with best practice. On this basis the proposed non-invasive exploration activities in the Concession Areas are acceptable, and invasive exploration activities are acceptable in the areas that are not delineated as CBAs or ESAs. The acceptability of invasive sampling in the CBAs and ESAs should be assessed based on the outcomes of the non-invasive sampling results and the provision of a detailed spatial sampling plan.

In this instance, the No Go option, in which no disturbance of the seabed takes place is preferable to the exploration alternative. However, the impacts on the remaining Concession Area that fall outside the CBAs and ESAs are very limited (9.2Ha of area to be disturbed) and could result in significant economic benefits derived from the area, which is in line with the published goals of the marine spatial planning initiative.

On this basis, we feel that exploration in the Concession Areas that fall outside the areas delineated on the CBA maps should be approved. Approval for non-invasive sampling in the CBAs and ESAs should be granted. Approval for invasive sampling in the CBAs and ESAs should be withheld at this stage pending further information on the mineral resources in this area based on the findings of the geophysical survey from which a detailed spatial sampling plan can be developed.

8 References

Anderson, T.J., Morrison, M., MacDiarmid, A., Clark, M., Archino, R.D., Tracey, D.M. and Wadhwa, S., 2019. Review of New Zealand's key biogenic habitats. *National Institute of Water and Atmospheric Research, Wellington*.

Amorim, M.C.P., Pedroso, S.S., Bolgan, M., Jordão, J.M., Caiano, M. and Fonseca, P.J., 2013. Painted gobies sing their quality out loud: acoustic rather than visual signals advertise male quality and contribute to mating success. *Functional Ecology*, *27*(2), pp.289-298.

Atkinson, L.J., 2009. Effects of demersal trawling on marine infaunal, epifaunal and fish assemblages: studies in the southern Benguela and Oslofjord. PhD thesis, University of Cape Town. Pp 141.

Augustyn, C.J., 1991. The biomass and ecology of chokka squid *Loligo vulgaris reynaudii* off the west coast of South Africa. *African Zoology*, *26*(4), pp.164-181.

Augustyn, C.J., Lipiński, M.R. and Roeleveld, M.A.C., 1995. Distribution and abundance of Sepioidea off South Africa. *South African Journal of Marine Science*, *16*(1), pp.69-83.

Awad, A.A., Griffiths, C.L. and Turpie, J.K., 2002. Distribution of South African marine benthic invertebrates applied to the selection of priority conservation areas. *Diversity and Distributions*, *8*(3), pp.129-145.

Bailey, G.W., De B. Beyers, C.J. and Lipschitz, S.R., 1985. Seasonal variation of oxygen deficiency in waters off southern South West Africa in 1975 and 1976 and its relation to the catchability and distribution of the Cape rock lobster *Jasus lalandii*. *South African Journal of Marine Science*, *3*(1), pp.197-214.

Bamford, M.K. and Stevenson, I.R., 2002. A submerged late Cretaceous podocarpaceous forest, west coast, South Africa. South African Journal of Science 98, 181-185.

Birch, G.F., Rogers, J., Bremner, J.M. and Moir, G.J., 1976. Sedimentation controls on the continental margin of southern Africa. In *Proceeding 1st Interdiciplinary Conference of Marines Freshwater Research of South Africa*.

Bluck, B.J., Ward, J.D., Cartwright, J. and Swart, R., 2007. The Orange River, southern Africa: an extreme example of a wave-dominated sediment dispersal system in the South Atlantic Ocean. *Journal of the Geological Society*, *164*(2), pp.341-351.

Boyd, S.E., Limpenny, D.S., Rees, H.L. and Cooper, K.M., 2005. The effects of marine sand and gravel extraction on the macrobenthos at a commercial dredging site (results 6 years post-dredging). *ICES Journal of Marine Science,* (62(2), pp.145-162.

Carter, R.A., 2008. Evaluation of water quality risks in the SASA ML3 Mining Licence Area. Prepared for Pisces Environmental Services on behalf of De Beers Marine, Report No. LT-08- 056. Pp24.

Carr, M.E., 2001. Estimation of potential productivity in Eastern Boundary Currents using remote sensing. *Deep Sea Research Part II: Topical Studies in Oceanography*, *49*(1-3), pp.59-80.

Chapman, P. and Shannon, L.V., 1985. The Benguela ecosystem. 2. *Chemistry and related processes. In Oceano*.

Cohen, L.A., Pichegru, L., Grémillet, D., Coetzee, J., Upfold, L. and Ryan, P.G., 2014. Changes in prey availability impact the foraging behaviour and fitness of Cape gannets over a decade. *Marine Ecology Progress Series*, *505*, pp.281-293.

Compagno, L.J.V., Ebert, D.A. and Cowley, P.D., 1991. Distribution of offshore demersal cartilaginous fish (Class Chondrichthyes) off the west coast of southern Africa, with notes on their systematics. *South African Journal of Marine Science*, *11*(1), pp.43-139.

Conn, P.B. and Silber, G.K., 2013. Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. *Ecosphere*, *4*(4), pp.1-16.

CMS., 1999. (https://www.cms.int/atlantic-turtles/en/legalinstrument/atlantic-turtles-mou) [accessed 15/04/2023]

Crawford, R.J.M. and Whittington, P.A., 2005. African Penguin. Roberts birds of southern Africa, pp.439-441

Currie J., 2021. BRIEF OVERVIEW OF POTENTIAL ECOSYSTEM IMPACTS OF MARINE PHOSPHATE MINING IN THE WESTERN CAPE, SOUTH AFRICA. WWF South Africa.

De Jong, K., Forland, T.N., Amorim, M.C.P., Rieucau, G., Slabbekoorn, H. and Sivle, L.D., 2020. Predicting the effects of anthropogenic noise on fish reproduction. *Reviews in Fish Biology and Fisheries*, *30*, pp.245-268.

DFFE, SANBI & NMU 2022. National Coastal and Marine Spatial Biodiversity Plan: Securing South Africa's coastal and marine biodiversity to support development and sustainable resource use. SANBI Factsheet Series. South African National Biodiversity Institute, Pretoria.

Dickerson, C., Reine, K.J. and Clarke, D.G., 2001. Characterization of underwater sounds produced by bucket dredging operations, *DOER Technical Notes Collection (ERDC TN-DOER-E14)*, U.S. Army Engineer Research and Development Center, Vicksburg, MS. 18pp.

Dingle, R.V. and Nelson, G., 1993. Sea-bottom temperature, salinity and dissolved oxygen on the continental margin off south-western Africa. *South African Journal of Marine Science*, *13*(1), pp.33-49.

Duarte, C.M., Chapuis, L., Collin, S.P., Costa, D.P., Devassy, R.P., Eguiluz, V.M., Erbe, C., Gordon, T.A., Halpern, B.S., Harding, H.R. and Havlik, M.N., 2021. The soundscape of the Anthropocene ocean. *Science*, *371*(6529), p.eaba4658.

Findlay, K.P., 1989. *The distribution of cetaceans off the coast of South Africa and South West Africa/Namibia* (Doctoral dissertation, University of Pretoria).

Findlay, K.P., 1996. The impact of diamond mining noise on marine mammal fauna off southern Namibia. Specialist Study# 10. *Environmental Impact Report. Environmental Evaluation Unit (ed.) Impacts of deep sea diamond mining, in the Atlantic*, *1*, p.370.

Freiwald, A., Fosså, J. H., Grehan, A., Koslow, T., and Roberts, J. M., 2004. Cold-water coral reefs. *UNEP-WCMC Biodiversity Series,* 22, pp.1-85.

Greene, C.R.J. and Moore, S.E., 1995, Man-made noise. In: 'Marine Mammals and Noise', Eds. W.J. Richardson, C.R.J. Greene, C.I. Malme and Thomson DH. pp.101-158, Academic Press, San Diego.

Griffiths, M.H., 2002. Life history of South African snoek, Thyrsites atun (Pisces: Gempylidae): a pelagic predator of the Benguela ecosystem. *Fisheries Bulletin* (100), pp 690-710.

Hagen, E., Feistel, R., Agenbag, J.J. and Ohde, T., 2001. Seasonal and interannual changes in intense Benguela upwelling (1982–1999). *Oceanologica Acta*, *24*(6), pp.557-568.

Harding, S. and Cousins N., 2022. Review of the Impacts of Anthropogenic Underwater Noise on Marine Biodiversity and Approaches to Manage and Mitigate them. *Technical Series No. 99,* Secretariat of the Convention on Biological Diversity, Montreal, 145pp.

Harris, L.R., Holness, S.D., Kirkman, S.P., Sink, K.J., Majiedt, P. and Driver, A., 2022. A robust, systematic approach for developing the biodiversity sector's input for multi-sector Marine Spatial Planning. *Ocean & Coastal Management*, *230*, p.106368.

Hildebrand, J., 2009. Anthropogenic and natural sources of ambient noise in the ocean. *Marine Ecology Progress Series*, 395, pp.5-20.

Honig, M.B., Petersen, S.L. and Duarte, A., 2008. Turtle bycatch in longline fisheries operating within the Benguela current large marine ecosystem. *Collect. Vol. Sci. Pap. ICCAT*, *62*(6), pp.1757-1769.

Hoyt, J.H., Oostdam, B.L. and Smith, D.D., 1969. Offshore sediments and valleys of the Orange river (South and South West Africa). *Marine Geology*, *7*(1), pp.69-84.

Hutchings, L., van der Lingen, C., Shannon, L.J., Crawford, R.J.M. + 14 others., 2009. The Benguela Current: An ecosystem of four components. *Progress in Oceanography*, 83(1-4), pp.15-32.

Imbol Koungue, R.A., Rouault, M., Illig, S., Brandt, P. and Jouanno, J., 2019. Benguela Niños and Benguela Niñas in forced ocean simulation from 1958 to 2015. *Journal of Geophysical Research: Oceans*, *124*(8), pp.5923-5951.

IUCN, 2023. IUCN Red List (www.iucnredlist.org) [accessed 15/04/2023]

James, A.G., 1987. Feeding ecology, diet and field-based studies on feeding selectivity of the Cape anchovy *Engraulis capensis* Gilchrist. *South African Journal of Marine Science*, *5*(1), pp.673-692.

Jorgensen, S.J., Micheli, F., White, T.D., Van Houtan, K.S., Alfaro-Shigueto, J., Andrzejaczek, S., Arnoldi, N.S., Baum, J.K., Block, B., Britten, G.L. and Butner, C., 2022. Emergent research and priorities for shark and ray conservation. *Endangered species research*, *47*, pp.171-203.

Kirkman, S.P., Yemane, D., Kathena, J., Mafwila, S.K., Nsiangango, S.E., Samaai, T., Axelsen, B. and Singh, L., 2013. Identifying and characterizing demersal fish biodiversity hotspots in the Benguela Current Large Marine Ecosystem: relevance in the light of global changes. *ICES Journal of Marine Science*, *70*(5), pp.943-954.

Koper, R.P. and Plön, S., 2012. The potential impacts of anthropogenic noise on marine animals and recommendations for research in South Africa. Endangered Wildlife Trust, South Africa.

Lange, L., 2012. Use of demersal bycatch data to determine the distribution of soft-bottom assemblages off the West and South coasts of South Africa. PhD Thesis, University of Cape Town.

Laird, M.C., 2013. Taxonomy, systematics and biogeography of South African Actiniaria and Corallimorpharia. PhD thesis, University of Cape Town. Pp 236

Le Gall, Y. 2016. Acoustis impact assemsnet of subbottom profilers on marine mammals. Department: Marine and Digital Infrastructures Unit: Vessels and On-board Systems. Ifremer.

Lipinski, M.R., 1992. Cephalopods and the Benguela ecosystem: trophic relationships and impacts. South African Journal of Marine Science (12) 791-802.

Lombard, A.T., Strauss, T., Harris, J., Sink, K., Attwood, C. and Hutchings, L., 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 4: Marine Component. Pretoria: South African National Biodiversity Institute.

Louw, G.G., Van der Lingen, C.D. and Gibbons, M.J., 1998. Differential feeding by sardine Sardinops sagax and anchovy Engraulis capensis recruits in mixed shoals. *South African Journal of Marine Science*, *19*(1), pp.227-232.

Lutjeharms, J.R.E. and Meeuwis, J.M., 1987. The extent and variability of South-East Atlantic upwelling. *South African Journal of Marine Science*, *5*(1), pp.51-62.

Makhado, A.B., Braby, R., Dyer, B.M., Kemper, J., McInnes, A.M., Tom, D. and Crawford, R.J., 2021. Seabirds of the Benguela Ecosystem: Utilisation, Long-Term Changes and Challenges. *Birds-Challenges and Opportunities for Business, Conservation and Research*, p.51.

McQueen, N.J., 2002. *Temporal variation in the diet and feeding intensity of Snoek (Thyrsites atun) in the Southern Benguela upwelling system* (Master's thesis, University of Cape Town).

Mecenero, S., Kirkman, S.P. and Roux, J.P., 2005. Seabirds in the diet of Cape fur seals *Arctocephalus pusillus pusillus* at three mainland breeding colonies in Namibia. *African Journal of Marine Science*, *27*(2), pp.509-512.

Mecenero, S., Roux, J.P., Underhill, L.G. and Kirkman, S.P., 2006a. Diet of Cape fur seals *Arctocephalus pusillus pusillus* at three mainland breeding colonies in Namibia. 2. Temporal variation. *African Journal of Marine Science*, *28*(1), pp.73-88.

Mecenero, S., Roux, J.P., Underhill, L.G. and Bester, M.N., 2006b. Diet of Cape fur seals *Arctocephalus pusillus pusillus* at three mainland breeding colonies in Namibia. 1. Spatial variation. *African Journal of Marine Science*, *28*(1), pp.57-71.

Monniot, C., Monniot, F., Griffiths, C.L. and Schleyer, M., 2001. *South African ascidians*. *Annals of the South African Museum,* 108, pp.1–141.

Monteiro, P.M. and van der Plas, A.K., 2006. 5 Low oxygen water (LOW) variability in the Benguela system: Key processes and forcing scales relevant to forecasting. In *Large Marine Ecosystems* (Vol. 14, pp. 71-90). Elsevier.

Mortensen, P.B., Hovland, T., Fosså, J.H. and Furevik, D.M., 2001. Distribution, abundance and size of *Lophelia pertusa* coral reefs in mid-Norway in relation to seabed characteristics. *Journal of the Marine Biological Association of the United Kingdom*, *81*(4), pp.581-597.

Nepgen, C.S.D.V., 1970. *Exploratory fishing for tuna off the South African west coast*. Division of Sea Fisheries.

Olivier, F., Gigot, M., Mathias, D., Jezequel, Y., Meziane, T., l'Her, C., Chauvaud, L. and Bonnel, J., 2023. Assessing the impacts of anthropogenic sounds on early stages of benthic invertebrates: The "Larvosonic system". *Limnology and Oceanography: Methods*, *21*(2), pp.53-68.

Oosthuizen, A., 2003. *A development and management framework for a new Octopus vulgaris fishery in South Africa* (Doctoral dissertation, Rhodes University).

Parker-Nance S, Atkinson LJ (2018) Phylum chordata. In: Atkinson LJ, Sink KJ (eds) Field guide to the offshore marine invertebrates of South Africa. Malachite Marketing and Media, Pretoria, pp 477–490

Perry, C., 1998, April. A review of the impact of anthropogenic noise on cetaceans. In *Scientific Committee at the 50th Meeting of the International Whaling Commission* (Vol. 27, p. 3).

Pillar, S.C., Barange, M. and Hutchings, L., 1991. Influence of the frontal system on the cross-shelf distribution of *Euphausia lucens* and *Euphausia 59ecurve* (Euphausiacea) in the southern Benguela system. *South African Journal of Marine Science*, *11*(1), pp.475-481.

Pillar, S.C. and Barange, M., 1995. Diel feeding periodicity, daily ration and vertical migration of juvenile Cape hake off the west coast of South Africa. *Journal of Fish Biology*, *47*(5), pp.753-768.

Pitcher, G.C. and Calder, D., 2000. Harmful algal blooms of the southern Benguela Current: a review and appraisal of monitoring from 1989 to 1997. *South African Journal of Marine Science*, *22*(1), pp.255-271.

Pörtner, H.O. and Farrell, A.P., 2008. Physiology and climate change. *Science*, *322*(5902), pp.690-692.

Pulfrich, A., 2018. BASIC ASSESSMENT FOR A PROSPECTING RIGHT APPLICATION FOR OFFSHORE SEA CONCESSION 6C WEST COAST, SOUTH AFRICA. Marine Faunal Assessment. Report prepared for SLR Consulting (Pty) Ltd. 113pp.

Pulfrich, A., Penney, A.J., Brandão, A., Butterworth, D.S. and Noffke, M., 2006. Marine Dredging Project: FIMS Final Report. *Monitoring of Rock Lobster Abundance, Recruitment and Migration on the Southern Namibian Coast. Prepared for De Beers Marine Namibia*.

Reine, K.J., Clarke, D.G. and Dickerson, C., 2012a. Characterization of underwater sounds produced by a backhoe dredge excavating rock and gravel. *DOER technical notes collection. ERDC TN-DOER-E36*. Vicksburg, MS: US Army Engineer Research and Development Center.

Reine, K.J., Clarke, D.G. and Dickerson, C., 2012b. Characterization of underwater sounds produced by a hydraulic cutterhead dredge fracturing limestone rock. *DOER technical notes collection. ERDC TN-DOER-E34*. Vicksburg, MS: US Army Engineer Research and Development Center.

Roel, B.A., 1987. Demersal communities off the west coast of South Africa. *South African Journal of Marine Science*, *5*(1), pp.575-584.

Samaai, T., Maduray, S., Janson, L., Gibbons, M.J., Ngwakum, B. and Teske, P.R., 2017. A new species of habitat–forming *Suberites* (Porifera, Demospongiae, Suberitida) in the Benguela upwelling region (South Africa). *Zootaxa*, *4254*(1), pp.49-81.

Samaai, T., Sink, K., Kirkman, S., Atkinson, L., Florence, W., Kerwath, S., Parker, D. and Yemane, D., 2020. The marine animal forests of South Africa: Importance for bioregionalization and marine spatial planning. *Perspectives on the marine animal forests of the world*, pp.17-61.

Schoeman, R.P., Patterson-Abrolat, C. and Plön, S., 2020. A global review of vessel collisions with marine animals. *Frontiers in Marine Science*, *7*, p.292.

Sink, K., Van der Bank, M.G., Majiedt, P.A., Harris, L.R., Atkinson, L., Kirkman, S.P. and Karenyi, N., 2019. South African National Biodiversity Assessment 2018 technical report volume 4: marine realm. *South African National Biodiversity Institute, Pretoria. South Africa. http://hdl. handle. net/20.500*, *12143*, p.6372.

Shillington, F.A., Reason, C.J.C., Rae, C.D., Florenchie, P. and Penven, P., 2006. 4 Large scale physical variability of the Benguela Current Large Marine Ecosystem (BCLME). In *Large marine ecosystems* (Vol. 14, pp. 49-70). Elsevier.

Slabbekoorn, H., Bouton, N., van Opzeeland, I., Coers, A., ten Cate, C. and Popper, A.N., 2010. A noisy spring: the impact of globally rising underwater sound levels on fish. *Trends in ecology & evolution*, *25*(7), pp.419-427.

Smale, M.J., 1992. Predatory fish and their prey—an overview of trophic interactions in the fish communities of the west and south coasts of South Africa. *South African Journal of Marine Science*, *12*(1), pp.803-821.

Spotila, J.R., 2004. *Sea turtles: a complete guide to their biology, behavior, and conservation*. JHU Press.

Steffani, N., 2007a. Biological Baseline Survey of the Benthic Macrofaunal Communities in the Atlantic 1 Mining Licence Area and the Inshore Area off Pomona for the Marine Dredging Project. *Prepared for De Beers Marine Namibia (Pty) Ltd*, p.42.

Steffani, N., 2007b. Biological Monitoring Survey of the Macrofaunal Communities in the Atlantic 1 Mining Licence Area and the Inshore Area between Kerbehuk and Bogenfels. 2005 Survey. *Prepared for De Beers Marine Namibia (Pty) Ltd*, p.51.

Stevenson, I.R. and Bamford, M.K., 2003. Submersible-based observations of in-situ fossil tree trunks in Late Cretaceous seafloor outcrops, Orange Basin, western offshore, South Africa. South African Journal of Geology 106, 315-326.

Stephen, V.C. and Hockey, P.A., 2007. Evidence for an increasing incidence and severity of Harmful Algal Blooms in the southern Benguela region. *South African Journal of Science*, *103*(5-6), pp.223-231.

Suedel, B.C., McQueen, A.D., Wilkens, J.L. and Fields, M.P., 2019. Evaluating effects of dredging-induced underwater sound on aquatic species: a literature review. *U.S. Army Engineer Research and Development Center, Technical Report No. ERDC/EL TR-19-18*. 138pp.

Talbot, F.H. and Penrith, M.J., 1968. *The Tunas of the Genus Thunnus in South African Waters: Introduction, Systematics, Distribution and Migrations. I*. South African Museum.

Thomsen, F. + 37 others., 2009. Assessment of the environmental impact of underwater noise. *OSPAR Commission: Biodiversity Series,* Publication Number 436/2009, 41pp.

Uriz, M.J., 1988. *Deep-water sponges from the continental shelf and slope of Namibia (south-west Africa). Classes Hexactinellida and Demospongiae*. CSIC-Instituto de Ciencias del Mar (ICM).

van der Knaap, I., Reubens, J., Thomas, L., Ainslie, M.A., Winter, H.V., Hubert, J., Martin, B. and Slabbekoorn, H., 2021. Effects of a seismic survey on movement of free-ranging Atlantic cod. *Current Biology*, *31*(7), pp.1555-1562.

Wang, S.V., Wrede, A., Tremblay, N. and Beermann, J., 2022. Low-frequency noise pollution impairs burrowing activities of marine benthic invertebrates. *Environmental Pollution*, *310*, p.119899.

Wickens, P.A., 1995. A review of operational interactions between pinnipeds and fisheries. *FAO Fisheries Technical Paper No. 346, 86pp. Rome, FAO*.

Wood, A.L., Probert, P.K., Rowden, A.A. and Smith, A.M., 2012. Complex habitat generated by marine bryozoans: a review of its distribution, structure, diversity, threats and conservation. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *22*(4), pp.547-563.

Appendices

Appendix A: Specialist CV

CURRICULUM VITAE: RUSSELL CHALMERS

PERSONAL DETAILS

Year of Birth: 1977
Place of Birth: Port Elizabeth, South Africa
Nationality: South African
Languages: English & Afrikaans
Civil status: Single

CONTACT DETAILS

7 Schonland Avenue
Grahamstown, 6139, South Africa
Cell: +27(0)82 873 9018
email: Russell@AquaticES.co.za

QUALIFICATIONS

PhD Rhodes University, Ichthyology, 2011
MSc Rhodes University, Ichthyology & Fisheries Science, 2002
BSc (Hons) First Class Pass Rhodes University, Ichthyology & Fisheries Science, 2000
BSC Rhodes University, Majors Zoology and Microbiology, 1999

OTHER RELEVANT QUAILIFICATIONS AND ASSOCIATIONS

- *Honorary Research Associate*, South African Institute for Aquatic Biodiversity
- *Professional Natural Scientist*; Aquatic Science (Pr. Sci. Nat.) with the South African Council for Natural Scientific Professions (SACNASP). Registration Number 400129/13 – August 2013.

KEY AREAS OF EXPERTISE

- Fisheries biology and ecology
- Marine ecology
- Ichthyology
- Specialist impact assessment studies
- Fisheries and ecological monitoring

ADDITIONAL COURSES AND EXPERIENCE

- Aquatic Biomonitoring (2003)
- Environmental Impact Assessment (2003)
- Class IV commercial/scientific SCUBA diver (2006); NAUI Master Diver (1996)
- Class IV commercial/scientific SCUBA diver Supervisor (2011)
- Small boat (<9m) skipper, Category C with endorsements for diving operations and surf launching (2002)
- Restricted Radiotelephone Operators Certificate (2008)
- Level 3 First Aid

PROFESSIONAL EXPERIENCE

Jan 2013 – Present	Director Aquatic Ecosystem Services (Pty) ltd
Jan 2012 – Dec 2012	Freelance Environmental and Fisheries Consultant
Jan 2006 – Dec 2011	Fisheries Consultant, Enviro-Fish Africa (Pty) ltd, PhD Candidate, Rhodes University;
Aug 2002 – Dec 2005	Environmental Consultant, Coastal & Environmental Services (Intern, Junior, Senior consultant).
Jan 2001 – Aug 2002	Field researcher, Eastern Cape Estuaries Management Programme, South African Institute for Aquatic Biodiversity (SAIAB). Field researcher, Rural Fisheries Project, Department of Ichthyology and Fisheries Science, Rhodes University.

COUNTRIES OF WORK EXPERIENCE

Angola; Gabon, Cameroon, Ghana; Guinea Bissau; Kenya; Lesotho; Madagascar; Mozambique; Sierra Leone; South Africa; Tristan da Cunha; Zambia

SELECTED RESEARCH PUBLICATIONS AND REPORTS

Holness, S.D., Harris, L.R., Chalmers, R. de Vos, D. Goodall, V. Trutter, H. Oosthuizen, A., Bernard, A.T.F., Cowley, P.D., da Silva, C., Dicken, M., Edwards, L., Marchand, G., Martin, P., Murray, T.S., Parkinson, M.C., Pattrick, P., Pichegru, L., Pistorius, P., Sauer, W.H.H., Smale, M., Thiebault, A., Lombard, A.T. 2022. *Using systematic conservation planning to align priority areas for biodiversity and nature-based activities in marine spatial planning: A real-world application in contested marine space*. Biological Conservation, 271: 109574.

Ortega-Cisneros, K., Weigum, E., Chalmers, R., Grusd, S., Lombard, A.T., Shannon, L. 2022. *Supporting marine spatial planning with an ecosystem model of Algoa Bay, South Africa*. African Journal of Marine Science, 44(2): 189-204.

Madzivanzira, T.C., South, J., Ellender, B.R., Chalmers, R., Chisule, G., Coppinger, C.R. et al. 2021. *Distribution and establishment of the alien Australian redclaw crayfish, Cherax quadricarinatus, in the Zambezi Basin*. Aquatic Conservation: Marine and Freshwater Ecosystems, 1– 13.

Chalmers, R., Oosthuizen, A., Götz, A., Paterson, A. & Sauer, W.H.H. 2014. *Assessing the suitability of commercial fisheries data for local scale marine spatial planning in South Africa*. African Journal of Marine Science 36(4):467-480.

Solano-Fernandez,S., Attwood,C.G., Chalmers,R., Clark,B.M., Cowley,P.D., Fairweather,T., Fennessy, S.T., Gotz,A., Harrison,T.D., Kerwath, S.E., Lamberth,J., Mann, B.Q., Smale,M.J. & Swart, L. 2012. *Assessment of the effectiveness of South Africa's marine protected areas at representing ichthyofaunal communities.* Environmental Conservation 39: 259-270.

Chalmers, R. 2012. *Systematic marine spatial planning and monitoring in a data poor environment: A case study of Algoa Bay, South Africa.* PhD Thesis, Department of Ichthyology and Fisheries Science, Rhodes University, South Africa.

P.D. Cowley, A.D. Wood, B. Corroyer, Y. Nsubuga & R. Chalmers. 2004. *A survey of fishery resource utilization on four Eastern Cape estuaries (Great Fish, West Kleinemonde, East Kleinemonde and Kowie).* Protocols Contributing to the Management of Estuaries in South Africa, with a Particular Emphasis on the Eastern Cape Province; Volume III, Project C, Supplementary Report C5.

RELEVANT PROJECTS

Fish and Fisheries Assessments

Rennie, C., Chalmers, R. 2023. *Fish and Fisheries Monitoring of 10 Dams in the Eastern Province, Zambia, Fish for Food Project*. GIZ Zambia.

Richardson, N.K., Chalmers, R., Rennie, C. 2023. *Bas Ogooué Baseline Livelihoods Household Survey*. The Nature Conservancy, Gabon.

Chalmers, R., Ellender, B.R.E., Richardson, N.K. 2022. *Okavango Upper Catchment, Cuito and Cubango Rivers, Baseline Fish and Fisheries Assessment.* The Nature Conservancy, Angola.

Chalmers, R., Richardson, N. 2022. *Baseline assessment of ichthyofauna of the Nsumbu National Park and adjacent areas, Zambia.* Nsumbu-Tanganyika Conservation Programme, Frankfurt Zoological Society.

Chalmers, R. and Richardson, N. 2021. *Fisheries Baseline Catch Assessment Survey, Kabompo and Barotse Landscapes: Resource Use and Management Options*. WWF Zambia.

Richardson, N., and Chalmers, R. 2022. *Kabompo and Barotse Landscapes Fishery Household Survey Report*. WWF Zambia.

Rice, J., Richardson, N., Chalmers, R., Ellender, B., Parker, D., and Sharma, R. 2022. *The effects of flow regime changes on the fisheries of the Itezhi Tezhi and Kafue Flats, Kafue River Zambia*. FAO.

Chalmers, R. and Richardson, N. 2021. *Rapid Assessment of the Fish and Fisheries of 10 Dams in the Eastern Province, Zambia*. GIZ Fish for Food Project

Chalmers, R. 2019. *WWF Upper Zambezi Programme - Electronic Catch Assessment Survey and database reporting system development and training*. WWF-Zambia.

Chalmers, R and Richardson, N. 2020. *Baseline Assessment of Fish and Fisheries of Lake Oguemoué, Gabon*. The Nature Conservancy, Gabon.

Bok, A, Chalmers, R, and Richardson, N. 2019. *Assessment of alternative designs and locations of the proposed fishway on the Kikagati-Murongo hydropower plant on the Kagera River, Uganda*. Kikagati Power Company.

Richardson, NK & Chalmers, R. 2019. *Situational review of fish and fisheries of lake Oguemoué, Gabon*. The Nature Conservancy, Gabon.

Chalmers R, Richardson N, Weyl O. 2018. *Baseline fish and fisheries assessment for the Kabompo Hydro Electric Project. Interannual baseline surveys*. Copperbelt Energy Corporation Kabompo Hydro Power Limited.

Chalmers, R., Nguku, J., Tweddle, D., and Richardson, N. 2018. *Ichthyofaunal Survey of the Arror River, Elgeyo Marakwet County, Rift Valley, Kenya*. Arror Dam Project. CMC di Ravenna Itinera Joint Venture, Kenya Branch.

Chalmers, R., Nguku, J., Tweddle, D., and Richardson, N. 2018. *Ichthyofaunal Survey of the Kimwarer River, Elgeyo Marakwet County, Rift Valley, Kenya*. Kimwarer Multipurpose Dam Project. CMC di Ravenna Itinera Joint Venture, Kenya Branch.

Chalmers, R., Nguku, J., and Richardson, N. 2018. *Preliminary assessment of the distribution, relative density and habitat preference of Chiloglanis kerioensis in the upper Kerio catchment, Kenya.* CMC di Ravenna Itinera Joint Venture, Kenya Branch.

Richardson N, Ellender B, Coppinger C, Huggins G, Tweedle D, Weyl O, Chalmers R. 2018. *Situational Analysis of the Fish and Fisheries of the Kafue Flats.* WWF Zambia and the Zambian Department of Fisheries, Zambia.

Chalmers R, Richardson N, Weyl O, Tweddle D. 2017. *Baseline fish and fisheries assessment for the Kabompo Hydro Electric Project. Interannual baseline surveys*. Copperbelt Energy Corporation Kabompo Hydro Power Limited

Richardson N, Ellender B, Coppinger C, Huggins G, Tweedle D, Weyl O, Chalmers R. 2017. *Survey design and literature review for the Situation Assessment of the Kafue Flats Fish and Fisheries.* Prepared on behalf of WWF Zambia and the Zambian Department of Fisheries.

Chalmers, R. 2015. *Fish, fisheries and infaunal assessment, Farim Phosphate Project, Guinea-Bissau*.

Holness S, Kirkman S, Samaai T, Wolf T, Sink K, Majiedt P, Nsiangango S, Kainge P, Kilongo K, Kathena J, Harris L, Lagabrielle E, Kirchner C, Chalmers R, Lombard M. 2014. *Spatial Biodiversity Assessment and Spatial Management, including Marine Protected Areas.* Benguela Current Commission.

Chalmers, R. 2014*. Fish and fisheries specialist study, Quantum LNG pipeline, Tema, Ghana*.

Richardson, N. & Chalmers, R. 2014. *Aquatic assessment field repor. Mine Site Creeks and Port Loko Creek.* London Mining Corporation.

Wood, A. & Chalmers, R. 2012. *Eastern Cape abalone resource survey, Area 4 - Wild Coast.* Department of Agriculture, Forestry and Fisheries.

Chalmers, R & Hardy, M. 2012. *Fish and fisheries assessment for the Toliara Sands Heavy Mineral Mining Project.* Toliara Sands, Madagascar.

Chalmers, R., Fielding, P. & Godfrey, B. 2012. *Juvenile rock lobster (Jasus tristanii) survey at Tristan da Cunha, Nightingale and Inaccessible Islands. Survey and monitoring report.* Administration of Tristan da Cunha.

Shipton,T. & Chalmers, R. 2012. *Monitoring, control and surveillance training manual for managers, Western Indian Ocean.* SmartFish.

Chalmers, R. 2012. *Detailed description of species distributions in the Benguela Current Large Marine Ecosystem, and development of GIS layers – Argyrosomus inodorus, Thyrsites atun, Engraulis encrasicolus, Trachurus, trachurus capensis, Sardinops sagax, Jasus lalandi and Chaceon maritae.* Benguela Current Commission.

Chalmers, R. & Watt-Pringle, P. 2010*. Algoa Bay coastal subsistence fisheries.* South African National Parks.

Chalmers, R. 2010. *Algoa Bay recreational shore and skiboat fisheries.* South African National Parks.

Chalmers, R. 2010. *Algoa Bay commercial Fishery Report 1: Small pelagic purse seine fishery.* South African National Parks.

Chalmers, R. 2010. *Algoa Bay commercial Fishery Report 2: Traditional linefishey.* South African National Parks.

Chalmers, R. 2010. *Algoa Bay commercial Fishery Report 3: Squid jig fishery.* South African National Parks.

Chalmers, R. 2010. *Algoa Bay commercial Fishery Report 4: Inshore demersal trawl fishery*. South African National Parks.

Chalmers, R. 2010. *Algoa Bay commercial Fishery Report 5: Demersal shark longline fishery.* South African National Parks.

Chalmers, R. 2010. *Algoa Bay commercial Fishery Report 6: South coast rock lobster fishery*. South African National Parks.

Chalmers, R. and Wood, A. D. 2007. *Marine (Reef, Fish and Fisheries) Assessment.* Specialist Report Toliara Mineral Sands Project, Madagascar. Exxaro.

Chalmers, R & Richardson, N. 2005. *Specialist fisheries investigation for the proposed Dynatec marine outfall pipe at Tamatave, Madagascar.*

Chalmers, R. 2005. *Luanda Bay prefeasibility assessment for the waterfront redevelopment, Artisanal Fisheries Specialist Investigation.* Luanda Bay Development Company.

Marine, Estuarine & Coastal Management Reports

Holness, S., Harris, L., Chalmers, R., De Vos, D., Goodall, V., Truter, H., Lombard, A.T., Vermeulen, E., Oosthuizen, A., Dorrington, R.A., Pichegru, L., and Pattrick, P. 2019. *Algoa Bay Systematic Conservation Plan*.

ECBCP.2018. *Eastern Cape Biodiversity Conservation Plan Handbook, estuarine and freshwater ichthyofaunal contributions*.

Oosthuizen A., Holness S. & Chalmers R. 2011. *Draft Addo MPA management plan*. Park Planning & Development, South African National Parks.

Holness S., Chalmers R, & Oosthuizen A. 2011. *Addo MPA Systematic Conservation Plan.* Park Planning & Development, South African National Parks.

Chalmers, R. 2011. *An assessment of the macrobenthic invertebrate communities in the Bird Island MPA.* Greater Addo MPA Project. South African National Parks.

Chalmers, R. & Watt-Pringle, P. 2010. *Baseline survey of abalone resources in the Bird Island MPA with recommendations for monitoring*. Greater Addo MPA project. South African National Parks.

Chalmers, R., Bennett, R.H., Turpie, J.K., Andrew, M., Andrew, T., Clarke, B.M., Hutchings, K. & de Wet, J. 2009. *Ecology, value and management of the Garden Route Coast.* WWF-SA & C.A.P.E. Marine Programme.

Chalmers, R. 2004. *Eastern Cape State of Environment Report – Coastal Chapter.* Department of Economic Affairs, Environment and Tourism.

Chalmers, R. & Carter, A. 2003. *Amatole District Municipality State of Environment Report – Coastal Chapter.* Amatole District Municipality.

Environmental Monitoring Reports

Chalmers, R. 2017. *DST KZN Aquaculture Development Project, Richards Bay Cage Culture Environmental Monitoring Report: Peak Production Survey.*

Chalmers, R. 2016. *Diamond Coast Abalone Environmental Monitoring Report: Monitoring Survey 3.*

Chalmers, R. 2015. *DST KZN Aquaculture Development Project, Richards Bay Cage Culture Environmental Monitoring Report: Baseline Survey.*

Chalmers, R. 2014. *Habitat assessment of Diamond Coast Abalone Ranching Sites, Hondeklipbaai, South Africa.* Diamond Coast Abalone, South Africa.

Chalmers, R. 2006. *Evaluation and recommendations for bio-physical monitoring programmes.* Chapter 13 De Beers Marine Environmental Review.

Chalmers, R. & Scherman, P.A. 2005. *Kenmare PLC Heavy Mineral Mining Project, Mozambique, Environmental Monitoring Programme Report.* Kenmare, Mozambique.

EIA Specialist Reports

Wood, A.D., Chalmers, R., Richardson, N.K. 2022. Estuarine Impact Assessment for the Port Alfred Desalination and Reclamation Reverse Osmosis Works. CEN IEM Unit, South Africa.

Chalmers, R and Parker-Nance, S. 2021. *Marine Benthic Shallow Water Impact Assessment, T3 Telecommunications Cable Amanzimtoti Landing, KwaZulu-Natal.* ACER Africa, South Africa.

Chalmers, R and Parker-Nance, S. 2021. *Marine Benthic Shallow Water Impact Assessment, Alcatel Submarine Networks Telecommunications Cable, 2AFRICA/GERA (East) Gqeberha (Port Elizabeth)*. ACER Africa, South Africa.

Chalmers, R and Parker-Nance, S. 2021. *Marine Benthic Shallow Water Impact Assessment, Alcatel Submarine Networks Telecommunications Cable, 2AFRICA/GERA (East) Amanzimtoti*. ACER Africa, South Africa.

Chalmers, R. 2019. *Marine Impact Assessment for the proposed Pearly Beach Abalone Farm*. Lornay Environmental Consulting, South Africa

Chalmers, R., Richardson, N.K. 2017. *Ichthyofaunal Impact Assessment, Lukupa River*. OLAM Northern Coffee Corporation Limited, Kasama, Zambia.

Chalmers, R & Wood, AD. 2017. *Marine and Estuarine Specialist Assessment, Kenmare Moma Pillivilli expansion project.* Kenmare Resources, Mozambique.

Chalmers, R. 2017. *Marine Specialist Assessment for the Coega Land-based Aquaculture Development Zone*. Coega Development Corporation, South Africa.

Paulet TG, Richardson N, Chalmers R. 2016. *Biosecurity and Biodiversity Risk Assessment for the Coega Development Corporation Land-Based Aquaculture Development Zone, Eastern Cape, South Africa*. Coega Development Corporation, South Africa.

Chalmers, R. & Shipton, T. 2008. *Irvin & Johnson's proposed aquaculture project, Mossel Bay. Marine Benthic Assessment.* Prepared for CCA Environmental (Pty) Ltd. on behalf of Irvin & Johnson Ltd.

Chalmers, R., Andrew, M.A., Jones, R. & Paterson, A.M. 2005. *Final Scoping Report for the proposed restoration and improvement of the Trunk Road 2 Section 10 between White Bridge and Knysna.*

Lubke, R.A., Chalmers, R., Avis, A.M., Carter, A. & Bosman, L. 2004. *Volume 1: General overview of the Coffee Bay and Hole-in-the-Wall region.* Development Bank of South Africa and the Eastern Cape Development Corporation.

Lubke, R.A., Chalmers, R., Avis, A.M., Carter, A. & Bosman, L. 2004. *Volume 3: Ecological economic and social viability analysis of proposed Coffee Bay and Hole-in-the-Wall projects.* Prepared for the Development Bank of South Africa and the Eastern Cape Development Corporation.

Paterson, A.W. & Chalmers, R. 2003. *Luanda Marginal and Marina Development Pre-feasibility study.* Luanda Bay Development Company.

CONFERENCE PRESENTATIONS

Oosthuizen, A., Chalmers, R. & Holness, S. *A systematic conservation plan for the proposed Addo ENP MPA.* Presented at the South African Marine Science Symposium (SAMSS) 2011: Estuarine, coastal and oceanic ecosystems: Breaking down the boundaries, 4-7 April 2011, Grahamstown, South Africa.

Oosthuizen, A., Holness, S. & Chalmers, R. 2011. Marine conservation planning versus MPA implementation. Presented at the Western Indian Ocean Marine Science Association (WIOMSA) Symposium, 24-29 October 2011, Mombasa, Kenya.

Chalmers, R., Götz, A. & Sauer, W.H.H. 2009. *Strategic assessment of resources and resource use for the proposed Greater Addo MPA, Eastern Cape, South Africa*. Poster presentation at the Western Indian Ocean Marine Science Association (WIOMSA) Symposium, 24-29 August 2009, Saint Denis, Reunion.

Chalmers, R., Götz, A., Sauer, W.H.H. & Holness, S. 2009. *Coastal bays, MPAs and fisheries – trying to balance conservation and socio-economic objectives.* Presented at the Western Indian Ocean Marine Science Association (WIOMSA) Symposium, 24-29 August 2009, Saint Denis, Reunion.

Chalmers, R., Götz, A. & Sauer, W.H.H. 2008. *Development of a spatially based conservation and management plan for the Addo Elephant National Park Marine Protected Area.* Presented at the Southern African Wildlife Management Association Symposium. Biodiversity Conservation: The Science Management Interface, 16-19 September, Mpekweni South Africa 2008.

Chalmers, R., Götz, A. & Sauer, W.H.H. 2008. *Strategic planning for the Greater Addo MPA – Understanding the key issues.* Presented at the South African Marine Science Symposium (SAMSS) 2008: Our changing seas, 29 June – 3 July, Cape Town South Africa.

Götz, A., Chalmers, R., Bennett, R., Kerwath, S.E. & Cowley, P.D. 2008. *Marine protected areas as a tool for long-term monitoring of marine biota: Separating climate from anthropogenetic influence.* Presented at the ICES International Symposium: Effects of Climate Change on the World Oceans, 19-23 May, Gijon, Spain.

Götz, A., R. Chalmers, R. Bennett, S.E. Kerwath & P.D. Cowley. 2007. *Marine protected areas (MPAs) as a tool for long term ecological research and monitoring.* Presented at the 1st SAEON Student Symposium, 11-13 September 2007, Cape Town, South Africa.

Chalmers, R. & Götz, A. 2007. *Development of a long-term monitoring protocol for marine biota in the proposed Greater Addo Marine Protected Area (MPA).* Presented at the 1st SAEON Student Symposium, 11-13 September 2007, Cape Town, South Africa.

Chalmers, R., Götz, A. & Sauer, W.H.H. 2007. *Assessment of the ichthyofaunal and macro-benthic community structure in the proposed Greater Addo Marine Protected Area (MPA): Experimental design and preliminary results.* Presented at the Western Indian Ocean Marine Science Association (WIOMSA) Symposium, 27-31 October 2007, Durban, South Africa.

Vorwerk, P.D., Chalmers, R., Avis, T.A., Scott, L.E.P., Andrew, T.G. & Ngwadla, X. 2003. *Optimising the benefits of the Eastern Cape Coastal Zone through the implementation of the White Paper on Coastal*

Zone Management. Poster presentation at the International Association for Impact Assessment (IAIA) Conference, Wilderness.

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Dr Russell Chalmers Date: 1 March 2023

CURRICULUM VITAE: NAOMI RICHARDSON

PERSONAL DETAILS

First name: Naomi
Surname: Richardson
Nationality: British
Civil status: Single
Year of Birth: 1981
Languages: English, French, Spanish

CONTACT DETAILS

7 Schonland Avenue
Grahamstown, 6139
South Africa
Tel: +27(0)46 622 2687
Cell: +27(0)723286623
email: Naomi@AquaticES.co.za

QUALIFICATIONS

MSc Rhodes University South Africa, Ichthyology & Fisheries Science, 2007
BSc (Hons) Rhodes University South Africa, Ichthyology & Fisheries Science, 2004
BSc University of Southampton United Kingdom, Oceanography with Marine Biology, 2003
European Baccalaureate, European School of Brussels 1, Belgium, 1999

OTHER RELEVANT QUALIFICATIONS AND ASSOCIATIONS

Professional Natural Scientist; Ecological Science (Pr. Sci. Nat.) with the South African Council for Natural Scientific Professions (SACNASP). Registration Number 400093/14.

ADDITIONAL COURSES AND EXPERIENCE

Statistical Modelling Course using R, University of Witwatersrand (2015)
Marine Stewardship Council Fisheries Overview and Chain of Custody training, Cape Town (2013)
Environmental Impact Assessment Course – Run by Coastal & Environmental Services (2008)
Diplôme Approfondis de la Langue Française, International French Competency Certificate (2007)

ASSOCIATIONS

The South African Network for Coastal and Oceanic Research (SANCOR)
Southern African Society of Aquatic Scientists (SASAqS)

COMPUTER EXPERIENCE AND SKILLS

MS Office – Word, Excel, Power Point, Access
Statistical packages – Statistica, PRIMER E

PROFESSIONAL EXPERIENCE

Nov 2012 – Present	Director Aquatic Ecosystem Services (Pty) ltd
May 2012 – Nov 2012	Freelance Environmental Consultant
Mar 2010 – Apr 2012	Senior Environmental Consultant, Coastal & Environmental Services
Apr 2008 – Feb 2010	Environmental Consultant, Coastal & Environmental Services

COUNTRIES OF WORK EXPERIENCE

Gabon, Kenya, Lesotho, Madagascar, Mauritania, Mozambique, Sierra Leone, South Africa, Tanzania, Zambia.

SELECTED RESEARCH PUBLICATIONS AND CONSULTING REPORTS

Fish and Fisheries Reports

Richardson N, Chalmers R & Rennie C. 2023. *Bas Ogooué Baseline Livelihoods Household Survey*. Prepared on behalf of The Nature Conservancy Gabon. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Richardson N, Gibbons E, McIntyre P, Golcher Benivalez J, Rennie C, Huggins G, Mgana H, 2022. *Lake Tanganyika Aquaculture, Tanlake Samaki Environmental and Social Monitoring Programme Initial Site Visit Report*. Prepared on behalf of The Nature Conservancy Tanzania. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown

Chalmers R, Richardson N. 2022. *Fisheries Baseline Survey for the Kabompo and Barotse Landscapes: Resource Use and Management Options.* Prepared on behalf of WWF Zambia. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Richardson N, Chalmers, R. 2022. *Towards a livelihoods baseline for rural communities in the Upper Zambezi Landscape: Implications for conservation and sustainable provision of natural resources*. Prepared on behalf of WWF Zambia. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Richardson N & Rennie C. 2022. Okavango Upper Catchment Programme. Cuito and Cubango Rivers Baseline Fish and Fisheries Assessment Literature Review. Prepared on behalf of The Nature Conservancy Botswana. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown

Rice J, Richardson N, Chalmers R, Ellender B, Parker D, Sharma R. 2022, *The effects of flow regime changes on the fisheries of the ItezhiTezhi and Kafue Flats, Kafue River, Zambia.* Prepared on behalf of the United Nations Food and Agriculture Organisation (FAO).

Chalmers R, Richardson N. 2021. *Review of the Fisheries Management Plan for the Lake Oguemoué Experimental Fishery*. Prepared on behalf of The Nature Conservancy Gabon. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Brown, C, Joubert, A, Birkhead D, Koehnhen L, Howard G, Reinecke, K, Cowx I, Richardson N, Scherman P. 2021. *Comprehensive Eflows Assessment of the Lower Kafue Sub-Catchment, Zambia*. Final Report Volume 2: Specialists' Report. Prepared on behalf of GIZ Zambia.

Chalmers R, Richardson N. 2021. *Situational Assessment of the Lake Oguemoué Experimental Fishery*. Prepared on behalf of The Nature Conservancy Gabon. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Chalmers R, Richardson N. 2020. *Situational Assessment of the Lake Oguemoué Experimental Fishery*. Prepared on behalf of The Nature Conservancy Gabon. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Chalmers R, Richardson N, Ellender B, Chomba M & Weyl O. 2019. *Development of a baseline fish and fisheries electronic monitoring programme for the Barotse Floodplain and Lower Kabompo River*. Prepared on behalf of WWF Zambia. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Chalmers R, Richardson N. 2019. *Baseline fish and fisheries assessment for the Kabompo Hydro Electric Project. Baseline Indicators and on going monitoring requirements*. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Chalmers R, Richardson N. 2019. *Lake Oguemoué Experimental Fishery Assessment Report*. Prepared on behalf of The Nature Conservancy Gabon. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Richardson N, Chalmers R. 2019. *Lake Oguemoué Fish and Fisheries Scoping Report*. Prepared on behalf of The Nature Conservancy Gabon. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Chalmers R, Richardson N, Weyl O. 2018. *Baseline fish and fisheries assessment for the Kabompo Hydro Electric Project. Interannual baseline surveys*. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Richardson N, Ellender B, Coppinger C, Huggins G, Tweedle D, Weyl O, Chalmers R. 2018. *Situational Analysis of the Fish and Fisheries of the Kafue Flats.* Prepared on behalf of WWF Zambia and the Zambian Department of Fisheries, Zambia. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Chalmers R, Richardson N, Weyl O, Tweddle D. 2017. *Baseline fish and fisheries assessment for the Kabompo Hydro Electric Project. Interannual baseline surveys*. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Richardson N, Ellender B, Coppinger C, Huggins G, Tweedle D, Weyl O, Chalmers R. 2017. *Survey design and literature review for the Situational Analysis of the Kafue Flats Fish and Fisheries.* Prepared on behalf of WWF Zambia and the Zambian Department of Fisheries. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Chalmers R, Richardson N, Weyl O, Tweddle D. 2016. *Baseline fish and fisheries assessment for the Kabompo Hydro Electric Project. Interannual baseline surveys*. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Chalmers R, Richardson N, Weyl O, Tweddle D. 2015. *Baseline fish and fisheries assessment for the Kabompo Hydro Electric Project. Pre- and post-wet season baseline surveys*. Aquatic Ecosystem Services Pty (ltd), 4 Parry Street, Grahamstown.

Chalmers R, Richardson N, Weyl O, Tweddle D. 2014. *Baseline fish and fisheries assessment for the Kabompo Hydro Electric Project. Wet season baseline.* Aquatic Ecosystem Services Pty (ltd), 4 Parry Street, Grahamstown.

Woodford D, Weyl OLF, Richardson N (eds). 2013. Monitoring the impact and recovery of the biota of the Rondegat River after the removal of alien fishes: Summary report. Report prepared for the Water Research Commission of South Africa.

Chalmers R, Richardson N. 2012. *Report on the water quality and fish composition at Mohale Dam, Lesotho Highlands*. Institute for Water Research, Rhodes University, Grahamstown, 6139.

Richardson N, Gordon AK, Muller WJ, Whitfield AK. 2011. *A weight-of-evidence approach to determine estuarine fish health using indicators from multiple levels of biological organization.* Aquatic Conservation: Marine and Freshwater Ecosystems. 21 423-432.

Richardson N, Gordon AK, Muller WJ, Pletschke BI, Whitfield AK. 2010. *The use of liver histopathology, lipid peroxidation and acetylcholinesterase assays as biomarkers of contaminant-induced stress in the Cape stumpnose, Rhabdosargus holubi, (Teleostei: Sparidae), from selected South African estuaries.* WaterSA. 46(4) 407-415.

Richardson N. 2010. *Estuarine Specialist Study for the Laguna Bay Resort and Visitor's Centre,* Jeffrey's Bay, South Africa. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N, Whitfield AK, Paterson AW. 2006. *The influence of selected environmental parameters on the distribution of the dominant demersal fishes in the Kariega Estuary Channel, South Africa*. African Zoology. 41(1) 89-102.

Chalmers, R, Richardson, N. 2005. *Specialist fisheries investigation for the proposed Dynatec marine outfall pipe at Tamatave, Madagascar.* Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Environmental Monitoring and Management Reports

Richardson N, Rodewald D, Everett M, Jones G. (2020). *Base Toliara Environmental Management System.* Prepared for the Base Toliara Mineral Sands Project, Madagascar.

Richardson N, Rodewald D, Everett M, Jones G. (2020). *Base Toliara Environmental and Social Management System.* Prepared for the Base Toliara Mineral Sands Project, Madagascar.

Richardson N, Jones G. 2019. *Base Toliara Construction Camp Environmental and Social Management Plan.* Prepared for the Base Toliara Mineral Sands Project, Madagascar.

Chalmers R, Richardson N. 2019. *Base Toliara Mineral Sands Environmental and Social Impacts Monitoring and Management System.* Prepared for the for the Base Toliara Mineral Sands Project, Madagascar.

Richardson N, Lane M, Jones G. 2017. *Base Titanium Annual Environmental Monitoring Report* for the Kwale Mineral Sands Project, Kenya.

Richardson N. 2017. *Standard Operating Procedure for the Tailings Storage Facility Rehabilitation Programme Implementation and Monitorin*g for the Kwale Mineral Sands Project, Kenya.

Richardson N, Lane M, Jones G. 2016. *Base Titanium Annual Environmental Monitoring Report* for the Kwale Mineral Sands Project, Kenya.

Richardson N, Lane M, Jones G. 2015. *Base Titanium Annual Environmental Monitoring Report* for the Kwale Mineral Sands Project, Kenya.

Richardson N, Lane M, Jones G. 2014. *Base Titanium Annual Environmental Monitoring Report* for the Kwale Mineral Sands Project, Kenya.

Richardson N, Jones G. 2014. Preliminary Closure Plan for Base Titanium Kwale Mineral Sands Project, Kenya.

Richardson N, Lane M, Jones G. 2013. *Base Titanium Annual Environmental Monitoring Report* for the Kwale Mineral Sands Project, Kenya.

Richardson N, Hawley G. 2011. *Environmental Monitoring Programme for the Addax Bioenergy Sugarcane to Ethanol Project,* Makeni, Sierra Leone. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N, Avis T, Davenport N. 2011. *Trident Copper, Nickel Environmental Management Plan.* FQM Minerals, Zambia. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N, Avis T, Davenport N. 2011. *Trident Copper, Nickel Environmental Monitoring Plan*. FQM Minerals, Zambia. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N, Wood A. 2010. *Mtentu Estuary Situation Assessment and Estuary Management Plan*, Eastern Cape Parks and Tourism Agency, Mkambathi Nature Reserve. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N, Wood A. 2010. *Msikaba Estuary Situation Assessment and Estuary Management Plan*, Eastern Cape Parks and Tourism Agency, Mkambathi Nature Reserve. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N and Rowlston W. 2009. *Close Out Audit for the Construction Phase of the Kenmare Moma Mineral Sands Project*, Nampula Province, Mozambique. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N and Rowlston W. 2009. *Initial Operations Audit for the Kenmare Moma Mineral Sands Project,* Nampula Province, Mozambique. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N and Whittington-Jones K. 2009. *Environmental Audit for the SAB Miller Nampula Brewery Facility,* Nampula, Mozambique. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Impact and Risk Assessments

Richardson N, Rodewald D, Everett M, Da Sousa A, Jones G. (2020). *Base Toliara Environmental and Social Risk and Impact Assessment.* Prepared for the Base Toliara Mineral Sands Project, Madagascar.

Bok A, Richardson N, Chalmers R. 2019. Assessment of alternative designs for the fish bypass system for the Kikagati Hydropower Plant, Uganda. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Chalmers, R., Nguku, J., Tweddle, D., and Richardson, N. 2018. *Ichthyofaunal Survey of the Arror River, Elgeyo Marakwet County, Rift Valley, Kenya*. Arror Dam Project. Prepared for CMC di Ravenna Itinera Joint Venture, Kenya Branch. Prepared by Aquatic Ecosystem Services, P.O. Box 7065, Grahamstown, 6148, South Africa.

Chalmers, R., Nguku, J., Tweddle, D., and Richardson, N. 2018. *Ichthyofaunal Survey of the Kimwarer River, Elgeyo Marakwet County, Rift Valley, Kenya*. Kimwarer Multipurpose Dam Project. Prepared for CMC di Ravenna Itinera Joint Venture, Kenya Branch. Prepared by Aquatic Ecosystem Services, P.O. Box 7065, Grahamstown, 6148, South Africa.

Chalmers, R., Nguku, J., and Richardson, N. 2018. *Preliminary assessment of the distribution, relative density and habitat preference of Chiloglanis kerioensis in the upper Kerio catchment, Kenya.* Prepared for CMC di Ravenna Itinera Joint Venture, Kenya Branch. Prepared by Aquatic Ecosystem Services, P.O. Box 7065, Grahamstown, 6148, South Africa.

Paulet TG, Richardson N, Chalmers R. 2016. Biosecurity and Biodiversity Risk Assessment for the Coega Development Corporation Land-Based Aquaculture Development Zone, Eastern Cape, South Africa. Aquatic Ecosystem Services Pty (ltd), 7 Schonland Avenue Grahamstown.

Richardson N, Chalmers R. 2015. *Ichthyofaunal biodiversity baseline and impact assessment,* Ancuabe Graphite Mine, Cabo del Gado Province, Mozambique. Aquatic Ecosystem Services Pty (ltd), 4 Parry Street, Grahamstown.

Richardson N, Chalmers R. 2014. *Aquatic assessment field report, London Mining Corporation. Mine Site Creeks and Port Loko Creek.* Aquatic Ecosystem Services Pty (ltd), 4 Parry Street, Grahamstown.

Richardson N, Avis T. 2012. *Scoping study for the Nataka Mineral Sands project,* Kenmare Moma Mine, Mozambique. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N, Avis T, Jackson A, Hardy M. 2012. *Niassa Green Resources Pine and Eucalyptus Plantation Environmental and Social Impact Assessment*. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N, Avis T, Bezuidenhout C. 2012. *Environmental and Social Impact Assessment for the World Titanium Resources Mineral Sands Mine, Toliara, Madagascar*. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N and Rowlston W. 2011. *Surface water assessment of the Matola River* GS Cimentos Project, Maputo, Mozambique. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

Richardson N, Avis T, Hawley G, Jones G. 2011. *Environmental, Social and Health Impact Assessment for the Addax Bioenergy Sugarcane to Ethanol Project*, Makeni, Sierra Leone. Coastal & Environmental Services, 67 African Street, Grahamstown, 6139.

.

Alexander Claus Winkler

Personal Details

Date of Birth: 03-08-1988
Gender: Male
ID: 8808035080082
Nationality: South African / German
Languages: English (fluent), Afrikaans (conversational), Portuguese (conversational)
Cell Phone: (+27) 76717 9223
Email: alexwinkrsa@gmail.com
@alexwinkrsa

Education

BSc (PhD), Fisheries Science, 2018. Degree by thesis: Using a multi-method approach to understand the movement patterns and the associated environmental correlates of an iconic West African recreational fish **(Graduated) (Rhodes University)** available at:
http://vital.seals.ac.za:8080/vital/access/manager/Repository/vital:30597?site_name=GlobalView&query=winkler&sort=ss_dateNormalized+desc%2Csort_ss_title+asc&queryType=vitalDismax

BSc (Masters), Fisheries Science**,** 2014. Degree by thesis: Aspects of the biology of an inshore Sparid fish *Diplodus cervinus* (Lowe 1841) off the southern coast of Angola. **(Graduated with distinction) (Rhodes University)** available at:
http://vital.seals.ac.za:8080/vital/access/manager/Repository/vital:5361?site_name=GlobalView&exact=sm_creator%3A%22Winkler%2C+Alexander+Claus%22&sort=sort_ss_title%2F

BSc (Honours), Ichthyology and fisheries science, 2010. Degree by coursework and thesis: The effect of a dietary kelp additive and protein level on abalone *Haliotis midae* (Linnaeus) growth and canning yield. **(Graduated with distinction) (Rhodes University)**.

BSc, majoring in Ichthyology and Fisheries Science and Botany, 2009. **(Graduated with distinction in Ichthyology and Fisheries Science) (Rhodes University)**.

Achievements and Awards

African Coelacanth Ecosystem Project (ACEP) Postdoctoral Fellow Award – 2019
NRF Knowledge, Interchange and Collaboration (KIC) Travel Award – 2017
4th International Conference on Fish Telemetry Student Travel Award – 2017
Rhodes University Vice Chancellors Award for Community Engagement – 2017
Margaret Smith bursary – 2016
NRF – DAAD in country PhD Scholarship 2013 to 2015
NRF – DAAD in country MSc Scholarship 2011 and 2012
Rhodes University Fishing Club President – 2011
Rhodes University Full Academic Colours – 2010
Rhodes University Dean's List for Academic Merit – 2010
Rhodes University Fishing Club Chairman – 2010

Other Qualifications and Courses (all certificates or licences available on request)

Class IV Commercial Scuba Diving Supervisor – obtained at the RDU at the University of Cape Town 2018
Class IV Commercial Scuba Diver – obtained at the RDU at the University of Cape Town 2013
Category C Commercial Skippers Licence (vessel < 9m, 40 NM off-shore restriction) – issued by the South African Maritime Safety Association (SAMSA)

Veterinary proficiency certificate to implant transmitters and take blood samples from fish
Pre-Sea Safety Course - SAMSA
Code 08 Drivers Licence (light motor vehicle)
Level 3 First Aid – NOSA Port Elizabeth (2019)
Rescue Level Scuba Diver - PADI

Professional Positions

Centro de Ciences do Mar (CCMAR) Junior Researcher (2020-2022) – Junior researcher working on the multidisciplinary BECORV project which aims to understand the movement biology of the meagre (*Argyrosomus regius*) in southern Portugal using acoustic and satellite telemetry as well as population genetics. Contact: David Abecasis – dabecassis@ualg.pt

GCRF One Ocean Hub Co-investigator (Current) – Co-investigator working on the sustainable fisheries component of a large multinational project lead by Strathclyde University aiming to transform our response to the urgent challenges facing our ocean in developing nations: Contact – oneocean-hub@strath.ac.uk

IUCN Snapper Seabream and Grunt species survival group member (invited-Current) – A member of the conservation assessment group due to my specialist knowledge on sparid fish taxonomy and conservation biology. Contact: Barry Russell - Barry.Russell@magnt.net.au

Rhodes University Honorary Research Associate (Current) – Honorary research associate through the department of Ichthyology and Fisheries Science at Rhodes University. Contact: Clifford Jones – c.jones@ru.ac.za

African Coelacanth Ecosystem Project (ACEP) Postdoctoral Fellow (01/01/2019 – 30/12/2019)– Independent postdoctoral researcher based at Rhodes University working on a variety of projects relating to the understanding of how climate change and exploitation effect fish physiology and activity patterns with projects based in South Africa, Namibia and Angola. Contact person: Warren Potts – w.potts@ru.ac.za

---

Work Related Experience

Ocean Tracking Network (OTN) Data and Equipment Management (2013 - 2019) – Responsible for the management of all acoustic telemetry data and equipment collected and used on two OTN projects in southern Angola and South Africa – a.childs@ru.ac.za

Rhodes University Recreational Fisheries Research Group Associated Scientist (2013 – current) – Participated as an associated research scientist in the formulation and collection of recreational fisheries data during various shore and boat-based fishing tournaments. – w.potts@ru.ac.za

Conference and Workshop Coordinator (2015 & 2019) – Coordinated the running and planning of an otolith preparation and ageing workshop as well as the 5th SAMLS Symposium (see www.samls5.com) in 2015 and 2019 respectively. Contact person: Warren Potts – w.potts@ru.ac.za

Commercial Diving Supervisor and Diver (Class IV) (2013 – 2019) – Contractual work for the South African Institute of Aquatic Biodiversity (SAIAB), South African Environmental Observation Node (SAEON) and Aquatic Ecosystem Services (AES) either servicing off-shore moorings or conducting benthic habitat assessments, > 100 diving hours logged, supervisors completed in 2018. Contact person: Russell Chalmers – pieter.truter@uct.co.za

Scientific manuscript reviewer (2013 – current) – The African Journal of Marine Science, Cahiers de Biologie Marine, Fisheries Research, Journal of Fish Biology and marine and freshwater research - https://publons.com/researcher/1305690/alexander-claus-winkler/

Grants

GCRF One Ocean Hub (2019 – 2024) – Co-investigator and collaborator on writing the sustainable fisheries component of the successful One Ocean Hub proposal (GCRF £ 20 million). Contact person: Warren Potts – w.potts@ru.ac.za

NRF South Africa/Namibia Bilateral grant (2017 – 2019) – Conceptualising and co-writing of the successful proposal to conduct thermal physiology work on fish being affected by a climate change induced hybridisation event occurring in Namibian coastal waters (NRF R 1.2 million). Contact person: Warren Potts – w.potts@ru.ac.za

NRF African Coelacanth Ecosystem Programme grant (2018 – 2020) - Conceptualising and co-writing of the successful proposal to conduct fish energetic studies on the effects of exploitation and climate change on a resident reef fish species using advanced acoustic telemetry techniques (NRF R 2 million). Contact person: Warren Potts – w.potts@ru.ac.za

Rhodes University Research Council Grant (2020 - 2023) – Principal investigator: *Working with, not against recreational ski-boat anglers*, research funding to conduct community engagement and fish health evaluations with recreational ski-boat in Port Elizabeth (US$ 1000 PA). Contact person: Amber Childs – a.childs@ru.ac.za

---

Publication Record (published, chronological order)

https://orcid.org/0000-0001-7864-8243

1. Allison, C., **Winkler, A.C**., Childs, A.R., Muller, C. and Potts, W.M., 2022. Can social media platforms be used to foster improved environmental behaviour in recreational fisheries?. *Fisheries Research*, p.106544.
2. Farthing, M.W., Mann-Lang, J., Childs, A.R., Bova, C.S., Bower, S.D., Pinder, A., Ferter, K., **Winkler, A.C**., Butler, E.C., Brownscombe, J.W. and Danylchuk, A.J., 2022. Assessment of fishing guide knowledge, attitudes, and behaviours in global recreational fisheries. *Fisheries Research*, *255*(November).
3. Strand, M., Ortega-Cisneros, K., Niner, H.J., Wahome, M., Bell, J., Currie, J.C., Hamukuaya, H., La Bianca, G., Lancaster, A.M., Maseka, N., McDonald, L., McQuaid, K.; Samuel, M., **Winkler, A.C**., 2022. Transdisciplinarity in transformative ocean governance research—reflections of early career researchers. *ICES Journal of Marine Science*, *79*(8), pp.2163-2177.
4. **Please refer to my Orcid profile (available above) for my further 20 past publications**

Conferences

Winkler A.C., Potts, W.M., Mann B.Q., Attwood C.A., Matuge D. (2020). Should we be worrying about marine recreational drone-fishing? Oral presentation. *6th International Marine Conservation Congress (IMCC)*, Kiel, Germany. (online).

Winkler A.C., Arkert N.K., Bernard A.T.F., Butler E.C., Bova C.S., Childs A.R., Farthing M.W., Hewett K., Mannheim S., Mullins R., Potts W.M. (2019). Working with, not against, recreational anglers: two case studies on changing angler behaviour through engagement, education, rules changes and incentives. *Southern African Marine Linefish Symposium*. Mpekweni, South Africa.

Winkler A.C., Childs, A.R., Parkinson, M.C., Henriques R., Skeeles M., Santos, C., Potts, W.M., (2019) The importance of understanding intraspecific behavioural variation in migratory fishes and its impact on the adaptability of these fishes to climate change. Oral presentation, *3rd Species On the Move*, Skukuza, Kruger National Park, South Africa.

Workshops

Hidden Markov models for animal movement and other ecological data, 7th March 2016, Ocean Research, Mossel Bay, South Africa.

Movement ecology workshop, 5th February 2015, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa.

South Africa – Namibia Joint Science and Technology Research Collaboration successful applicant launching workshop, 8-10 March 2017, Windhoek, Namibia

GCRF One Ocean, proposal writing workshop, 29 March – 1 April 2018, Glasgow, Scotland.

WIOMSA – Marine Organism Response to Climate Change Effects – Adaption or Extinction? 8 – 10 October 2018, Mombasa, Kenya

---

Supervision, Teaching and engagement

Graduate students:

2016 – 2020 graduated, Edward Butler, Rhodes University, (PhD, supervisors: W. Potts and A. Childs). role: co-supervisor

2018 – 2020 graduated, Micheal Skeeles, Rhodes University, (MSc, supervisors: W. Potts and A. Childs) role: co-supervisor *Awarded a PhD scholarship to pursue a PhD at Deakin University, Australia

2019 – 2021, graduated, Brett Pringle, Rhodes University, (MSc, supervisors: W. Potts and A. Childs). role: co-supervisor

Lecturing

2020, Commonwealth of Learning, Massive Online Course for Development, Understanding the Blue Economy, Fisheries. Lectured the fisheries section of the MOOC, pre-recorded lecture series - Kelly@unisey.ac.sc

2020, Centro de Ciences do Mar, Marine Protected Areas. Guest lecturer on the potential behavioural responses of fish in MPAs to MSc students- dabecassis@ualg.pt

2019, Lectured honours year Ichthyology students at Rhodes University on the current and potential effects of climate change on marine fish population – p.britz@ru.ac.za

2016 – 2017, Lectured honours year Zoology students at the University of Fort Hare on how to conduct and analyses fish life history studies in the context of how fish life histories have evolved. Contact person: Niall Vine – NVine@ufh.ac.za

Engagement

United Nations World Oceans Week webinar co-organiser; Breaking Laws on the Sea, https://www.youtube.com/watch?v=tOmP-7hZO8U

Breaking Laws on the Sea II - review global supply chains, external market incentives, and customary practices and pose the question "is localised enforcement is targeted at the right actors? https://www.youtube.com/watch?v=8uC4203R2wI&t=2s

Invited speaker for the South Durban Community Environmental Alliance on the topic of oil and gas exploration along the South African coast.

References

Prof Warren Potts: Professor of Ichthyology, DIFS, Rhodes University
Relationship: MSc, PhD supervisor, Post-doc advisor (2019)

Email: w.potts@ru.ac.za

Dr David Abecasis: Lecturer, CCMAR, University of the Algarve
Relationship: Junior researcher advisor (2020-2022)
Email: dabecassis@ualg.pt

Prof Colin Attwood: Professor**,** UCT
Relationship: Collaborator/ co-author
Email: colin.attwood@uct.ac.za

Appendix B: Declaration of Independence

SPECIALIST DECLARATION OF INDEPENDENCE

Samara Mining (Pty) Ltd Proposed Diamond Prospecting Right In Offshore Concession Areas 4C And 5C Off The West Coast, South Africa

SPECIALIST INFORMATION

Specialist Company Name:	Aquatic Ecosystem Services		
Specialist name:	Naomi Richardson		
Specialist Qualifications:	MSc		
Professional affiliation/registration:	Pri.Sci.Nat. 400093/14		
Physical address:	7 Schonland avenue, Makhanda,		
Postal address:	7 Schonland avenue, Makhanda,		
Postal code:	6139	**Cell:**	0723286623
Telephone:		**Fax:**	
E-mail:	Naomi@AquaticES.co.za		

DECLARATION BY THE SPECIALIST

I, __Naomi Richardson_, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
  - I declare that there are no circumstances that may compromise my objectivity in performing such work;
  - I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, Act No. 107 of 1998, as amended (the Act) and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations) and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose 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;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

____

Signature of the Specialist

Aquatic Ecosystem Services

____

Name of Company:

11 May 2023

____

Date

SPECIALIST DECLARATION OF INDEPENDENCE

UNDERTAKING UNDER OATH/ AFFIRMATION

I, ____Naomi Richardson______, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Aquatic Ecosystem Services

Name of Company

11 May 2023

Date

Signature of the Commissioner of Oaths

11 May 2023.

Date

De Jager & Lordan Inc.
STUART ANDREW TARR
COMMISSIONER OF OATHS
PRACTISING ATTORNEY
P O BOX 930 POSBUS 930
2 ALLEN STREET ALLENSTRAAT 2
GRAHAMSTOWN GRAHAMSTAD
COMMISSIONER OF OATHS KOMMISSARIS VAN EDE
PRACTISING ATTORNEY PRAKTISERENDE PROKUREUR
R.S.A

SPECIALIST DECLARATION OF INDEPENDENCE

Samara Mining (Pty) Ltd Proposed Diamond Prospecting Right In Offshore Concession Areas 4C And 5C Off The West Coast, South Africa

SPECIALIST INFORMATION

Specialist Company Name:	Aquatic Ecosystem Services		
Specialist name:	Dr Russell Chalmers		
Specialist Qualifications:	PhD		
Professional affiliation/registration:	SACNASP Pri Sci Nat 400129/13		
Physical address:	7 Somerland Avenue, Makhanda		
Postal address:	n/A		
Postal code:	6139	**Cell:**	0828739018
Telephone:	n/A	**Fax:**	n/A
E-mail:	Russell@AquaticES.co.za		

DECLARATION BY THE SPECIALIST

I, Russell Chalmers, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
  - I declare that there are no circumstances that may compromise my objectivity in performing such work;
  - I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, Act No. 107 of 1998, as amended (the Act) and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations) and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose 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;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

[signature]

Signature of the Specialist

Aquatic Ecosystem Services

Name of Company:

10/5/2023

Date

SPECIALIST DECLARATION OF INDEPENDENCE

UNDERTAKING UNDER OATH/ AFFIRMATION

I, Russell Chalmers, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Aquatic Ecosystem Services

Name of Company

10/5/2023

Date

Robin M'soni
LLB (UNZA), AHCZ
Legal Practitioner
Commissioner for Oath

Signature of the Commissioner of Oaths

10th May, 2023

Date

SPECIALIST DECLARATION OF INDEPENDENCE

Samara Mining (Pty) Ltd Proposed Diamond Prospecting Right In Offshore Concession Areas 4C And 5C Off The West Coast, South Africa

SPECIALIST INFORMATION

Specialist Company Name:	Aquatic Ecosystem Services (AES)		
Specialist name:	Alexander Claus Winkler		
Specialist Qualifications:	PhD (Fisheries Science)		
Professional affiliation/registration:	SANCOR		
Physical address:	Department of Ichthyology and Fisheries Science, Rhodes University, EC, 6140		
Postal address:	Same as above		
Postal code:	6140	**Cell:**	0767179223
Telephone:	NA	**Fax:**	NA
E-mail:	alexwinkrsa@gmail.com		

DECLARATION BY THE SPECIALIST

I, Alexander Claus Winkler declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
  - I declare that there are no circumstances that may compromise my objectivity in performing such work;
  - I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, Act No. 107 of 1998, as amended (the Act) and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations) and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose 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;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Aquatic Ecosystem Services (AES)

Name of Company:

11/05/2023

Date

SPECIALIST DECLARATION OF INDEPENDENCE

UNDERTAKING UNDER OATH/ AFFIRMATION

I, Alexander Claus Winkler, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Aquatic Ecosystem Services (AES)

Name of Company

11/05/2023

Date

Signature of the Commissioner of Oaths

11|05|2023

Date

COMMISSIONER OF OATHS
COLLETTE HUXTABLE
AGA(SA)
SAICA No: 20022991
26 New Street, Grahamstown, 6140